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Development and Validation of the Body Understanding Measure for Pregnancy Scale (BUMPs) and Its Role in Antenatal Attachment

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Pregnancy is a unique period in a woman's life during which her body undergoes rapid and dramatic change. Many of these changes are in direct conflict to social ideals of female body appearance, such as increases in body size and weight. Existing research that has examined body satisfaction in pregnancy is limited by the use of measures that are not designed for pregnancy, yielding biased results. Two studies have attempted to develop measures for pregnancy but have used suboptimal sample sizes and/or have not fully validated the measure with independent samples. We seek to address these limitations in the current study and report the development and validation of the newly developed Body Understanding Measure for Pregnancy scale (BUMPs) in 613 pregnant women across two independent samples. Exploratory factor analysis revealed three factors; satisfaction with appearing pregnant, weight gain concerns, and physical burdens of pregnancy, which were confirmed with confirmatory factor analysis. Multiple Indicators Multiple Causes (MIMIC) modeling indicated the scale is appropriate for women in all three trimesters of pregnancy. Evidence of internal reliability, test–retest reliability and convergent validity provide excellent psychometric support. We further demonstrated construct validity by supporting 3 hypotheses, finding that more positive body satisfaction in pregnancy was related to: (a) better relationship quality; (b) lower depression and anxiety; (c) higher levels of interoception, specifically body listening, and body trusting. Additionally, we present evidence that BUMPs score was the strongest predictor of antenatal attachment when compared against depression, anxiety, gestational age, and relationship satisfaction.

Public Significance Statement
This study describes a new self-report questionnaire to measure women's body satisfaction during pregnancy. The Body Understanding Measure for Pregnancy scale (BUMPs) is the first fully validated measure of body satisfaction during pregnancy and is suitable for women in all three trimesters of pregnancy. Women who felt more positively about their body changes in pregnancy were more likely to have better relationship quality, lower scores of depression and anxiety, and were better at interpreting their bodily signals. BUMPs scores were the strongest predictor of antenatal attachment.

Keywords: pregnancy, attachment, body satisfaction, scale development, factor structure

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Body image is a multifaceted concept thought to comprise affective/attitudinal and perceptual components that together create an internal representation of one's own body (Grogan, 2016). An important aspect of body image is body satisfaction which is based on thoughts and feelings about our own body (Grogan, 2016). Western sociocultural norms promote a largely unattainable slim ideal body shape for women, deviation (actual or perceived) from which is linked to body dissatisfaction (Thompson & Stice, 2001). Because of the negative impact on women's health and well-being, research into women's body image and body satisfaction has become prolific over the last two and a half decades. Within this field there is a growing body of research investigating body satisfaction during pregnancy. Pregnancy is a unique time in a woman's life, during which her body undergoes significant physical changes over a relatively short period of time (approximately 40 weeks). Many of these prepartum bodily changes are in direct conflict to social ideals of female body appearance, such as increases in body size and body weight (Greer, 1984). In addition, such deviations from social body ideals are commonly accompa-

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nied by competing sensations such as increased requirements for food intake (Butte & King, 2005) as well as restrictions on physical activity through fatigue (Chien & Ko, 2004) and pain (Vermani, Mittal, & Weeks, 2010). Pregnancy is also a period that signifies a change in responsibility in a woman's life, with social expectations surrounding ideals of being a good mother being important. In this context, bodily changes during pregnancy are also considered as part of a woman's transition to their new role as a mother (Chang, Chao, & Kenney, 2006). Therefore, pregnant women have to balance the (real and perceived) needs of the fetus ("eating for two") alongside pressures to maintain a socially desirable "nonfat" pregnant body shape (Nash, 2015). These different and competing pressures acting on women may have an impact on how they feel about and, thus, how satisfied they are, with their changing pregnant body.

This complexity in the pressures acting on how women experience their body during pregnancy may help explain the numerous conflicting results in the literature, with different studies revealing both an improvement (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009; Loth, Bauer, Wall, Berge, & Neumark-Sztainer, 2011) and a worsening (Brown, Rance, & Warren, 2015; Inanir, Cakmak, Nacar, Guler, & Inanir, 2015; Skouteris, Carr, Wertheim, Paxton, & Duncombe, 2005) in prepartum body satisfaction. For example, Loth et al. (2011) conducted a longitudinal study and found that pregnant women were more content with their body compared with nonpregnant women as well as compared with their own body satisfaction 5 years earlier (before pregnancy). Conversely, Skouteris et al. (2005) found women felt less attractive during pregnancy compared with their retrospective accounts of body satisfaction prepregnancy, with the majority of their pregnant sample continuing to desire a smaller body size throughout the prepartum period.

Insights from qualitative research suggest that the lack of consensus in the empirical literature may be an accurate reflection of the heterogeneity of women's experiences of pregnancy; every pregnancy is experienced uniquely by different women. Interviews with pregnant women reveal conflicting views of the pregnant body, with some women embracing their bodily changes ("It feels good and liberating to be allowed to have a big belly"; Bergbom, Modh, Lundgren, & Lindwall, 2017, p. 583) and others rejecting them ("I can't wait to get rid of it [the bump], I know that sounds horrible, just want to get back to normal." (Earle, 2003, p. 250). In a recent poll of over 200,000 pregnant women on the parenting website BabyCentre.com, 72% of respondents indicated they were not happy with or had mixed feelings about their pregnant body, compared with 28% who loved the way they looked (BabyCentre.com, 2018). Therefore, our aim is not to evaluate whether body satisfaction is better or worse in pregnancy, but to gain greater understanding of how women feel about the bodily changes in pregnancy and how this is related to other factors, including relationship quality, mood (depression and anxiety), interoceptive awareness, and antenatal attachment.

Despite disagreement concerning the prevalence of body dissatisfaction during pregnancy there is a relative consensus that a negative experience of the prepartum body is linked to negative maternal and infant outcomes, including depression, low birth weight, and low rates of breastfeeding (Brown et al., 2015; Conti, Abraham, & Taylor, 1998; Schmied & Lupton, 2001). Silveira, Ertel, Dole, and Chasan-Taber (2015) conducted a review of the literature examining the link between body dissatisfaction and antenatal and postpartum depression. Notwithstanding a lack of consistency between studies in terms of measures and gestation, the authors concluded that there was evidence for a weak relation between body dissatisfaction in pregnancy and depressive symptoms postpartum. Conti et al. (1998) compared women who gave birth to infants with low birth weight (<2,500 g) to those who gave birth to healthy weight infants. It was found that women who had low-birth weight babies reported elevated body and eating concerns during pregnancy, which may suggest that feelings and behaviors associated with maternal pregnancy body dissatisfaction can also influence infant health and well-being. Moreover, a recent study by Brown et al. (2015) asked pregnant women about their body satisfaction during their second or third trimester of pregnancy and at 6 months postpartum, and data were collected on mode of infant feeding and breastfeeding duration. Mothers who did not breastfeed at birth had significantly higher body concerns during pregnancy. Among women who did breastfeed, more positive attitudes toward the body in pregnancy was associated with a longer duration of breastfeeding.

In addition to significant changes in the outward appearance of the prepartum body, pregnancy is a period of time when women may turn their attention toward signals coming from within their body, such as feeling for the baby kicking (Clark et al., 2009). Such perceptual experiences, which are unique to pregnancy, are thought to help women adapt positively to their bodily changes at this time (Clark et al., 2009) and strengthen fetal attachment (Condon, 1985; Heidrich & Cranley, 1989). In general, interoceptive signals coming from within the body can provide us with information about our physical condition, such as hunger and thirst, as well as underlying our emotional state (e.g., increased heart rate; Craig, 2002). Poor subjective accounts of interoceptive awareness have been linked to body dissatisfaction in nonpregnant women, particularly in those with high Body Mass Index (BMI; Lewis & Cachelin, 2001) and those suffering from clinical eating disorders (Merwin et al., 2010). Recent research supports a multidimensional approach to assessing subjective experience of interoception, tapping into different modes of self-reported attention to bodily signals, including constructs relating to listening to the body for insight and trusting in the body as a safe place (Mehling et al., 2012). These constructs seem to be important for mental health as they have been linked to depression (Fissler et al., 2016), clinical eating disorders (Brown et al., 2017), and overall psychological well-being (Hanley, Mehling, & Garland, 2017) in nonpregnant individuals.

During pregnancy, how, and in what capacity, we attend to signals from within the body may be important, particularly with the often complex experience of self-other boundaries between the mother and fetus (Schmied & Lupton, 2001). Expectant mothers may spend more time listening to their bodies to feel movement of the fetus, detection of which has a positive impact on body experience during pregnancy (Clark et al., 2009). Thus, those women who listen more to their body during pregnancy may have a more positive experience of their changing body. Additionally, feelings of trust toward the body and bodily sensations may be important for coping with bodily changes beyond conscious control. For many women, pregnancy elicits feelings of loss of control over their bodies, as the complex phenomenon of developing a fetus results in bodily changes seemingly without their active

involvement (Schmied & Lupton, 2001). Trusting in the body to grow and nourish the fetus and that the bodily changes occurring at this time are a necessary and important part of that process, may help women to successfully adapt to these changes and maintain a positive experience of the body during pregnancy. Therefore, the interoceptive constructs of listening to the body and trusting the body are anticipated to relate to maintaining positive feelings about the body during pregnancy.

One of the main limitations underlying body image research during pregnancy is the lack of a standardized validated measure. Many studies adapt nonpregnancy body satisfaction measures such as the Body Attitudes Questionnaire (e.g., Skouteris et al., 2005), the Body Shape Questionnaire (e.g., Fox & Yamaguchi, 1997), and variations based on the Body Cathexis Scale (e.g., Loth et al., 2011). However, as these measures are not specially designed for pregnancy, they may fail to capture specific concerns associated with bodily changes during this time and, thus, lead to biased results (Fuller-Tyszkiewicz, Skouteris, Watson, & Hill, 2012). To date, two studies have previously developed their own pregnancy body satisfaction scales (e.g., Brown et al., 2015; Watson, Fuller-Tyszkiewicz, Broadbent, & Skouteris, 2017), but these measures are developed using suboptimal sample sizes (Watson et al., 2017) and/or have not been fully validated with independent samples (Brown et al., 2015; Watson et al., 2017). For example, Brown et al. (2015) developed a body satisfaction measure specifically for their pregnant sample when examining the association between body satisfaction and breastfeeding. Although this measure was originally developed on a large cohort, the details of the scale development were not reported. Hicks and Brown (2016) utilized this measure again in their study examining the association between social media and body satisfaction during pregnancy, but with significant modifications and no statistical examination of model fit was implemented. Recently, Watson et al. (2017) also attempted to develop a specific body satisfaction measure for pregnancy, the Body Image in Pregnancy Scale (BIPS). However, this measure was initially developed using a suboptimal sample size ($<$10:1 ratio for participants and items, Schreiber, Nora, Stage, Barlow, & King, 2006) and independent validation of model fit was also wanting. While these studies have taken the research in an important direction, there is still a need for a fully validated scale to assess the experience of the body during pregnancy.

Another aspect important to consider during scale development, is the complexity of the experience and how this can be interpreted. The scale by Brown et al. (2015) consisted of only one subscale (seven items) that focused on body satisfaction in pregnancy. While this adequately met the needs of their study (other subscales measuring prospective postnatal body satisfaction and dieting during pregnancy in line with their hypotheses), as a stand-alone measure of body experience during pregnancy the brevity of the scale may miss important aspects of women's experience. On the other hand, the BIPS by Watson et al. (2017) incorporates seven different aspects of pregnancy body experience into a single scale. This leads to a longer questionnaire (36 items) and may also mean that individual subscales are difficult to interpret. Indeed, four of the BIPS subscales explained less than 5% of the variance each; thus, it is questionable how meaningful these factors are. Previous findings associating body satisfaction in pregnancy with negative maternal outcomes (e.g., depression and poor breastfeeding rates) predominantly consist of items tapping into satisfaction with appearance, weight, and fitness as well as comparisons with, and attitudes of, others (Brown et al., 2015; Clark et al., 2009). Thus, we aimed to create a measure which balances the complexity of these aspects while maintaining a brief, meaningful, and focused scale.

An important motivation of this research is to validate a measure to test hypotheses regarding the association between women's acceptance of their bodily changes in pregnancy and antenatal attachment. Hand in hand with the physical adaptations in pregnancy, women are psychologically preparing for the birth of a new child and begin to form a relationship with their unborn baby. Antenatal attachment refers to the emotional tie or bond, which normally develops between the pregnant parent and her unborn infant (Condon & Corkindale, 1997) and is associated with a range of maternal and infant outcomes, including positive health and safety practices during pregnancy (Lindgren, 2001), secure attachment classifications in infancy (Muller, 1996), more attuned mother–infant interaction (Fuller, 1990), and maternal sense of competence (Mercer & Ferketich, 1994). A meta-analysis (Yarcheski, Mahon, Yarcheski, Hanks, & Cannella, 2009) identified gestational age to be the most powerful predictor of antenatal attachment, with depression and anxiety identified as having low overall effect sizes that varied greatly across studies. Relationship quality has also been identified as an important predictor (Condon & Corkindale, 1997).

While the process of antenatal attachment formation involves mental representation of the child, the pregnant mother's bodily sensations and perceptions connect her to her growing baby. Given that the experience of pregnancy is so overwhelmingly physical, it is surprising that little attention has been paid to the contribution of women's feelings about their pregnant bodies to the formation of bonds with their unborn babies. If women embrace their bodily changes and feel good about their body during pregnancy, then they may have a greater proclivity to engage emotionally with their unborn child. On the other hand, if women feel negatively about the bodily changes that pregnancy have brought, this may moderate feelings of attachment toward to the developing fetus.

Few studies have considered how women's feelings toward their bodies in pregnancy relate to antenatal attachment. Those that have been conducted report mixed findings, which is unsurprising given that they all use different measures of body satisfaction, none of which were designed for pregnancy (Haedt & Keel, 2007; Huang, Wang, & Chen, 2004; Małus et al., 2014). We aimed to test the hypothesis that body satisfaction in pregnancy would be related to stronger feelings of antenatal attachment. The Maternal Antenatal Attachment Scale (MAAS; Condon, 1985) was used to measure antenatal attachment. This is a widely used measure that has good reliability and validity (Condon, 1993) but critically, unlike other measures, the items do not measure attitudes toward the physical state of pregnancy. Thus, we could be sure that if we found a relation that this would not be because of shared variance.

The current study reports on the development and validation of a BUMPs. This was achieved in six steps. First, we created potential items designed to capture components of body satisfaction specifically aimed at pregnancy. Second, we conducted exploratory factor analysis in a large pregnant sample (N = 378). Third, full independent confirmatory factor analysis was conducted with a new large sample (N = 235). Fourth, we tested

measurement invariance to examine whether the scale was relevant to women in all three trimesters. Bodily changes and experiences in the first, second, and third trimester are very different; therefore, it was important to investigate differential item functioning. Fifth, we demonstrated test–retest reliability, discriminant and convergent validity. And finally, sixth, we demonstrated construct validity by testing the relation between the BUMPs and a general measure of body satisfaction as well as to other relevant constructs in a series of hypotheses based on known associations with nonpregnant body satisfaction.

Nonpregnant women with low levels of body satisfaction are found to be less satisfied with their relationship (e.g., Friedman, Dixon, Brownell, Whisman, & Wilfley, 1999). Therefore, our first hypothesis is that BUMPs scores would be negatively associated with relationship quality, such that women who were more satisfied with their relationships would feel more positive about their pregnant bodies. Our second hypothesis stems from the link between body satisfaction and the risk of depression in both pregnant (Silveira et al., 2015) and nonpregnant women (Stice, Hayward, Cameron, Killen, & Taylor, 2000). Therefore, it is predicted that women experiencing higher levels of depression and anxiety would have lower pregnancy body satisfaction (higher BUMPs scores).

We also hypothesize that BUMPs scores will be related to the way that women attend to internal bodily signals (interoception). Because of the increased importance of events occurring within the body during pregnancy (baby kicking) and of trusting for the body to take control of fetal development (Schmied & Lupton, 2001) it is predicted that women who listen to and trust in their body more will have greater satisfaction with their pregnant body. Our final hypothesis is that BUMPs score will be a negative predictor of antenatal attachment, over and above that of a more general measure of body satisfaction, such that women who feel more positive about their changing body during pregnancy will have a stronger attachment to their unborn child.

Method

Participants and Procedure

Sample 1. A total of 565 pregnant women responded to an advertisement calling for pregnant women, at any stage of pregnancy, to complete an online survey about how pregnant women feel about their pregnant bodies. The survey was hosted on Qualtrics (Provo, UT). The advertisements were distributed via social media sites (Twitter, Facebook), University staff newsletters, parenting websites, parenting groups and classes, a local maternity ward, and a maternity retailer. Ethical approval was granted by the University of York Psychology Department Ethics Committee. We eliminated responses of 187 respondents for being incomplete and the final sample consisted of 378 pregnant women. The sample demographics are reported in Table 1 (Sample 1).

Sample 2. Pregnant women were recruited as per Sample 1. A total of 358 respondents started the survey. Incomplete responses were excluded, and two respondents were excluded because they were not pregnant, resulting in $N = 235$. Demographic information about the sample is reported in Table 1 (Sample 2).

Participants were asked whether they would be willing to complete a follow-up survey 1-week later. If they answered yes, they were asked to provide a contact e-mail and an automated e-mail was sent 7 days later with a link to complete the BUMPs a second time. A subset of participants ($n = 101$) responded to this e-mail request and completed the survey a second time. Responses were removed from respondents who completed the retest survey more than once ($n = 2$), provided an anonymity code that did not match ($n = 5$) or were no longer pregnant at the time of retest ($n = 1$). The retest analyses are conducted on a final sample size of $n = 93$, representing 40% of the original sample. Sample characteristics are reported in Table 1 (Sample 2 retest subsample). The mean number of days between test and retest was 16.85 ($SD = 15.54$). The respondents completed the retest survey in their own time; therefore, there is variation in the number of days between test and retest.

Table 1
Sample Characteristics

Demographics	Sample 1	Sample 2	Sample 2 retest subsample
N	378	235	93
Mean maternal age (*SD*)	31.50 (4.78)	32.28 (4.37)	32.71 (4.24)
Mean number of weeks pregnant (*SD*)	26.86 (9.33)	25.99 (9.13)	26.50 (8.98)
Expecting first baby (%)	40	44	41
First trimester (%)	12	12	13
Second trimester (%)	35	41	48
Third trimester (%)	53	47	39
Expecting a multiple birth (%)	2	<1	1
Medical issues (%)	27	25	31
Married or in a relationship (%)	98	98	99
Ethnicity Caucasian (%)	96	93	93
University undergraduate Degree or higher (%)	61	66	88

Note. Respondents provided their ethnicity as free text. The majority of the samples described themselves as White British or White/Caucasian. These responses were combined to calculate the percentage of respondents reporting as Caucasian. For brevity we have reported the percentages of respondents categorized within the majority group for marital status, ethnicity, and education.

Measures

One or more of the samples completed each of the following measures. Each scale description identifies which sample(s) completed the scale and includes the relevant reliabilities.

The BUMPs. To develop the scale, the authors (who were both pregnant at the time) identified potential themes for questions based on their own experiences of bodily changes during pregnancy, discussions with other pregnant women, and from a review of the qualitative literature. These themes included shape changes (e.g., looking pregnant), weight changes (concerns about health and appearance), comparisons (to other pregnant and nonpregnant women, and to one's own prepregnant body), and attitudes of others (e.g., support from partner, comments about one's bump size from other people). An initial pool of 37 items was generated and the valence of the items was balanced to ensure a fair distribution of negatively worded items (e.g., *I worry about getting my figure back after pregnancy*) and positively worded items (e.g., *I feel good about my changing body*). Items were reviewed for clarity to avoid ambiguity, double negatives, and double-barreled items. Response format was on a 5-point Likert scale (1 = *strongly disagree*; 2 = *somewhat disagree*; 3 = *neither agree nor disagree*; 4 = *somewhat agree*; 5 = *strongly agree*). The instructions stated "Please read each statement and indicate on the 5-point scale the extent to which you agree. Please answer based on your feelings during the last 2 weeks." We asked four women who had recently given birth (within the last 2 months) to review the items for clarity and relevance to pregnancy. They judged the items to be appropriate. Sample 1 completed the full BUMPs (37 items) and Sample 2 (and the retest subsample) completed the reduced BUMPs (20 items) that resulted from the exploratory factor analysis. Scores are calculated by summing all items and higher scores indicate higher levels of dissatisfaction. Samples 1 and 2 consisted of 378 and 235 participants, respectively; thus, providing acceptable ratios of 10.2 and 11.8 participants to 1 parameter estimated (Schreiber et al., 2006).

Body Cathexis Scale (BCS). The BCS is a self-report questionnaire that measures body satisfaction (Secord & Jourard, 1953). We use an adapted version of the BCS consisting of 43-items. Each item relates to satisfaction with a part of the body or bodily functions, for instance: hands, body build, eyes, health, and weight. Responses are scored on a 5-point Likert scale, ranging from 1 (*very dissatisfied*) to 5 (*very satisfied*). Scores are calculated by summing all items. Higher scores indicate higher levels of body satisfaction. Balogun (1986) has previously reported good test–retest reliability (.89) and internal validity (α = .78–.87). In the current study the BCS was completed by Samples 1 and 2, with both samples demonstrating excellent internal consistency (Sample 1 α = .921, Sample 2 α = .929).

Multidimensional Assessment of Interoceptive Awareness (MAIA). The MAIA is 32-item self-report questionnaire measuring independent constructs of subjective experience of interoceptive signals (Mehling et al., 2012). Responses are made on a 6-point Likert scale, in which participants indicate how often each statement applies to them generally in daily life, with responses from 0 (*never*) to 5 (*always*). The MAIA consists of eight subscales: (a) Noticing, how much an individual is aware of their bodily sensations such as breathing and heart rate (four items); (b) Not-distracting, the tendency not to ignore or distract oneself from sensations of pain or discomfort from the body (three items); (c) Not-worrying, the tendency not to experience emotional distress or worry with sensations of pain or discomfort from the body (three items); (d) Attention regulation, the ability to sustain and control attention to bodily sensations (seven items); (e) Emotional awareness, the awareness of the connection between body signals and emotional states (five items); (f) Self-regulation, the ability to regulate psychological distress by attention to bodily sensations (four items); (g) Body listening, the tendency to actively listen to the body for insight (three items); and (h) Trusting, the experience of one's body as safe and trustworthy (three items). The score for each scale is calculated by the mean of its individual items. The MAIA is found to have acceptable internal consistency (subscale α = .66–.82) and good convergent and discriminant validity of all scales (Mehling et al., 2012).

In the current study the MAIA was completed by Samples 1 and 2. Both samples demonstrated good internal consistency for the majority of subscales. Noticing, α = .658, .744; Not distracting, α = .673, .627; Not worrying, α = .679, .660; Attention regulation, α = .858, .895; Emotional awareness, α = .812, .810; Self-regulation, α = .836, .819; Body listening α = .847, .806; Trusting α = .877, .904 (Samples 1 and 2, respectively).

Relationship satisfaction. The Quality of Marriage Index (QMI; Norton, 1983) assesses relationship satisfaction with five items on a 7-point Likert scale (e.g., "*My relationship with my partner makes me happy*") and one item that asks respondents to "*Circle the point that best describes the degree of happiness in your marriage*" on a scale of 1–10. A meta-analysis reported an average reliability of α = .94 across 189 coefficients (Graham, Diebels, & Barnow, 2011). This was completed by Samples 1 and 2. Reliability was excellent, α = .93 for both samples.

Anxiety and depression. The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) comprises seven questions to assess anxiety (HADS-A; example item: "*I feel tense or 'wound up'*," response options: *Most of the time*; *A lot of the time*; *From time to time*; *Not at all*) and seven items to assess depression (HADS-D; example item: "*I still enjoy the things I used to enjoy*," response options: *Definitely as much*; *Not quite as much*; *Only a little*; *Hardly at all*). Responses are on a 4-point Likert scale and higher scores indicate higher levels of anxiety and depression, with scores of 15 and above indicating severe levels. The HADS has been previously reported to have good reliability and validity (see Bjelland, Dahl, Haug, & Neckelmann, 2002, for a review). This was completed by Sample 2 only. Internal consistency was good, HADS-A α = .81, HADS-D α = .74.

Antenatal attachment. The Maternal Antenatal Attachment Scale (MAAS; Condon, 1985) is a 19 item self-report scale to measure antenatal attachment. The MAAS comprises two subscales: Quality of Attachment (10 items), which focuses on the mother's conceptualization of the fetus as a little person and includes items related to feelings of closeness and pleasure in interaction; and Strength of Intensity of Preoccupation (eight items), which is the extent to which the fetus occupies a central place in the woman's emotional life (Condon, 1985). A Global Attachment Score is calculated from the sum of all 19 items (one item does not load on either subscale). Condon (1993) reports good reliability with α = .82 for the total scale. The MAAS was administered to Sample 2 only; however, only a subsample competed this (n = 123). We found good internal consistency for

Global Attachment ($\alpha = .78$), Attachment Quality ($\alpha = .75$), and Attachment Intensity ($\alpha = .72$).

Analytic Plan

The factor structure of BUMPs scores was examined using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). In the first sample we assessed the factor structure of the BUMPs using EFA with principle axis factoring in IBM SPSS Statistics for Macintosh, Version 25. Promax rotation was used as we expected latent factors to be correlated. Horn's Parallel Analysis was used to confirm factor structure (Horn, 1965). To verify a three factor structure we conducted a CFA of the BUMPs using data collected from a new sample of pregnant women (Sample 2) who completed the 20-item BUMPs scale. CFA was conducted using MPlus Version 8.1 (Muthén & Muthén, 1998-2017) with maximum likelihood estimation. Skewness and kurtosis were inspected according to the guidelines of Kline (1998) with skewness values <3 and kurtosis values <10 defined as acceptable. Multiple indices are reported to reflect different aspects of model fit (Crowley & Fan, 1997). The model χ^2 is reported; however, it is widely accepted that this is limited as a fit statistic because of its sensitivity to sample size (Hooper, Coughlan, & Mullen, 2008). Therefore, a significant result will not be taken alone to indicate a poorly fitting model; instead, we will look to other indices of fit to evaluate the model. These include the Comparative Fit-Index (CFI; Bentler, 1990) with values of $\geq .95$ indicative of good fit (Hu & Bentler, 1999). Root mean square error of approximation (RMSEA; Steiger, 1990), with acceptable fit defined as $<.08$ (MacCallum, Browne, & Sugawara, 1996) and a confidence interval upper limit $<.08$ (Hooper et al., 2008). The RMSEA is highly regarded as an informative fit index (Diamantopoulos & Siguaw, 2000). The standardized root mean square residual (SRMR) is included with values $<.08$ defined as acceptable fit (Hu & Bentler, 1999).

Analyses were conducted to test whether women score differently on the BUMPs depending on the progress of their pregnancy. BUMPs scores were compared by trimester using analysis of variance (ANOVA). However, before doing so it was important to examine invariance in the BUMPs as a function of trimester of pregnancy. To test this, Multiple Indicators, Multiple Causes (MIMIC) modeling was used. This method was chosen over multiple-Groups CFA because of the relatively small sample sizes of women in each of three trimesters (Muthén & Muthén, 2009). Analyses were conducted to assess population heterogeneity to determine whether there was a significant relation between trimester and the BUMPs factors. If this is significant this indicates that the factor means vary by trimester. The direct associations between trimester and the BUMPs factor indicators were assessed to test measurement invariance because of differential item functioning.

Internal consistency for the scale and the subscales was assessed using Cronbach's α along with the associated confidence intervals (CI). Alpha values of $>.70$ indicate acceptable reliability (Bland & Altman, 1997). Additionally composite reliability was calculated with values $>.70$ judged acceptable (Hair, Anderson, Tatham, & Black, 1998). However, because of the assumptions of Cronbach's α being frequently violated in Psychology (Dunn, Baguley, & Brunsden, 2014) internal consistency was also estimated using McDonald's ω (Dunn et al., 2014; Peters, 2014). To determine reliability of the BUMPs we assessed test–retest reliability in a sample of women who completed the BUMPs twice. Convergent validity was assessed by conducting correlational analyses between the BUMPs and the BCS. Construct validity was assessed by testing the following hypotheses using correlational analyses: (a) BUMPs scores will be negatively associated with relationship quality; (b) depression and anxiety will be positively associated with BUMPs scores; and (c) BUMPs scores will be negatively associated with aspects of subjective experience of interoception, body listening, and body trusting. External discriminant validity will additionally be tested through the calculation of Average Variance Extracted (AVE) scores that were assessed according to the criteria of Fornell and Larcker (1981) that to show internal convergent validity of a factor, the AVE score should exceed 0.5 and to show discriminant validity the AVE score should exceed each of its squared correlations with other factors.

As a final step to validate the scale, we test whether the BUMPs was a significant predictor of antenatal attachment. A series of multiple regression models were performed to test the contribution of variables identified in the literature as significant predictors (gestational age, depression, anxiety, and relationship satisfaction) and body satisfaction measures (BUMPs, BCS) in explaining variation in attachment scores. We test the hypothesis that the BUMPs, but not the BCS, will be a significant predictor of attachment.

Results

Exploratory Factor Analysis of the BUMPs Scale

EFA was conducted on responses from Sample 1. Responses were coded from 1 (*strongly disagree*) to 5 (*strongly agree*). Positively worded items were reverse scored, so that higher scores indicated greater dissatisfaction. Skewness and kurtosis values were acceptable indicating data were in the normal distribution. An r-matrix was produced to report the Pearson correlations between all pairs of items. This was inspected to check the pattern of associations and to identify any items that were weakly related to the others. Seven items were removed that correlated weakly with other items ($r < .3$). These items were: *My partner accepts my physical changes*; *I enjoy exercising in pregnancy*; *I look noticeably pregnant*; *I weigh myself more often now I am pregnant*; *I worry about getting the right nutrients*; *I monitor closely what I eat and restrict calories*; *I enjoy eating extra food for me and my baby.* No issues of multicollinearity were identified (r values $<.9$).

EFA was conducted on the remaining 30 items. This was conducted first as an unrotated solution. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .93 ("marvelous"; Kaiser, 1974). Bartlett's test of sphericity was significant, $\chi^2(496) = 5294.81$, $p = <.001$, confirming that factor analysis was appropriate.

An initial analysis was run to identify the number of components present. Six components had eigenvalues over Kaiser's criterion of 1 and in combination explained 60.42% of the variance. However, only the first three factors explained more than 5% of the variance. The scree plot confirmed that there was one clear primary factor but the inflections would justify retaining two or three factors. Because the two methods converged on three factors, this was the number retained in a rotated solution (promax). A

three factor model was also supported by Horn's Parallel Analysis (Horn, 1965). Items were removed that did not load sufficiently onto the factors (loadings <.4) and one item that loaded across factors. EFA was repeated using promax rotation with three fixed factors. This three factor model explained a total of 54.88% of the total variance in BUMPs score and the three factors explained 37.27, 10.62, and 6.99% of the variance, respectively. The factor loadings are reported in Table 2. The factor loadings had high interpretability and the three factors appeared to tap into distinct aspects of the changing body during pregnancy. The 10 items that loaded onto factor 1 related to satisfaction with appearing pregnant (*Appearance*), for example "I like it when people notice I'm pregnant." The factor score had good internal consistency, Cronbach's $\alpha = .88$ (CI [.86, .90]), McDonald's $\omega = .88$ (CI [.86, .90]). Seven items loaded onto Factor 2 and these related to weight gain concerns (*Weight*), for example "I am worried about the amount of weight I am putting on." Internal consistency was good, Cronbach's $\alpha = .85$ (CI [.83, .87]), McDonald's $\omega = .85$ (CI [.83, .88]). The three items that loaded onto the third factor were related to the physical burdens of pregnancy (*Physical*), for example "I get frustrated that I am less physically able than I was before I was pregnant." Internal consistency was adequate, Cronbach's $\alpha = .71$ (CI [.66, .76]), McDonald's $\omega = .72$ (CI [.67, .77]). Internal consistency for the total 20 item BUMPs was excellent, Cronbach's $\alpha = .91$ (CI [.89, .92]), McDonald's $\omega = .91$ (CI [.89, .92]). Factor intercorrelations ranged from .51 to .54 and did not exceed .7, indicating that factors measure related but distinct constructs.

CFA of the BUMPs

Next, we tested the fit of the three factor model (comprising 20 items) by conducting a CFA with the data from Sample 2. Although the CFI value is not ideal, both RMSEA and SRMR suggest that the three factor model provided acceptable fit (see Table 3). This was compared against a two factor model (combining the appearance and weight factors) and a one factor model. The three factor model was significantly better than the two factor model, $\chi^2 = 132.755$ (2), $p < .001$, and the one factor model $\chi^2 = 227.038$ (3) $p < .001$. Thus, the results support a three factor model. Internal consistency for the final BUMPs scale was good ($\alpha = .90$, CI [.88, .92]; $\omega = .90$, CI [.88, .92]) and the internal consistency and composite reliability of the three factors was above acceptable (see Table 4). AVE scores were calculated for each factor and compared against the recommended threshold of .5 (Fornell & Larcker, 1981) and against each factor's squared correlations with other factors (see Table 4). The AVE score for the physical factor was above the desired threshold and exceeded the squared correlations with appearance and weight. The AVE scores for the appearance and weight factors were below the desired threshold and did not exceed all squared correlations with other factors. All three factors had good test–retest reliability: $r_{appearance} = .93$, $p < .001$; $r_{weight} = .88$, $p < .001$; $r_{physical} = .78$, $p < .001$, $r_{BUMPSstotal} = .91$, $p < .001$ ($n = 93$). The factor structure is demonstrated in Figure 1.

Table 3
Goodness-of-Fit Information for Confirmatory Factor Analysis of 20-Item BUMPs

Model	χ^2 (*df*)	CFI	RMSEA [90% CI]	SRMR
Three factors	415.835 (167)	.866	.080 [.070, .089]	.065
Two factors[a]	548.590 (169)	.796	.098 [.089, .107]	.076
One factor	642.873 (170)	.746	.109 [.100, .118]	.082

Note. BUMPs = Body Understanding Measure for Pregnancy scale; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
[a] Weight and appearance factors combined.

BUMPs scores by trimester. Next, MIMIC analysis was conducted to examine invariance in BUMPs scores based on trimester

Table 2
Factor Loadings for the Three Factor Model of the BUMPs (20 Items): Promax Rotation

Questionnaire items	1	2	3
I like it when people notice I'm pregnant	**.898**	−.175	−.108
I wear clothes to accentuate my pregnancy	**.883**	−.256	−.182
I like it when people comment on the size of my bump	**.782**	−.072	−.089
I'm inclined to hide my body (e.g., example by wearing loose clothing)	**.721**	.053	−.105
I am enjoying my new curves in pregnancy	**.639**	.171	.079
I look good pregnant	**.625**	.148	.078
I have enjoyed changing my wardrobe during pregnancy	**.608**	−.016	.119
I enjoy taking photos of my changing body	**.581**	.029	.113
I feel good about my changing body	**.501**	.189	.203
It upsets me when people comment on my changing body	**.502**	.221	.010
I am worried about the amount of weight I am putting on	−.098	**.956**	−.117
I am concerned about the amount that I am eating and the effect this has on my physical appearance	−.154	**.896**	−.120
I worry about getting my figure back after pregnancy	−.113	**.809**	−.094
I look overweight	−.009	**.737**	−.031
When I compare the shape of my body to other pregnant women, I'm dissatisfied with my own	.122	**.617**	.064
When I compare the shape of my body to other nonpregnant women, I'm dissatisfied with my own	.217	**.532**	.129
I feel like my bump is too big	.116	**.414**	.251
I get frustrated that I am less physically able than I was before I was pregnant	−.081	−.101	**.930**
I find it hard to accept that I get more tired now I am pregnant	−.090	−.161	**.853**
I get embarrassed that I can't do as much physically as I could before I was pregnant	−.032	.055	**.759**

Note. $n = 378$. Loadings > .40 are in boldface.

Table 4
Reliability and Validity Indices for the Three-Factor Model

	Reliability and validity indices				Correlations with other factors			Squared correlations with other factors		
Factor	α [CI]	ω [CI]	CR	AVE	F1	F2	F3	F1	F2	F3
Appearance	.85 [.82, .88]	.85 [.83, .88]	.87	.41	—					
Weight	.84 [.81, .87]	.84 [.81, .87]	.89	.43	.73**	—		.53		
Physical	.74 [.68, .80]	.75 [.70, .81]	.75	.51	.56**	.54**	—	.31	.29	—

Note. α = Chronbach's alpha; CI = confidence intervals; CR = composite reliability; ω = McDonald's omega; AVE = average variance extracted.
** $p < .001$.

of pregnancy. The mean scores on the three factors by trimester are presented in online supplemental material Table 1. The variable trimester was dummy coded and entered as a covariate into a CFA of the BUMPs with 20 items and the three factors of appearance, weight, and physical. The model fit was adequate with little change from the CFA without covariates: χ^2 (201) = 488.233, $p < .001$; CFI = 0.849, RMSEA = 0.078 (90% CI [0.069, 0.087]), SRMR = 0.066. There was no significant direct effect of trimester on the factors (all $z < 1.96$, $p > .05$); thus, indicating no issue of population heterogeneity.

Measurement invariance was tested by fixing all direct effects between the covariates and the indicators to zero and inspecting the modification indices. One item, "I'm inclined to hide my body (e.g., by wearing loose clothing)," had a high modification index (33.157) indicating differential item functioning, such that women in Trimester 1 have a higher mean than women in Trimesters 2 and 3. This makes sense that this item would have a different meaning for women in the first trimester who may attempt to conceal their pregnancies, whereas for women later on in their pregnancies this item relates to feelings of satisfaction with appearing pregnant. Retaining the item would mean that women in their first trimester would score marginally higher on the factor, which could be misinterpreted. Therefore, the decision was made to remove this item. BUMPs scores were compared by trimester using ANOVA. There was no significant difference in total or subscale scores as a function of trimester (all *p*s $> .05$, see online supplemental material Table 1).

Scale Validation

For the purpose of testing convergent and construct validity, data from Samples 1 and 2 were combined. Table 5 presents the correlations between the BUMPs and the BCS, the subscales of the MAIA, the QMI, and the HADS, along with the sample size, means, *SD*s, and range of scores for each measure. The BUMPs demonstrated good convergent validity, with moderate correlations with the BCS, such that respondents who felt more positive about their body changes in pregnancy had a higher degree of satisfaction more generally with their body.

The data confirmed our first hypothesis that BUMPs score would be negatively related with relationship quality. The association was weak to moderate, indicating that higher body satisfaction in pregnancy was related to better relationship quality. Our second hypothesis was that BUMPs score would be positively associated with depression and anxiety scores. We found a medium positive correlation between the BUMPs and HADS-D and HADS-A, indicating that BUMPs scores were related to depression and anxiety but measure a distinct construct. Finally, we predicted that BUMPs scores would be negatively associated with aspects of subjective experience of interoceptive signals, namely the body listening and trusting subscales of the MAIA. As predicted, the trusting subscale of the MAIA was negatively and moderately correlated with the BUMPs, indicating that experiencing one's body as safe and trustworthy was positively associated with acceptance of body changes in pregnancy. The body listening scale was also significantly associated with BUMPs score; however, this association was weak.

Predictors of Antenatal Attachment

In the next set of analyses we test the contribution of BUMPs in explaining antenatal attachment scores (global attachment, and the subscales of quality and intensity) along with other known predictors (gestational age, depression and anxiety, and relationship satisfaction) and including the BCS as a comparison. Zero-order correlations were first conducted to identify predictors for each model (online supplemental material Table 2). The analyses in this section are conducted on Sample 2 only.

A hierarchical multiple regression was conducted to examine predictors of global attachment. Known predictors with significant zero-order correlations were entered in Step 1 (depression and relationship satisfaction) using entry method, and body satisfaction measures (BUMPs and BCS) were entered in Step 2 using entry method. Model 1 was significant, $F(2, 106) = 11.70$, $p < .01$, and explained 18% of the variance. Model 2 explained 27% of the variance in global attachment, $F(4, 104) = 9.56$, $p < .001$. BUMPs and relationship satisfaction were the only significant predictors (see Table 6).

Next, a hierarchical multiple regression was conducted to examine predictors of the subscale attachment quality. Known predictors with significant zero-order correlations were entered in Step 1 (depression, anxiety, and relationship satisfaction) using forced entry method, and body satisfaction measures (BUMPs and BCS) were entered in Step 2 using entry method. Model 1 explained 23% of the variance ($F(3, 107) = 10.48$, $p < .001$) and Model 2 explained 28% of the variance ($F(5, 105) = 7.95$, $p < .001$). The significant predictors were depression and BUMPs scores (see Table 6).

The last model tested predictors of the subscale attachment intensity. Known predictors with significant zero-order correlations were entered in Step 1 (relationship satisfaction and gestational age) using entry method, and body satisfaction measures

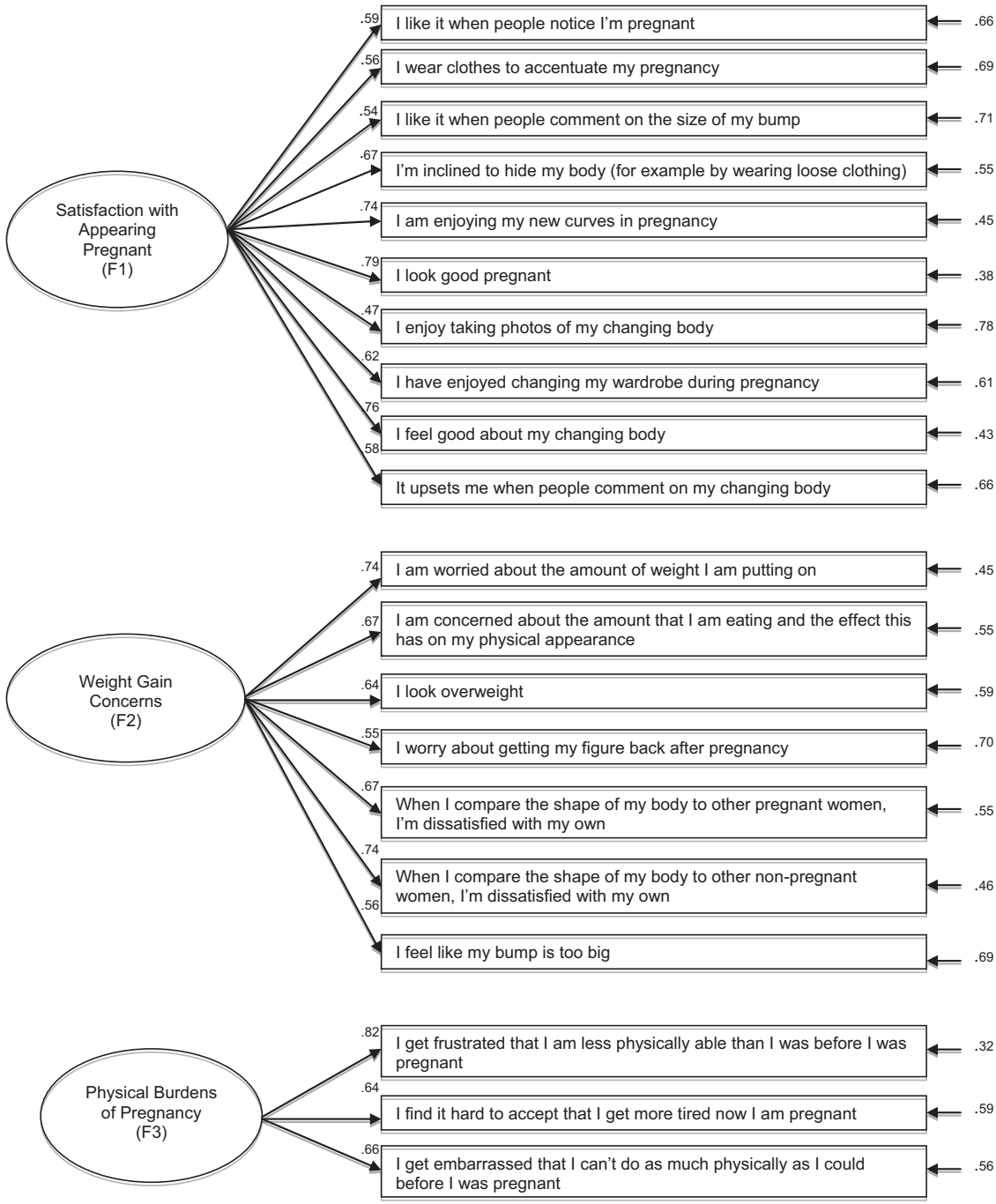

Figure 1. Final confirmatory factor analysis model reporting factor intercorrelations and standardized loadings.

(BUMPs and BCS) were entered in Step 2 using entry method. Model 1 explained 11% of the variance ($F(2, 123) = 7.50$, $p < .01$) and Model 2 explained 22% of the variance ($F(4, 121) = 8.32$, $p < .001$). The significant predictors were BUMPs scores, relationship satisfaction, and gestational age (see Table 6). For all regression models reported in the main text observed scores were used (sum of observed items). However, equivalent regressions using a composite score obtained from the weighted factor scores also produced comparable results (see online supplemental material Table 3).

Discussion

Pregnancy presents a major stage in a woman's life in which her body is changing in often dramatic and unique ways. Women are required to adapt to these physiological and psychological changes

Table 5
Body Understanding Measure of Pregnancy Scale (BUMPs) in Relation to Measures of Marriage Satisfaction, Depression and Anxiety, Body Satisfaction, and Interoceptive Awareness

Measures	Descriptives				Pearson's correlations			
	n	Mean	*SD*	Range	BUMPs	Appearance	Weight	Physical
BUMPs total	608	55.89	14.09	22–94	—			
Appearance	609	25.68	7.27	9–45	—			
Weight	612	20.38	6.59	7–35	—			
Physical	613	9.82	3.07	3–15	—			
QMI total	271	36.79	6.84	18–45	−.235**	−.212**	−.165**	−.205**
HADS-A	166	13.98	3.78	7–27	.404**	.337**	.324**	.373**
HADS-D	151	13.02	3.39	8–23	.549**	.464**	.428**	.522**
BCS	282	141.84	22.46	74–210	−.479**	−.402**	−.450**	−.242**
MAIA trusting	282	4.06	1.10	1–6	−.459**	−.375**	−.461**	−.194**
MAIA body listening	281	3.06	1.10	1–6	−.155**	−.128*	−.163**	−.048
MAIA self-regulation	277	3.63	.97	1–6	−.228**	−.192**	−.217**	−.113
MAIA emotion awareness	283	4.18	.96	1–6	−.033	−.042	−.036	.029
MAIA Not distracting	284	3.18	.94	1–6	−.159**	−.109	−.160**	−.121*
MAIA attention regulation	282	3.72	.86	1–6	−.133*	−.109	−.116	−.095
MAIA noticing	285	4.34	.92	1.25–6	.042	−.021	.064	.103
MAIA not worrying	286	3.62	.95	1–5.67	−.097	−.034	−.118*	−.104
Global attachment	123	71.51	7.38	49–86	−.435**	−.458**	−.291**	−.247**
Attachment quality	123	43.90	4.19	29–50	−.422**	−.462**	−.240**	−.283**
Attachment intensity	123	26.16	4.71	16–36	−.334**	−.336**	−.274**	−.128

Note. BUMPs = Body Understanding Measure for Pregnancy scale; QMI = Quality of Marriage Index; HADS-A = Hospital Anxiety and Depression Scale, anxiety subscale; HADS-D = Hospital Anxiety and Depression Scale, depression subscale; BCS = Body Cathexis Scale.
* $p < .05$. ** $p < .001$.

during a relatively short period of 9 months. This article describes the development and preliminary validation of a novel measure to assess women's feelings toward their bodily changes during pregnancy. The majority of previous research that has considered body satisfaction during pregnancy has relied on general measures not designed for pregnancy, nor fully validated with pregnant samples. General body satisfaction measures are not nuanced to capture feelings toward the body that are unique to pregnancy. We saw it necessary to understand how women feel about these changes and to validate a measure that could be used by researchers to examine the implications that this has for mother and infant outcomes.

Table 6
Summary of Hierarchical Regression Analyses Predicting Antenatal Attachment

Model	Outcome variable	Predictor	β	R^2	Adjusted R^2	F	ΔR^2	ΔF
Step 1	Global attachment	HADS-D	−.30***	.18	.17	11.70***		
		QMI	.25**	.27	.25	9.56***	.09	6.26**
Step 2	Global attachment	HADS-D	−.09					
		QMI	.20*					
		BCS	.00					
		BUMPs	−.37***					
Step 1	Attachment quality	HADS-D	−.46***	.23	.21	10.48***		
		HADS-A	.05					
		QMI	.17					
Step 2	Attachment quality	HADS-D	−.33*	.27	.24	7.95***	.05	3.44*
		HADS-A	.05					
		QMI	.17					
		BCS	−.10					
		BUMPs	−.29*					
Step 1	Attachment intensity	QMI	.27**	.11	.09	7.50**		
		Gestational age	.17					
Step 2	Attachment intensity	QMI	.16					
		Gestational age	.18*	.20	.19	8.32***	.11	8.26***
		BCS	.14					
		BUMPs	−.25**					

Note. BUMPs = Body Understanding Measure for Pregnancy scale; QMI = Quality of Marriage Index; HADS-A = Hospital Anxiety and Depression Scale, anxiety subscale; HADS-D = Hospital Anxiety and Depression Scale, depression subscale.
* $p < .05$. ** $p < .01$. *** $p < .001$.

It has already been demonstrated that body image concerns more generally are associated with negative maternal and infant outcomes, including postpartum depression (Silveira et al., 2015), low infant birth weight (Conti et al., 1998), and lower rates of breastfeeding initiation and retention (Brown et al., 2015). A more precise and validated measure is needed to fully understand the relationship that women have with their pregnant bodies, which can then be used in further studies to assess factors that contribute to a positive experience of the body in pregnancy.

Items were developed drawing on experiences of pregnant women and were evaluated across two samples of pregnant women. Exploratory factor analysis revealed a highly interpretable factor structure consisting of three subscales relating to different aspects of the physical experience of pregnancy: satisfaction with appearing pregnant, weight gain concerns, and the physical burdens of pregnancy. This three factor structure was confirmed with confirmatory factor analysis and resulted in a more parsimonious scale of 19 items. The results indicate adequate goodness-of-fit and the scale has good internal reliability and test–retest reliability, and good convergent and construct validity. While the AVE scores did not fully meet the thresholds for external discriminant validity outlined by Fornell and Larcker (1981), the scores are acceptable given that the factors exhibited excellent internal reliability (Cronbach's α, McDonald's ω, and composite reliability) and that this article reports the first validation of this novel scale; therefore, we recognize that the scale validation is provisional and in need of further replication.

It is of interest that the factors "satisfaction with appearing pregnant" and "weight gain concerns" were moderately correlated, indicating that they are related but distinct constructs. In nonpregnant healthy people, body shape and weight can be considered as similar constructs (Carey et al., 2019). It is understandable that these constructs diverge in pregnancy when women may enjoy looking noticeably pregnant and having a bump but may simultaneously be concerned about the weight that she has gained. The BUMPs correlated moderately with the general measure of body satisfaction, demonstrating that the two constructs are related but measuring different feelings toward the body. This confirms our view that research on body satisfaction in pregnancy needs to consider the multifaceted nature of pregnancy and highlights the need for a specific instrument tailored for pregnancy.

The MIMIC model confirmed that the scale was relevant to women across all three trimesters but indicated that one item ("*I'm inclined to hide my body (for example by wearing loose clothing*") exhibited DIF and was, therefore, removed. Our interpretation was that in early pregnancy women may hide their bodies to conceal weight gain because they do not typically make their pregnancy public until after the first scan (at 12 weeks in the United Kingdom) that is also the point at which the risk of miscarriage decreases (Ammon Avalos, Galindo, & Li, 2012). Insights from a qualitative study of the experiences of mothers in their first trimester supports this, which found that women "were concerned that people who did not know they were pregnant might think that they had become fat, so they tried to hide their pregnancy by wearing different clothes" (Bergbom et al., 2017, p. 583).

We tested a series of hypotheses concerning factors expected to be related to BUMPs scores. Because of a known association with body satisfaction in nonpregnant samples, we hypothesized that relationship quality would be important for explaining some of the variation in BUMPs scores. We found a significant but weak association, with better relationship quality related to more positive feelings toward the pregnant body. The strength of the association is similar to that observed in a large sample of more than 16,000 men and nonpregnant women (Friedman et al., 1999), supporting our finding.

As anticipated, depression and anxiety scores also correlated moderately with BUMPs scores. Given the correlational nature of our data we cannot comment on the causality of this relation. Women with existing depression or anxiety may have more difficulty accepting the body changes in pregnancy. Equally, dissatisfaction with bodily changes in pregnancy or physical difficulties could cause changes in mood. Future work could investigate whether interventions to improve feelings toward the pregnant body also reduce depression and anxiety scores.

We considered the association between the BUMPs and aspects of the subjective experience of interoceptive signals as measured using the MAIA, a multiconstruct self-report measure on interoception (Mehling et al., 2012). The trusting subscale of the MAIA had the strongest association with the BUMPs, and in particular, with the weight gain concerns subscale. The MAIA items that measure trusting refer to feelings of the body as a safe place and trust in bodily sensations. This is pertinent to pregnancy because this is a time in which women are observing and experiencing their bodies developing in unique ways and without their conscious involvement. If one trusts their body to control this process, then it follows that weight gain is accepted as part of the body's response to developing the fetus. We had predicted body listening (the tendency to actively listen to the body for insight) to be associated with BUMPs scores. While we did find a significant correlation, this was weak. However, the subscale may not capture body listening in a way relevant to pregnancy; the items focus on extracting emotional information from the body, whereas a pregnant woman may listen to her bodily signals for insight into the activity of the fetus. A number of MAIA subscales exhibited weak but significant correlations with the BUMPs, which suggests that interoception is a relevant construct to consider but that the MAIA may not tap into this in a meaningful way for pregnant women.

An advantage of the MAIA is that in taps into multiple different aspects of interoception, which may provide a more informative assessment of interoceptive experience during pregnancy. However, such self-report measures do not capture all aspects of interoception. For example, it has been shown that behavioral measures, such as heartbeat detection tasks, provide information about detection of interoceptive signals, which is a dissociable phenomenon compared with the subjective experience of interoception, referred to as interoceptive sensibility, as measured by self-report questionnaires (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015) Furthermore, the MAIA has been criticized for only assessing interoceptive sensibility using a small number of items, with the majority of items probing other related constructs (Brewer, Cook, & Bird, 2016). Therefore, future studies should aim to examine interoception during pregnancy using multiple measures including both self-report questionnaires and behavioral experiments. It may be particularly important to understand these varied aspects of our interoceptive experience during pregnancy, because they may be differentially affected by antenatal bodily changes. For example, the experience of hunger, thirst, and bodily signals from the abdomen might be more likely to be directly

changed by pregnancy because of the close link between these sensations and needs/wellbeing of the growing fetus.

The BUMPs was further validated by the finding that this measure significantly predicted antenatal attachment, and was a more powerful predictor than gestational age, depression, and anxiety; factors previously identified in the literature to be the strongest predictors of attachment (Yarcheski et al., 2009). In addition, not only was BUMPs the strongest predictor, but including BUMPs in the regression model explained a significantly greater amount of variance for each aspect of attachment. The BCS, a general measure of body satisfaction, was not a significant predictor of attachment, demonstrating the significance of having a measure tailored to pregnancy. Forming a bond with the unborn baby is an important process that occurs during pregnancy and has been identified to be related to numerous maternal and infant outcomes, including depression during pregnancy and maternal postpartum psychological health (Alhusen, Hayat, & Gross, 2013; Condon & Corkindale, 1997; Lindgren, 2001) and at the extreme end of the scale, intention to harm the fetus (Pollock & Percy, 1999).

We have demonstrated that this process of forming a psychological attachment with the unborn baby is, in part, related to the mother's perception and experience of the bodily changes in pregnancy. Indeed, there are physical aspects of the experience that have been identified to contribute to attachment, including feeling fetal movements (e.g., Condon, 1985) and viewing the fetus via ultrasound scanning (Sedgmen, McMahon, Cairns, Benzie, & Woodfield, 2006); however, the effect sizes are low (Yarcheski et al., 2009). Body satisfaction is not an aspect of pregnancy that is currently given attention in routine antenatal care. The BUMPs offers a quick and reliable way to gauge women's feelings during pregnancy and could be a useful tool for midwives and other professionals supporting women antenatally. An interesting question that warrants further investigation is whether women's body satisfaction in pregnancy could be improved via intervention and whether this results in improved antenatal attachment and better maternal and infant outcomes. One outcome of note would be breastfeeding duration, which has been related to body concerns in pregnancy (Brown et al., 2015).

The limitations of the study suggest important avenues for future research. First, we did not consider women's prepregnancy BMI. Overweight or obese women may have a different experience during pregnancy compared with healthy weight women. Some research suggests that many overweight women feel pregnancy gives them temporary respite from worrying about weight because the nutritional needs of the fetus come first, giving them a reason to gain weight (Wiles, 1998). Fox and Yamaguchi (1997) report differences in body satisfaction in pregnancy depending on prepregnancy weight status. Of women who entered pregnancy with a normal weight, 62% reported feeling dissatisfied with their bodies during pregnancy, compared with 23% of overweight women. However, a more recent study by Furber and McGowan (2011) highlights the negative experiences of being overweight and pregnant that relate directly to the constructs captured in the BUMPs. For example, some of the overweight women they interviewed reported feeling distress when others did not notice that they were pregnant until later on in their pregnancy (Furber & McGowan, 2011). In addition, weight gain during pregnancy was seen as more of a contentious issue for those already overweight because of the medicalization of their pregnancy because of being labeled "high-risk" (Furber & McGowan, 2011). Because higher prepregnancy BMI is related to greater health concerns for both mother and infant (Yu, Teoh, & Robinson, 2006) interactions with medical professionals about pregnancy weight gain can be humiliating and distressing (Furber & McGowan, 2011).

On the other hand, low prepregnancy BMI may also influence BUMPs scores given that bodily changes may be perceived as more dramatic in this cohort. Apart from a higher incidence of low infant birth weight, underweight prepregnancy BMI has actually been associated with more positive pregnancy outcomes (Bhattacharya, Campbell, Liston, & Bhattacharya, 2007; Sebire, Jolly, Harris, Regan, & Robinson, 2001) so is unlikely to receive the same medicalization as for high BMI women. Indeed, those with eating disorders, including anorexia nervosa with extreme low body weight, are reported to experience a temporary reduction of their symptoms during pregnancy (Blais et al., 2000; Micali, Treasure, & Simonoff, 2007; Rocco et al., 2005) but are at a higher risk of postnatal depression (Morgan, Lacey, & Chung, 2006). However, to date little research has been conducted on antenatal body satisfaction in healthy low and underweight women and what effect this may have on postnatal outcomes. Therefore, it is important that future studies examine how BUMPs scores relate to prepregnancy BMI.

A second limitation is that the BUMPs was developed on a sample of predominantly white British women; therefore, the extent to which the scale is applicable across cultures is not known. There are cultural variations in body ideals (Kronenfeld, Reba-Harrelson, Von Holle, Reyes, & Bulik, 2010) and ethnic origin has been found to be related to prenatal weight gain (e.g., Rosenberg, Garbers, Lipkind, & Chiasson, 2005). It is then presumed that there will be cultural differences in the perceptions of pregnancy and the pregnant body and also health care practices (e.g., recommendations about weight gain, exercise, and diet), however research is limited. A future direction for research would be to examine variations in women's feelings toward their pregnant bodies across cultures, and how this relates to antenatal health care practices.

The BUMPs offers a reliable and valid measurement of women's feelings toward their body during pregnancy and distinguishes between three distinct dimensions; satisfaction with appearing pregnant, weight gain concerns, and the physical burdens of pregnancy. The scale is relevant to women in all three trimesters of pregnancy, demonstrates good convergent, and construct validity and retest reliability. It is quick to administer and could be used by midwives during routine appointments to identify women who may be experiencing high levels of body dissatisfaction during their pregnancy and, thus, may find it less easy to form strong attachments with their unborn child. However, it should be noted that our models explained a total of 20–27% of the variance in attachment scores; therefore, beyond BUMPs and the established predictors identified in the literature (i.e., depression and anxiety, relationship quality, and gestation) we are yet to fully understand this complex psychological process that women experience during pregnancy. Identifying body satisfaction as a significant contributor to this process takes us one step closer. Now that we have a reliable and valid measure of body satisfaction specific to pregnancy, future work can focus on determining the importance of this for postnatal maternal and infant outcomes, for example postnatal

depression, infant birth weight, breastfeeding initiation and retention.

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