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The psychological burden of baby weight: Pregnancy, weight stigma, and maternal health

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ABSTRACT

Weight stigma is increasingly prevalent, highly distressing, and associated with an array of negative health and psychological outcomes. Many of the known correlates - depression, stress, and weight gain - have the potential to be particularly harmful in the context of pregnancy and the postpartum, a life phase in which women's social roles, body weights, and body meanings are in particular flux. Yet, there is little literature connecting the experiences of weight stigma to the wellbeing of pregnant and postpartum women. 501 pregnant (n = 143) and postpartum (n = 358) women in the United States were surveyed between August and November of 2017. They answered questions about their experiences with weight stigma and standardized scale measures of depressive symptoms, perceived stress, maladaptive dieting behavior, emotional eating behavior, gestational weight gain, and postpartum weight retention. Regression analyses revealed that women experiencing weight stigma from more sources reported more depressive symptoms, maladaptive dieting behavior and perceived stress when controlling for pre-pregnancy BMI, parity, weeks of pregnancy or months since birth, and demographic covariates. Weight-stigmatizing experiences were also associated with more emotional eating behavior in pregnant participants and greater postpartum weight retention in postpartum participants. This preliminary study suggests that experiencing weight stigma may contribute to unfavorable physical and mental health outcomes for pregnant and postpartum women. These findings reflect the powerful negative social meanings of weight gain faced in pregnancy and often unachievable social standards of "dropping the baby weight" as new mothers.

1. Introduction

Heavier bodies appear to be increasingly problematized and stigmatized globally, especially for women living in advanced economies. These women report feeling chronic pressures to meet ideals of thinness, and they internalize most the cacophony of social messages that equate weight with failure, weakness, gluttony, laziness, and other moral failings (Brewis et al., 2018; Farrell, 2011; Gailey and Harjunen, 2019). Worries around weight gain, attempts to lose weight, and the experienced and felt stigma of living with the social "abomination" of actual (or even imagined) excess weight are all associated with an array of serious negative psychological and physical health outcomes (Brewis, 2014; Pearl and Puhl, 2018; Puhl and Suh, 2015).

Multiple studies demonstrate that weight stigma is associated with depression and depressive symptomatology, especially for women (Hatzenbuehler et al., 2009; Incollingo Rodriguez et al., 2016). Experiences of weight stigma, in general, are also associated with increased eating and decreased exercise motivation and behavior (Vartanian and Smyth, 2013), and more unhealthy and maladaptive eating behavior (Major et al., 2014; Schvey et al., 2011). Additionally, reported experiences of weight stigma are associated with risk of weight gain and obesity over time (Sutin and Terracciano, 2013). This is proposed to be, at least in part, a function of elevated stress-related emotions that stigma elicits (Major et al., 2012; Tomiyama, 2014) and attendant physiological stress reactivity via the stress hormone cortisol (Himmelstein et al., 2015; Schvey et al., 2014).

The period of pregnancy through postpartum is one in which many women gain excess weight, often permanently. A recent population-based study in the United States estimated that 47% of women gain excess weight during pregnancy (Deputy et al., 2015). Excess weight gain is defined as weight gain beyond 35 pounds for underweight and normal weight body mass index (BMI), 25 pounds for overweight BMI,

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and 20 pounds for obese BMI (Institute of Medicine and National Research Council, 2009), and it carries negative short- and long-term consequences. For instance, in one study of first-time mothers, excess weight gain was associated with increased risk of cesarean delivery, macrosomia, and maternal hypertension (Johnson et al., 2013). Evidence also suggests that high gestational weight gain promotes weight retention and lifelong obesity risk (Endres et al., 2015; Rooney and Schauberger, 2002).

Several studies have considered how pregnancy-related weight gain and worsening psychosocial status and health behaviors are linked, but they have not yet directly addressed a role for weight-related stigma. Particularly, pre-pregnancy weights have been reported as predictive of postpartum psychological status. For example, a Danish longitudinal study (N = 70,355) showed that women who retained more additional weight and were classified as overweight or obese postpartum were more likely to qualify for diagnosed depression up to six years postpartum compared to those who maintained "normal" weights (Bliddal et al., 2015; LaCoursiere et al., 2010). Similarly, a longitudinal study of Norwegian women (N = 39,915) found that greater body image concerns at the start of pregnancy predicted emergence of postpartum depression in the first three years postpartum, and that women with the highest body weights were most negatively affected (Han et al., 2016). A cross-sectional study of Swedish women (N = 611,506) found that, for those without histories of depression, postpartum obesity was associated with higher odds of postpartum depression (Silverman et al., 2018).

The effects of weight stigma in shaping psychological (ill) health matter greatly, because weight stigma likely negatively affects the broader health of both the mother and the child (Accortt et al., 2015; Dennis and McQueen, 2009; Marcus, 2009). For instance, depression during pregnancy has been associated with delayed fetal growth, low birthweight, prematurity, and newborn biochemical dysregulation that can include elevated cortisol profiles and lowered dopamine and serotonin levels (Field et al., 2006). Postpartum depression, in turn, is associated with impaired quality of mother-infant bonding (Moehler et al., 2006) and can undermine healthy weight gain, sleep, and physical health in infancy (Gress-Smith et al., 2012). Recent meta-analytic evidence also suggests that having a mother who experienced postpartum depression is a risk factor for lower child intelligence quotient (IQ) (Sui et al., 2016). Additionally, increased stress and cortisol can by themselves put the health of the unborn child at risk, for instance through promoting preterm birth and low birthweight (e.g., Sandman et al., 1997).

Given the increasingly detailed literature linking weight-related stigma to negative psychosocial outcomes, it seems plausible that the experience of weight stigma has a negative effect – perhaps even a heightened one – on the psychological status of peri- and postpartum women. Indeed, the motherhood transition, from pre-to post-pregnancy, is one in which body weight, women's views of their bodies, what they eat, and their mood are all in considerable flux (e.g., Rode et al., 2012; Silveira et al., 2015). The medical literature suggests that postpartum changes themselves appear to generate heightened risk of depression, but social science literature suggests that psychosocial stress around pregnancy linked to shifting roles matters as well. Pregnancy and the postpartum are often understood as a socially and psychologically vulnerable time for many women, especially those in advanced economies. In places such as the United States, new motherhood is associated with many complex concerns and anxieties around self, social identity, and social place, often alongside social withdrawal, which adds to maternal stress. This is because the transition to motherhood in such settings can be marked by status losses as much as gains. These include diminishment in social capital embodied in youth and pre-maternity along with distancing from economic power with transitions to direct responsibility for child care (Davis-Floyd and Cheyney, 2019; Onoye et al., 2014; Stern and Kruckman, 1983).

Perhaps as a defining part of this, postpartum women in such contexts have reported feeling considerable social pressure to return to their "pre-baby" figure (referred to colloquially in the United States as "losing the baby weight") almost immediately (Trakas, 2009; Watson et al., 2015). Messages in the public media can portray new mothers who gain and keep weight postpartum as lazy or as having "let themselves go," and peers and societal influences may echo this sentiment. During pregnancy, friends, family, and medical professionals alike can admonish heavy pregnant women for their weight (Trakas, 2009) and suggest – in a blaming fashion – that the weight is harming or even killing their babies (e.g., Parker, 2014). Indeed, pregnancy and the postpartum are times when body dissatisfaction is reportedly common and weight becomes highly salient (Clark et al., 2009).

Potentially damaging weight-related messaging from healthcare providers may reflect an effort to have expecting mothers keep their weight within specified standard ranges (Institute of Medicine and National Research Council, 2009). Communicating these guidelines is medically indicated because excess gestational weight gain can adversely affect health, for instance through increasing risk for cesarean delivery and postpartum weight retention (Institute of Medicine and National Research Council, 2009). However, prenatal healthcare providers face barriers such as insufficient training when it comes to communicating these guidelines (Stotland et al., 2010), and they too often interact with their heavy patients in ways that are stigmatizing and, hence, distressing. For example, in a study surveying Australian women (N = 627) and maternity healthcare providers (N = 248), women with higher BMIs reported more negative interactions with their providers than those with lower BMIs (Mulherin et al., 2013). Prenatal healthcare providers also reported holding more negative beliefs about their heavier patients in this study. Similarly, a qualitative study of British mothers with pre-pregnancy obesity (N = 19) found that these women reported negative interactions with their healthcare professionals and feelings of humiliation over being obese (Furber and McGowan, 2011). Additionally, a study of Canadian women with overweight and obesity (N = 24) found that these women often felt vilified by their healthcare providers for conceiving at their weight (Bombak et al., 2016; McPhail et al., 2016).

Although weight stigma, in general, clearly elicits consequences that are relevant to maternal mental and physical health, very little research has examined the experience of weight stigma among pregnant and postpartum women or how weight stigma may be associated with other psychological statuses known to be fluctuating in this same life stage. Our group recently found that everyday discrimination attributed to weight during pregnancy was associated with postpartum depression and weight retention in the first year postpartum (Incollingo Rodriguez et al., 2019). However, this study, which analyzed existing data, relied on a one-time retrospective report of weight-related everyday discrimination. It was also limited in that there were few potential consequences to examine, and these consequences were measured only during the postpartum period. Therefore, more detailed measurement of weight-stigmatizing experiences is needed along with testing a broader range of potential outcomes among both pregnant and postpartum women.

The present study, therefore, sought to address these important issues. Randomly assigning pregnant women to experience weight stigma in a laboratory setting may pose too serious a risk considering that the consequences of such experiences are still largely unknown. As such, this study implemented a survey of both pregnant and postpartum women to understand what outcomes may be associated with experiencing weight stigma both while pregnant, as well as after delivering a child. Specifically, it was hypothesized that experiences of weight stigma would be associated with greater depressive symptoms, maladaptive dieting behavior, emotional eating behavior, perceived stress, gestational weight gain, and postpartum weigh retention.

Table 1
Characteristics of the study sample.

Variable	Overall (*N* = 501)	Pregnant (*N* = 143)	Postpartum (*N* = 358)
Status			
Pregnant	28.5%	–	–
Postpartum	71.5%	–	–
Age (years)	28.31 (5.15)	28.86 (5.03)	28.07 (5.19)
Education			
None	0.3%	–	0.6%
Middle school or less	0.8%	–	1.1%
High school or GED	25.7%	25.2%	26%
Technical or vocational school	10%	5.6%	11.7%
Associate's degree	12.4%	14%	11.7%
Bachelor's degree	22.2%	23.8%	21.5%
Graduate degree	15%	20.3%	12.8%
Other or not reported	13.6%	11.2%	14.5%
Employment status			
On paid/maternity leave	6.8%	1.4%	8.9%
On unpaid leave	3.8%	1.4%	4.7%
Working part time	12.6%	12.6%	12.6%
Working full time	25.5%	32.9%	22.6%
Unemployed	6.2%	8.4%	5.3%
Full time homemaker	25.9%	26.6%	25.7%
Student	3%	3.5%	2.8%
On disability	0.4%	0.7%	0.3%
Other or not reported	15.8%	12.6%	17%
Race/Ethnicity			
White	67.3%	65.7%	67.9%
Black	2.8%	2.8%	2.8%
Latina	10.2%	11.2%	9.8%
Asian/Pacific Islander	2.8%	4.9%	2.0%
Other or multiracial	2.2%	2.8%	2.0%
Not reported	14.8	12.6%	15.6%
Per capita income (in thousands of dollars)	70.53 (61.92)	75.17 (73.62)	68.54 (56.18)
Household size	3.67 (1.34)	2.84 (1.03)	4.01 (1.31)
Poverty status			
At or below federal poverty line	12%	9.8%	12.8%
100%–200% of the federal poverty line	19.2%	18.9%	19.3%
> 200% of the federal poverty line	50.5%	57.3%	47.8%
Not reported	18.4%	14%	20.1%
Pre-pregnancy BMI categories			
Underweight	2.6%	2.8%	2.5%
Normal weight	26.1%	22.4%	27.7%
Overweight	17.2%	11.2%	19.6%
Obese	54.1%	63.6%	50.3%

Note. Numbers in parentheses are standard deviations.

2. Method

2.1. Participants

Participants consisted of 501 women composed of 143 pregnant women in their second or third trimester and 358 postpartum women who had given birth within the previous 12 months. Exclusion criteria were pregnant women carrying multiple babies or postpartum women who had delivered more than one baby, as weight gain guidelines and trajectories are different for multiple gestation. Also excluded were pregnant women in their first trimester, as weight gain is not common during this time (Institute of Medicine and National Research Council, 2009). Finally, because different countries may have different norms and guidelines regarding pregnancy weight and weight gain, residence outside the United States was an exclusion criterion. The final sample of women came from 48 states around the United States, with the greatest representation from California (16.8%). See Table 1 for demographic characteristics overall and by pregnancy/postpartum status.

2.2. Procedure

The University of California, Los Angeles Institutional Review Board approved all procedures. Participants were recruited via flyers posted in healthcare offices, cafés, childcare centers, and baby retail locations in the wider Los Angeles area. Even within the United States, southern California is widely recognized as a social context in which the need to display thinness as an index of body control is well established and agreed on (Greenhalgh, 2012). Participants were also recruited online via advertisements shared on Internet forums for pregnant women and new mothers, such as groups on Facebook, Yahoo!, and Instagram. The research was advertised as a study of "your experiences while being pregnant or since having your baby." The survey was completed online and was anonymous. Participants were incentivized with entry into a raffle for one of five prizes of $100. Participants had the option of providing their email addresses if they wished to be entered into the raffle, and this information was deleted after the raffle and prior to analyses.

2.3. Measures

See Table 2 for descriptive statistics on all variables of interest.

2.3.1. Predictor variables

Sources and frequency of weight-stigmatizing experiences. Participants were asked: "Since becoming pregnant, have you ever been treated differently because of your weight or has something or someone made you feel bad or uncomfortable because of your weight?" This description of a weight-stigmatizing experience was adapted and expanded for the present study based on prior work by Vartanian et al., 2014, 2018. The verbiage "has something or someone made you feel bad or uncomfortable because of your weight" was added to capture the negative affective experience associated with weight stigma. Participants then selected from a 12-item list that included all people from whom or situations in which they had experienced weight stigma since becoming pregnant. Response options included work, family (immediate and extended), friends, faith community members, partners, healthcare providers, strangers, media, other mothers, and society (Cronbach's alpha = .73). They also had the option to fill in the blank if they had experienced weight stigma from a source not on the list or to select "this has not happened to me at all." These options were

Table 2
Descriptive statistics for predictor and outcome variables and covariates.

Variable	Pregnant (*N* = 143)	Postpartum (*N* = 358)
Predictor variables		
Number of sources endorsed	1.76 (1.96) [0–9]	1.95 (2.22) [0–11]
Frequency of weight stigma[a]	2.30 (1.19) [1–7]	2.40 (1.16) [1–6]
Outcome variables		
Depressive symptoms	9.41 (4.78) [0–20]	9.07 (5.40) [0–23]
Perceived stress	6.81 (3.42) [0–16]	6.98 (3.64) [0–16]
Maladaptive dieting behavior	25.40 (11.21) [3–56]	27.38 (12.35) [0–59]
Emotional eating behavior	25.25 (9.19) [9–45]	25.83 (9.59) [9–45]
Pregnancy weight gain	9.40 (18.30) [-30 – 65]	–
Postpartum weight retention	–	5.89 (20.70) [-65 – 101]
Covariates		
Pre-pregnancy BMI	36.11 (12.21)	32.68 (10.61)
Multiparous	55.3%	46.9%
Weeks of gestation	25.75 (8.56)	–
Months postpartum	–	5.59 (3.69)

Note. Numbers in parentheses are standard deviations. Numbers in brackets are ranges.

[a] 1 = less than once a month; 2 = a few times a month; 3 = at least once a week; 4 = a few times a week; 5 = almost every day; 6 = one or two times a day; 7 = three or more times a day.

compiled based on common sources of weight stigma from the broader literature (Puhl and Brownell, 2006) and from sources mentioned by pregnant and postpartum women with whom structured interviews were conducted during pretesting for the present study's protocol. The number of sources endorsed was then summed for each participant. Overall, 64.9% (n = 325) of participants endorsed at least one source of stigma. Then, for each source they had endorsed, participants indicated how frequently they generally experienced weight stigma from that source from the following seven options: less than once a month, a few times a month, at least once a week, a few times a week, almost every day, one or two times a day, three or more times a day. The response scale was developed by modifying the response options from the Everyday Discrimination Scale (Williams et al., 1997) to allow for reports of multiple daily experiences of weight stigma, as previous research has found that heavy women experience weight stigma on average three times each day (Seacat et al., 2016). These responses were then averaged across all the sources to create an average frequency of experiences for each participant.

2.3.2. Outcome variables

Depressive symptoms. To assess depressive symptomatology in the context of pregnancy, participants completed a slightly modified version of the Edinburgh Postnatal Depression Scale (Cox et al., 1987), which contained nine items. Responses indicated how frequently items from a list of common depressive symptoms had occurred over the previous week. A sample item is, "I have been so unhappy that I have been crying." Follow-up of women at risk for self-harm was not possible given the anonymous internet administration of this survey. Therefore, the tenth item in the scale, which assesses self-harm, was removed, leaving a total of nine items. The original Edinburgh Postnatal Depression Scale has demonstrated good psychometric properties (Cox et al., 1987), including reliability (Cronbach's alpha = .87), validity, and sensitivity to changes in depressive symptoms. Cronbach's alpha was .88 for the nine-item version used in this study.

Eating behavior. To assess unhealthy and disordered eating behavior, participants completed a measure of maladaptive dieting behavior from the Eating Attitudes Test (Garner et al., 1982), which contained 13 items. A sample item is, "I like my stomach to be empty." The Eating Attitudes Test has demonstrated good reliability (Cronbach's alpha = .90) in prior research, and it has demonstrated good validity compared to similar measures of disordered eating behavior (Garner et al., 1982). This measure has been used to assess maladaptive dieting behavior in pregnant and postpartum samples, providing evidence that this behavior tends to increase between pregnancy and postpartum (Baker et al., 1999). In this sample, Cronbach's alpha was .83. To assess emotional eating behavior participants also completed a nine-item version of the Dutch Eating Behavior Questionnaire (van Strien et al., 1986). A sample item is, "Do you feel a desire to eat when you are depressed or discouraged?" The Dutch Eating Behavior Questionnaire has also demonstrated psychometric properties, including validity and reliability (Cronbach's alpha = .93; van Strien et al., 1986). In this sample, Cronbach's alpha was .95.

Gestational weight gain and postpartum weight retention. To assess weight gain and loss, participants self-reported their height in feet and inches, their weight in pounds prior to being pregnant, and their current weight in pounds. These self-reported pre-pregnancy weight and current weight values were used to calculate gestational weight gain for pregnant participants as well as retention of that gestational weight gain for postpartum participants.

Perceived stress. To assess perceived stress, participants responded to the four-item brief version of the Perceived Stress Scale (Cohen and Williamson, 1988). This scale assessed how frequently participants had perceived their own feelings of stress over the previous month. A sample item is, "How often have you felt that you were unable to control the important things in your life?" In a previous sample of pregnant women, this brief Perceived Stress Scale has been validated specifically as an index of maternal stress, demonstrating acceptable reliability (Cronbach's alpha = .79; Karam et al., 2012). In this sample, Cronbach's alpha was .83.

2.3.3. Covariates

Demographics. Participants reported their age in years, their race/ethnicity identification, household size (i.e. number of people living in their household), and household income. Household size and income were used to calculate per capita household income and federal poverty status based on the federal poverty line, (defined as $12,060 for one person plus $4180 for each additional person in the household according to the United States Department of Health and Human Services).

Pre-pregnancy BMI. Pre-pregnancy BMI values were calculated according to the standard formula using self-reported anthropometry values: weight (kg)/[height (m)]^2. BMI values were also categorized according to the Institute of Medicine's cutoffs for underweight (< 18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obesity (≥ 30.0).

Pregnancy- and postpartum-related information. Pregnant participants indicated whether the pregnancy was their first or if they had been pregnant previously as well as how many weeks of gestation they were at the time they completed the survey. Postpartum participants reported whether their most recent birth had been their first along with the age of the child at the time they completed the survey. For both pregnant and postpartum participants, parity was coded dichotomously as primiparous or multiparous.

2.4. Data analytic plan

A series of separate linear regression analyses (controlling for per capita income, age, race, pre-pregnancy BMI, parity, and weeks pregnant or months postpartum) tested the total number of sources endorsed as a continuous predictor of depressive symptoms, maladaptive dieting behavior, emotional eating, perceived stress, gestational weight gain, and weight retention. Separate linear regression analyses also tested the average frequency of experiences as a continuous predictor of the above outcomes among the subset of women that had endorsed at least one source of stigma. Because the number of sources endorsed and the average frequency of experiences were only weakly correlated (r (324) = 0.23, $p < .001$) and only a subset of women was asked about frequency of sources, these were tested separately as predictors. The outcomes of interest in these analyses have different implications in pregnancy versus the postpartum period. For instance, prenatal depression is associated with impaired fetal development, preterm birth, low birthweight, and physiological dysregulation in newborns (Field et al., 2006), while postpartum depression can impair mother-infant bonding (Moehler et al., 2006) and undermine infant weight gain, sleep, health, and cognitive development (Gress-Smith et al., 2012; Sui et al., 2016). Therefore, it was decided *a priori* that all analyses would be conducted separately for pregnant and postpartum participants. The sample was large enough that power was not a concern, and therefore, missing data were dealt with using casewise deletion for each individual test. Finally, a false discovery rate analysis (Benjamini and Hochberg, 1995) accounted for alpha accumulation across the tests reported below.

3. Results

3.1. Descriptive information

Overall, 64.9% of the sample reported experiencing weight stigma from at least one source, and 35.1% reported no sources of stigma. Individual sources of stigma were endorsed at the following rates: Society in general (33.9%), Media (24.6%), Strangers (21.2%), Immediate family (21%), Healthcare providers (18.4%), Other mothers

Table 3
Regression analyses for variables predicting outcomes of interest.

DEPRESSIVE SYMPTOMS

Variable	Pregnant Participants (n = 118)				Postpartum Participants (n = 272)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.28	.007	0.00	0.00	-.07	.326
Age	−0.05	0.09	-.05	.576	−0.12	0.07	-.12	.088
Race	0.26	0.99	.02	.791	−0.40	0.81	-.03	.628
Pre-pregnancy BMI	0.03	0.04	.08	.373	0.06	0.03	.12	.054
Multiparous	−1.84	0.92	-.20	.048	−0.13	0.70	-.01	.848
Weeks pregnant OR months postpartum	0.003	0.05	.01	.956	0.26	0.09	.18	.003
Number of sources	0.63	0.21	.27	.003	0.50	0.14	.22	< .001
F	3.26				6.35			
p-value	.004				< .001			
R^2	.17				.14			

Variable	Pregnant Participants (n = 79)				Postpartum Participants (n = 176)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.26	.046	0.00	0.00	-.11	.254
Age	−0.11	0.12	-.12	.353	−0.16	0.09	-.16	.077
Race	−0.003	1.36	.00	.998	−0.11	1.02	-.01	.914
Pre-pregnancy BMI	0.03	0.04	.08	.478	0.06	0.04	.13	.097
Multiparous	−1.82	1.14	-.19	.115	−0.69	0.85	-.07	.416
Weeks pregnant OR months postpartum	−0.02	0.06	-.04	.735	0.25	0.10	.18	.013
Average frequency[a]	0.56	0.44	.14	.205	0.22	0.36	.05	.536
F	1.74				3.88			
p-value	.114				.001			
R^2	.14				.14			

MALADAPTIVE DIETING BEHAVIOR

Variable	Pregnant Participants (n = 117)				Postpartum Participants (n = 271)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	.02	.883	0.00	0.00	.07	.332
Age	0.15	0.22	.07	.511	−0.51	0.17	-.21	.002
Race	−2.13	2.48	-.08	.393	−0.84	1.85	-.03	.649
Pre-pregnancy BMI	0.07	0.09	.08	.419	0.22	0.07	.18	.003
Multiparous	−0.82	2.31	-.04	.724	1.68	1.59	.07	.293
Weeks pregnant OR months postpartum	−0.18	0.12	-.13	.153	0.15	0.20	.05	.433
Number of sources	1.77	0.53	.31	.001	1.32	0.32	.25	< .001
F	2.34				6.45			
p-value	.029				< .001			
R^2	.13				.15			

Variable	Pregnant Participants (n = 78)				Postpartum Participants (n = 176)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.02	.906	0.00	0.00	.02	.821
Age	0.04	0.31	.02	.891	−0.52	0.21	-.22	.015
Race	2.47	3.53	.08	.486	−0.33	2.38	-.01	.890
Pre-pregnancy BMI	0.07	0.12	.07	.575	0.23	0.09	.21	.008
Multiparous	−0.33	3.00	-.01	.912	−0.85	1.98	-.04	.667
Weeks pregnant OR months postpartum	−0.28	0.15	-.22	.066	0.17	0.24	.05	.462
Average frequency[a]	−0.26	1.16	-.03	.824	1.66	0.83	.15	.046
F	0.66				3.84			
p-value	.708				.001			
R^2	.06				.14			

EMOTIONAL EATING BEHAVIOR

Variable	Pregnant Participants (n = 118)				Postpartum Participants (n = 271)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	.02	.865	0.00	0.00	-.03	.666
Age	0.24	0.17	.13	.175	0.05	0.13	.03	.686
Race	2.67	1.96	.12	.175	1.70	1.50	.07	.259
Pre-pregnancy BMI	0.12	0.07	.17	.076	1.71	0.06	.19	.004

(*continued on next page*)

Table 3 (*continued*)

Multiparous	1.10	1.81	.06	.546	−1.54	1.29	-.08	.234
Weeks pregnant OR months postpartum	0.08	0.10	.08	.398	0.16	0.16	.06	.310
Number of sources	0.99	0.42	.22	.019	0.40	0.26	.10	.128
F	2.73				3.12			
p-value	.012				.003			
R^2	.15				.08			

Variable	Pregnant Participants (*n* = 79)				Postpartum Participants (*n* = 176)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.10	.426	0.00	0.00	-.06	.543
Age	0.14	0.23	.07	.549	−0.01	0.18	-.01	.957
Race	5.52	2.63	.23	.039	0.05	1.99	.002	.982
Pre-pregnancy BMI	0.22	0.09	2.9	.014	0.16	0.07	.18	.027
Multiparous	4.20	2.21	.22	.061	−0.43	1.65	-.02	.797
Weeks pregnant OR months postpartum	−0.01	0.11	-.01	.954	0.11	0.20	.04	.567
Average frequency[a]	−0.10	0.85	-.01	.908	1.31	0.69	.151	.060
F	2.63				2.05			
p-value	.018				.052			
R^2	.20				.08			

PERCEIVED STRESS

Variable	Pregnant Participants (*n* = 117)				Postpartum Participants (*n* = 272)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.30	.006	0.00	0.00	-.13	.053
Age	0.03	0.07	.05	.627	−0.08	0.05	-.11	.087
Race	0.19	0.75	.02	.804	0.16	0.53	.02	.772
Pre-pregnancy BMI	−0.01	0.03	-.02	.857	0.02	0.02	.06	.303
Multiparous	−1.19	0.69	-.18	.085	0.33	0.46	.05	.472
Weeks pregnant OR months postpartum	0.02	0.04	.05	.588	0.20	0.06	.21	< .001
Number of sources	0.33	0.16	.20	.037	0.39	0.09	.25	< .001
F	1.95				8.18			
p-value	.069				< .001			
R^2	.11				.18			

Variable	Pregnant Participants (*n* = 79)				Postpartum Participants (*n* = 176)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.20	.139	0.00	0.00	-.16	.086
Age	−0.04	0.08	-.07	.609	−0.11	0.06	-.16	.070
Race	0.52	0.99	.06	.604	0.72	0.70	.07	.303
Pre-pregnancy BMI	0.002	0.03	.01	.962	0.03	0.03	.07	.327
Multiparous	−0.57	0.83	-.09	.494	0.23	0.58	.03	.693
Weeks pregnant OR months postpartum	−0.003	0.04	-.01	.935	0.19	0.07	.20	.007
Average frequency[1]	0.47	0.32	.17	.145	0.42	0.24	.13	.085
F	1.07				5.28			
p-value	.392				< .001			
R^2	.09				.18			

GESTATIONAL WEIGHT GAIN or POSTPARTUM WEIGHT RETENTION

Variable	Pregnant Participants (*n* = 118)				Postpartum Participants (*n* = 271)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*β*	*p*-value
Per capita income	0.00	0.00	-.15	.078	0.00	0.00	-.04	.540
Age	0.52	0.28	.15	.061	−0.07	0.28	-.02	.801
Race	1.03	3.11	.02	.741	5.79	3.12	.11	.064
Pre-pregnancy BMI	−0.60	0.11	-.41	< .001	−0.71	0.12	-.36	< .001
Multiparous	−2.04	2.88	-.06	.480	−1.90	2.67	-.05	.477
Weeks pregnant OR months postpartum	1.00	0.15	.47	< .001	0.45	0.33	.08	.175
Number of sources	−0.03	0.66	-.004	.959	1.86	0.54	.21	.001
F	13.24				7.09			
p-value	< .001				< .001			
R^2	.46				.16			

(*continued on next page*)

Table 3 (*continued*)

Variable	Pregnant Participants (n = 79)				Postpartum Participants (n = 175)			
	B	*SE B*	*β*	*p*-value	*B*	*SE B*	*B*	*p*-value
Per capita income	0.00	0.00	-.18	.073	0.00	0.00	-.08	.367
Age	0.89	0.37	.24	.018	−0.22	0.38	-.05	.570
Race	3.59	4.29	.07	.406	10.27	4.34	.17	.019
Pre-pregnancy BMI	−0.70	0.14	-.45	< .001	−0.64	0.16	-.31	< .001
Multiparous	−3.68	3.60	-.10	.310	−4.14	3.61	-.09	.254
Weeks pregnant OR months postpartum	1.09	0.18	.51	< .001	0.68	0.43	.12	.114
Average frequency[a]	0.60	1.39	.04	.666	−1.19	1.51	-.06	.433
F	9.86				4.57			
p-value	< .001				< .001			
R^2	.49				.16			

Note. Race was coded dichotomously as White or non-White. Parity was coded dichotomously.

[a] 1 = less than once a month; 2 = a few times a month; 3 = at least once a week; 4 = a few times a week; 5 = almost every day; 6 = one or two times a day; 7 = three or more times a day.

(14.2%), Friends (14%), Work (13.8%), Extended family (12.2%), Partner (11%), Church (4%), and Other (2.6%).

3.2. Primary analyses

See Table 3 for results of linear regression analyses and test statistics.

Depressive Symptoms. For pregnant participants, the number of sources of weight stigma endorsed was significantly associated with greater depressive symptoms, but the average frequency of experiences of weight stigma was not. For postpartum participants as well, only the number of sources endorsed was significantly positively associated with depressive symptoms.

Eating Behavior. For pregnant participants, the number of sources of weight stigma endorsed was significantly associated with both greater maladaptive dieting behavior and greater emotional eating behavior. The average frequency of experiences was not associated with either eating behavior. For postpartum participants, both the number of sources endorsed and the average frequency of experiences were significantly positively associated with maladaptive dieting behavior, but neither predictor was associated with emotional eating behavior.

Perceived Stress. For pregnant participants, the number of sources of weight stigma endorsed was significantly associated with greater perceived stress. The average frequency of experiences was not. For postpartum participants as well, only the number of sources endorsed was significantly positively associated with perceived stress.

Gestational Weight Gain. This outcome was examined only in pregnant participants. Neither the number of sources of weight stigma endorsed, nor the average frequency of experiences was significantly associated with gestational weight gain.

Postpartum Weight Retention. This outcome was examined only in postpartum participants. The number of sources of weight stigma endorsed was significantly associated with higher postpartum weight retention. However, the average frequency of weight-stigmatizing experiences was not.

3.3. False discovery rate analysis

All original *p*-values surpassed the corrected threshold for significance with the exception of the following tests: number of sources and emotional eating in pregnant participants (original p = .019; corrected threshold = 0.018); number of sources and perceived stress in pregnant participants (original p = .037; corrected threshold = 0.020); average frequency of stigma and maladaptive dieting in postpartum participants (original p = .046; corrected threshold = 0.023). See Table 4 for full results of the false discovery rate analysis for all reported linear regressions.

4. Discussion

The findings from this study represent some of the first evidence that experiencing weight stigma may be associated with various unfavorable maternal health factors among pregnant and postpartum women in a sample of women from around the United States. Generally consistent with hypotheses that weight stigma would be related to deleterious psychosocial outcomes among pregnant and postpartum women, the number of sources of weight stigma that participants endorsed was associated with more depressive symptoms, more maladaptive dieting behavior, more emotional eating behavior (in pregnant women only), and higher perceived stress. Moreover, these results emerged controlling for income, age, race, pre-pregnancy BMI, parity, and weeks of gestation in pregnancy or months postpartum, and significant results neared or surpassed the corrected significance thresholds in the False Discovery Rate analysis. The number of sources of weight stigma that participants endorsed was also associated with greater retention of weight gained over gestation, again controlling for covariates. However, the frequency of experiences of weight stigma was not related to these outcomes in pregnant participants and only related to maladaptive dieting behavior among postpartum participants. This highlights a meaningful distinction in how we understand these two features of weight-stigmatizing experiences.

As mentioned above, these significant findings emerged even when controlling for pre-pregnancy BMI. Thus, it is unlikely that the results were driven merely by a woman's actual weight. That is, it is not the case that, for instance, heavier women are just more depressed or stressed. Nonetheless, the cross-sectional design leaves open the possibilities that reverse causation or third variables could explain the results. For instance, it is possible that women suffering from depression or high stress may be more susceptible to perceiving experiences of weight stigma. Bolstering our interpretation of the findings, though, is the fact that the results coincide with evidence from non-pregnancy samples where weight stigma has been shown to predict all the outcomes examined here, including evidence from longitudinal designs and experimental paradigms demonstrating causality. Obtaining evidence to support the direction of causality in pregnant and postpartum samples, namely with longitudinal designs, is nevertheless an important direction for future research.

The implications of weight stigma's associations with depressive symptoms, perceived stress, maladaptive eating behavior, and postpartum weight retention are worthy of further study, given their known risks not only for the mother, but also for her child. For instance, there is evidence that depression and stress during pregnancy are associated with low birthweight and preterm birth in the child (Accortt et al., 2015). Stress in pregnancy and adverse birth outcomes both carry long-term implications for child health outcomes, such as cognitive and learning disabilities, impaired health, chronic conditions, and

Table 4
False discovery rate analysis.

Rank of *p*-value	Test	Original *p*-value	Corrected threshold
1	Sources and depressive symptoms in postpartum	< .001	.003
2	Sources and maladaptive dieting in postpartum	< .001	.005
3	Sources and perceived stress in postpartum	< .001	.008
4	Sources and maladaptive dieting in pregnancy	.001	.010
5	Sources and postpartum weight retention	.001	.013
6	Sources and depressive symptoms in pregnancy	.003	.015
7	Sources and emotional eating in pregnancy	.019	.018
8	Sources and perceived stress in pregnancy	.037	.020
9	Frequency and maladaptive dieting in postpartum	.046	.023
10	Frequency and emotional eating in postpartum	.060	.025
11	Frequency and perceived stress in postpartum	.085	.028
12	Sources and emotional eating in postpartum	.128	.030
13	Frequency and perceived stress in pregnancy	.145	.033
14	Frequency and depressive symptoms in pregnancy	.205	.035
15	Frequency and postpartum weight retention	.433	.038
16	Frequency and depressive symptoms in postpartum	.536	.040
17	Frequency and gestational weight gain in pregnancy	.666	.043
18	Frequency and maladaptive dieting in pregnancy	.824	.045
19	Frequency and emotional eating in pregnancy	.908	.048
20	Sources and gestation weight gain in pregnancy	.959	.050

Note. For this false discovery rate analysis, tests are listed in rank-order of their *p*-values. Each rank is multiplied by 0.05 and divided by the number of tests in the analyses to produce a new corrected threshold for determining significance (Benjamini and Hochberg, 1995).

behavioral and social issues (Moster et al., 2008). Depression during pregnancy and in the postpartum period are also important concerns. Prenatal depression is a risk factor for impaired fetal development, prematurity, low birthweight, and physiological dysregulation in newborns (Field et al., 2006). Postpartum depression, in turn, puts mothers at increased risk for difficulty with breastfeeding and reduced duration (Dennis and McQueen, 2009), and it can impair the quality of mother-infant bonding (Moehler et al., 2006). It is also associated with impaired healthy weight gain, sleep, and physical health in infancy (Gress-Smith et al., 2012) and risk for lower IQs (Sui et al., 2016). In terms of the other observed associations, unhealthy and maladaptive eating behaviors may put mothers at risk for unhealthy weight gain and weight loss trajectories. Additionally, if a woman retains her gestational weight gain, she is more likely to stay in or enter the “obese” BMI category and to therefore begin a subsequent pregnancy at an unhealthy weight (Endres et al., 2015; Rooney and Schauberger, 2002). Future research can examine a range of both maternal and child health outcomes as potential downstream consequences of pregnancy-related weight stigma.

These results also highlight unique dimensions of the weight stigma experience that may warrant further consideration. The present study compared the number of sources from which participants experienced weight stigma to the frequency of weight-stigmatizing experiences. These two variables, which were only weakly correlated, appeared to have different relationships with the outcome variables of interest. In particular, the number of sources endorsed was consistently associated with the outcome variables, while the frequency of experiences was not. This makes sense given that stigmatization from some sources may be impactful even when less frequent. For example, pregnant and postpartum women see their healthcare providers relatively infrequently compared to their exposure to media, yet stigmatizing behavior from physicians could still be influential given their higher status. Regarding the relationship between number of sources and depressive symptoms specifically, experiencing weight stigma from multiple sources may be indicative of a lack of social support. Poor social support is a known risk factor for depression, including during pregnancy (e.g., Lancaster et al., 2010) and the postpartum period (e.g., Hübner-Liebermann et al., 2012). This distinction between number of sources and frequency of experiences may be useful in determining new weight stigma measurement approaches.

Considering that sources of weight stigma included both individual actors, such as healthcare providers, and more general sources, such as the media, intervening to reduce weight stigma in just one domain could be ineffective to circumvent potential negative outcomes. Should the current study's results be replicated in longitudinal studies, future weight stigma reduction efforts might consider taking an integrative approach. For instance, family, friends, and healthcare providers could be trained in acceptance of women of different sizes, counter-conditioning prevailing social messaging to instead associate weight with neutral or positive qualities, and changing attributions about obesity so as to avoid direct stigmatization of women during pregnancy and postpartum. This seems to be, for example, the current dynamic in some middle income countries like Samoa where cultural ideas around weight are in rapid flux (Hardin, 2015; Hardin et al., 2018). Research suggests that combined intervention strategies such as the above are especially promising for reducing feelings of weight-related stigma (Brewis and Wutich, 2019; Daníelsdóttir et al., 2010). In this vein, doctors might be trained to sensitively address the weight gain guidelines with heavy patients without criticizing them for their weight. Meanwhile, efforts should be made to reduce weight-stigmatizing portrayals of pregnancy in the media. Additionally, to address similarly frequent occurrences of weight stigma from society at large, public awareness campaigns might highlight the potentially damaging correlates associated with experiencing weight stigma to increase sensitivity to this topic on a broader societal level.

4.1. Limitations

These findings must be interpreted in light of some limitations. As mentioned above, the cross-sectional design of this study precludes causal inferences or ruling out reverse causation, although the findings are consistent with experimental designs investigating weight stigma and its consequences in non-pregnancy samples. Similarly, although we controlled for pre-pregnancy BMI, a woman's objective weight or other confounds could still possibly influence these findings. Additionally, this study relies on a convenience sample, and as such, the findings may not be broadly generalizable to the national population of pregnant and postpartum women. Given that the sample, on average, had an obese BMI, the findings are likely relevant to a large number of victims of weight stigma, but evidence from nationally representative samples is nonetheless needed. Lastly, this study relied on self-reported pre-pregnancy weight and current weight, and it is possible that participants

may not have been willing or able to accurately report their weight. However, the magnitude of reporting error for self-reported pregnancy-related weight is typically low (Headen et al., 2017), and using self-reported pre-pregnancy weight usually still yields a correct BMI classification (Holland et al., 2013). Future research should corroborate these associations using prospective longitudinal designs incorporating multiple measures of weight stigma and its potential consequences throughout the pregnancy and the postpartum period.

5. Conclusions

This study provides novel preliminary evidence that weight stigma – especially when experienced from multiple sources – may be associated with deleterious psychological and behavioral health outcomes for pregnant and postpartum women. These findings provide a basis for follow-up and timely efforts to attend to pregnancy-related weight stigma during an important social and physical transitional time in women's lives.

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Declaration of interests

The authors declare no conflicts of interest.

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