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The Power of Believing: Salient Belief Predictors of Physical Activity Behavior in Normal Weight, Overweight, and Obese Pregnant Women

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Abstract

Background—Nearly 50% of U.S. women enter pregnancy as overweight or obese (OW/OB). There is a critical need to understand how to motivate OW/OB pregnant women for exercise behavior to improve their health and reduce adverse pregnancy outcomes.

Purpose: To examine salient Theory of Planned Behavior belief predictors of normal weight (NW) and OW/OB pregnant women's exercise behavior (EXB) across pregnancy.

Methods—Pregnant women (N = 357) self-reported their exercise beliefs and behavior during each pregnancy trimester. Pearson correlations were used to examine exercise beliefs-behavior associations. Stepwise regressions were used to identify trimester (TRI) 1 and TRI 2 belief predictors of TRI 2 and TRI 3 EXB, respectively, for each weight status group. Belief endorsement was examined to identify critical beliefs.

Results—TRI 1 EXB beliefs explained 58% of the total variance (22% NW, 36% OW/OB) in TRI 2 EXB. TRI 2 EXB beliefs explained 32% of the total variance (17% NW, 15% OW/OB) in TRI 3 EXB. Individual beliefs varied by weight status and trimester. Control beliefs emerged with the lowest endorsement; making them most critical to target for exercise interventions.

Conclusion: Prenatal exercise interventions should be weight status specific and target salient beliefs/barriers unique to the pregnancy trimesters.

Keywords

Pregnancy; Exercise; Theory of Planned Behavior

Prenatal exercise behavior (EXB) is associated with numerous health benefits including a reduced risk of pregnancy complications (e.g., gestational diabetes, preeclampsia, high gestational weight gain) and improved cardiorespiratory fitness, body image, and stamina

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during delivery.[1,2] Despite these benefits, epidemiological evidence shows that only 15% of pregnant women meet national guidelines of at least 150 min/week of moderate intensity physical activity compared to the general population (58%).[2-4] Given the physiological (e.g., increased blood volume and weight) and psychological (e.g., anxiety) changes of pregnancy, exercise levels tend to decrease from prepregnancy to pregnancy and often do not rebound after delivery.[3,5,6] Low EXB is also common among overweight and obese (OW/OB) women and nearly 50% of U.S. women enter pregnancy classified as already OW/OB.[1, 7] Even more concerning is the high rate of complications (macrosomia, shoulder dystocia, birth trauma) among infants of OW/OB women.[1, 8] Consequently, there is an important need to understand how to promote prenatal exercise among OW/OB women.

One theory that has been used to understand pregnant women's exercise motivation and behavior is the Theory of Planned Behavior (TPB).[9] In short, the TPB posits that a woman is more likely to engage in EXB when she is motivated (intention), which is preceded by thoughts that exercise is useful and beneficial (attitude), significant others want her to engage in exercise (subjective norm), and she has the ability and resources needed to be active (perceived behavioral control). Underlying these motivational constructs are beliefs including behavioral beliefs, or the thoughts/cognitions influencing attitude which can be categorized as affective (e.g., exercising for enjoyment or pleasure) and instrumental (e.g., exercising for utility such as health benefits). Normative beliefs are one's perception of the social pressures and willingness to comply with the wishes of others; these beliefs influence subjective norm. Lastly, control beliefs, or one's opinion of the ease or difficulty in adopting a behavior, such as lack of time due to family or work commitments, influence perceived behavioral control.[9] The TPB has been used to understand the motivational determinants of pregnant women.[10-15] Past researchers have found the predictors of EXB vary across the trimesters, with perceived behavioral control emerging as the strongest predictor of EXB in the 1st trimester and intention emerging as the strongest predictor in the 2nd and 3rd trimesters.[11] These findings suggest that unique changes associated with pregnancy across the trimesters may influence the strength of these motivational determinants. For example, in early pregnancy, common 1st trimester symptoms (nausea, vomiting) may influence a woman's perceived control for EXB whereas in later pregnancy, it appears that the strength of her motivation most strongly influences her EXB.[11,15]

Although the validity of the TPB is a topic of much debate with some opponents[16] and some proponents,[17] a main focus of the critiques is the intention-behavior gap and that belief-intention relations may not translate to belief-behavior relations.[16, 17] However, examining belief-level constructs with the TPB is nonetheless appealing because one's behavior is a direct function of one's belief about the behavior[9,18] and beliefs may be salient targets for behavior change interventions. Few (if any) studies have examined belief-level exercise predictors in pregnant women and no located studies were found that examined these predictors across normal weight and OW/OB pregnant women despite that researchers have found weight status differences in exercise-related beliefs of non-pregnant women.[19, 20] Specific to pregnant women, past researchers have identified exercise beliefs (e.g., exercise improves mood, physical symptoms [nausea] limit exercise),[14] however, these beliefs were elicited from mostly normal weight women. A more recent study[21] qualitatively examined exercise beliefs in OW/OB women and found that they viewed healthy eating as more

important to maternal-infant health than EXB and the main benefit of EXB was to reduce weight in postpartum. It may be that a woman's exercise beliefs and the extent to which these beliefs are influenced by her weight status are independent predictors of her EXB. Understanding if beliefs vary across weight status is needed to design effective interventions that promote prenatal EXB in normal weight and OW/OB women. However, for an intervention directed at changing beliefs to increase EXB, the beliefs that have a relationship with EXB must have enough variability (i.e., room for improvement) for an intervention to be able to impact them in a practical way. Those beliefs with lower endorsement, in the absence of a ceiling effect, should be most receptive to intervention because they have more room for improvement.[18] By identifying the theoretically-based, belief-level predictors of EXB that are most salient among both normal weight and OW/OB women, interventions can be designed to strengthen beliefs positively related to EXB (e.g., affective beliefs)[20] and reduce exercise barriers (i.e., control beliefs).[20]

The purpose of this study was threefold. The first aim was to examine associations among individual beliefs (behavioral, normative, control) with EXB from the 1st to 2nd and 2nd to 3rd trimesters across weight status groups (normal weight; OW/OB) pregnant women. Based on prior research,[15, 17, 22] it was hypothesized that both affective (i.e., behavioral) and control beliefs would correlate with EXB. Due to the scant research in this area, no a-priori hypotheses were established regarding the extent to which the relationship of the beliefs with EXB would be moderated by weight status or trimester. The second purpose was to examine the extent to which the beliefs predicted 2nd and 3rd trimester EXB across normal weight and OW/OB pregnant women. Based on prior research,[10, 13, 20] it was hypothesized that affective and control beliefs would predict EXB. No a-priori hypotheses were not established regarding the individual contributions of the beliefs across the weight status groups due to the lack of past evidence in this area. The third goal was to identify beliefs that are most critical to target in a future exercise intervention by examining belief advocacy (% of women who agreed with and endorsed the belief) across normal weight and OW/OB pregnant women. It was hypothesized that control beliefs would display lower agreement than behavioral and normative beliefs.[22, 23]

Methods

Participants

Sample characteristics by weight status (normal weight; OW/OB) are presented in Table 1. Participants were 357 pregnant women (*M* age = 30 years) and the majority were Caucasian (92%), married (91%), college graduates (95%), working full-time (72%), and had a family income in the middle range of $40,000-$100,000 per year (51%). Most of the participants were not on maternity leave (99%) and over half had no other children (61.4%). The mean prepregnancy body mass index (BMI) was 24.41 (*SD* = 5.14), which was within the normal range.[24] Normal weight women had significantly lower BMI compared to OW/OB women. No other weight status group differences were observed for participant demographic characteristics.

Design and Procedures

This study was approved by the university's institutional review board and conducted using a prospective design as part of a larger longitudinal study in the first author's laboratory. Consent was obtained from a local OB/GYN clinic to recruit participants from the office. At their first prenatal visit (8-12 weeks gestation), pregnant women received an informational study flyer; interested participants provided their contact information on the form, which was collected by the nurse or mailed to the research team by the woman herself. Volunteers were then mailed a 1st trimester (TRI 1) questionnaire packet containing the TPB measures and demographic surveys. Ransdell's[25] procedures were used to increase the response rate: providing stamped return envelopes, personalized cover letters, and administering multiple reminders by telephone and postcard over a 3-week period. Participants who did not return their surveys after the reminder period were removed from the study. Women who returned their TRI 1 surveys (N = 357) were then mailed the TRI 2 packet using the same follow-up methods. Those who returned the TRI 2 surveys (N = 300) were sent the TRI 3 packet, of which 249 returned their surveys. The overall response rate was 70% from TRI 1 to TRI 3; which is slightly above the average rate (65%) for mail survey-based studies.[26]

Measures

TPB Beliefs. Behavioral beliefs (BB) were measured with 7-items based on Ajzen's recommendations[27] for TPB questionnaires with the addition of exercise-related beliefs elicited from pregnant women.[14] The statement "Exercising regularly in my 1st/2nd trimester will:" preceded affective (e.g., improve my overall mood, provide stress relief) and instrumental (e.g., help to control my weight, keep me in shape) beliefs which were assessed with a seven-point unipolar scale ranging from 1 (i.e., extremely unlikely) to 7 (i.e., extremely likely). *Normative beliefs (NB)* were assessed with 4-items from an elicitation study with pregnant women.[14] The statement "How strongly will these people approve of you exercising in your 1st/2nd trimester:" preceded belief items: husband/partner/fiancé, friends, nurses, and doctors/nurse midwives. Participants rated the items on a Likert scale ranging from 1 (not strongly) to 7 (very strongly). *Control beliefs (CB)* were measured with 9-items based on Ajzen's recommendations[27] for a control belief questionnaire and elicited with pregnant women.[14] The question "How difficult will it be for you to exercise in your 1st/2nd trimester given the following" preceded the 9 belief items reflecting salient control beliefs (e.g., no time to exercise, experiencing soreness, being afraid to harm self, having no motivation to exercise, experiencing pain). The items were rated on a Likert scale ranging from 1 (not difficult) to 7 (extremely difficult).

Leisure-Time Exercise Questionnaire (LTEQ). The frequency of strenuous (e.g., running, swimming), moderate (e.g., fast walking, dancing), and mild (e.g., easy walking) leisure-time exercise performed during a typical week was measured using the validated LTEQ.[28,29] Participants were asked to report average weekly bouts of at least 15 min of strenuous, moderate, and mild exercise for each trimester. Total minutes were determined by summing strenuous, moderate, and mild scores (i.e., bout×15 min). The LTEQ is a valid and reliable measure of exercise in adults[28] and has been successfully used in studies examining the TPB and exercise behavior of pregnant women.[11, 14, 30]

Demographic questionnaire

A demographic questionnaire assessed age, height, weight, marital status, occupation, employment, education, ethnicity, socioeconomic status, and baby's due date.

Data Analyses

Preliminary Study Analyses

All analyses were performed in SPSS software (version 22). Descriptive statistics were used to examine means and frequencies of the study variables. Data were examined by prepregnancy weight status groups. Women with a BMI < 18.50 were classified as underweight and were excluded from the study (N = 15). Women with a BMI > 18.50 and ≤ 24.99 were classified as normal weight (NW; N = 174). Women with a BMI ≥ 25 classified as overweight/obese (OW/OB; N = 75). No significant differences were observed for demographic variables (i.e., age, race/ethnicity, education, family income, marital status), pre-pregnancy BMI, or parity between women who completed all surveys and those who dropped out. No significant weight status differences in age, parity, or demographic variables were also observed. No significant weight status differences in LTEQ total min were observed in TRI 2 or TRI3 although examination of the mean values and percent meeting national guidelines were higher for NW compared to OW/OB women (see Table 2). Missing data across the TPB beliefs were mean replaced only if one or two items were missing from the participant's responses. If greater than two items were missing for behavioral or control belief scales, none of the missing items in the respective scale were mean replaced for that participant at that time point. If greater than one normative belief item was missing from the scale, the missing items were not mean replaced at that time point. Less than 5% of overall data were mean replaced; all items were checked for normality.

Main Study Analyses

Given the criticisms of the TPB[17] and equivocal support for examining the intention-behavior associations in the TPB literature[19, 31, 32] EXB (and not intention) was the primary dependent variable for this study. Pearson correlations between the beliefs and EXB (LTEQ total minutes) were conducted by weight status from TRI 1 to TRI 2 and TRI 2 to TRI 3. To reduce multicollinearity among the belief variables, the means for each individual belief variable were centered and entered into a stepwise regression to identify independent predictors of EXB for each weight status group.[30] This approach has been used to determine if TPB beliefs are independent predictors of EXB.[22] To explore belief advocacy and to identify the salient beliefs, the following conditions were considered.[34] (1) belief is strongly related to EXB, (2) enough individuals should not advocate for the belief (i.e., those that do not rate it positively) to merit an attempt at changing the belief; and (3) it should be possible to change the belief (amenable to change and reinforced by strong evidence). To determine belief advocacy, frequency counts were calculated within the belief-item response scales (1-not strongly to 7-very strongly) for each belief that was a significant predictor of EXB. Percent-below-advocacy was calculated for each belief at each time point by summing the frequencies for scale responses 1-4 (i.e., < endorsement of five on the seven-point scale) and dividing by the total responses for that item.[31] Beliefs with ≥ 50% of responses below the

endorsement margin were considered “below advocacy,” those with ≥ 50% of responses above the endorsement margin were considered “above advocacy” and beliefs with > 50% advocacy but still with room for greater endorsement (i.e., > 35% below advocacy) were considered to have “moderate” advocacy.

Results

Correlations

Bivariate correlations for the weight status groups are presented in Table 3. All seven behavioral beliefs (BB; range r = .40-.86) and four normative beliefs (NB; range r = .25-.97) were significantly and positively correlated within their respective belief groups within each trimester and weight status groups. The strongest BB associations were between “improve overall mood” and “increase energy/stamina” and “improve overall health”. The strongest NB association was between nurses and doctors/midwives. Most of the control beliefs (CB) were significantly associated with each other for the NW group (range r = .15-.78; strongest association was between “feeling lazy” and “no motivation”). However, fewer CB were significantly correlated for OW/OB women (range r = .25-.65; with the strongest association between “experiencing soreness” and “experiencing pain”).[a] All TRI 1 BB for the NW group were significantly correlated with TRI 2 EXB except “keep me in shape” and “improve overall health.” The only TRI 1 BB for the OW/OB group that was significantly correlated with TRI 2 EXB was “decrease discomfort/soreness.” No TRI 2 BB were significantly correlated with TRI 3 EXB in the NW group. In the OW/OB group, the TRI 2 BB that EXB would “control weight” and “improve overall health” were significantly correlated with TRI 3 EXB. No TRI 1 NB were significantly correlated with TRI 2 EXB for either group. The TRI 2 NB that “friends” approve of EXB in the 2nd trimester were significantly correlated with TRI 3 EXB in the OW/OB group. No TRI 2 NB of the NW group were significantly correlated with TRI 3 EXB. In the NW group, all TRI 1 and TRI 2 CB except “being afraid to harm self” and “experiencing pain” were significantly negatively correlated with TRI 2 and TRI 3 EXB, respectively. In the OW/OB group, the TRI 1 CB “experiencing soreness,” “no motivation to exercise,” and “feeling lazy” were significantly negatively correlated with TRI 2 EXB. The TRI 2 CB “no motivation to exercise” was significantly correlated with TRI 3 EXB. Fisher’s *r-to-Z* transformation showed the TRI 1 CB to TRI 2 EXB correlations for “no motivation to exercise” (Z = −1.99, p < .05) and the TRI 2 CB to TRI 3 EXB correlation for “no time to exercise” differed significantly between weight status groups (Z = −1.91, p < .05).

Stepwise Regressions

The exploratory stepwise regressions can be found in Table 4. In the model predicting TRI 2 EXB, the TRI 1 BB that exercise would “decrease discomfort/soreness” significantly predicted TRI 2 EXB in both weight status groups and explained 6% of the variance in TRI 2 EXB in the NW group and 10% of the variance in TRI 2 EXB in the OW/OB group. In the model predicting TRI 2 EXB in the NW group, the TRI 1 CB “being tired or fatigued” in

[a]Due to the large number of inter-correlations, the individual correlations were not presented here but are available upon request from the first author.

model one significantly predicted TRI 2 EXB and explained 11% of the variance in TRI 2 EXB. Including the TRI 1 CB “family responsibilities” in model two explained an additional 5% of the variance in TRI 2 EXB among the NW group with “being tired or fatigued” providing the greatest overall contribution followed by “family responsibilities.” In the model predicting TRI 2 EXB in the OW/OB group, the TRI 1 CB “no motivation to exercise” significantly predicted TRI 2 EXB and explained 26% of the variance in TRI 2 EXB. No TRI 1 NB emerged as significant predictors of TRI 2 EXB for either weight status group. In the model predicting TRI 3 EXB, the TRI 2 BB that exercise would “control weight” was the only significant BB predictor of TRI 3 EXB and explained 8% of the variance of EXB in OW/OB women. The TRI 2 NB that “friends” approve of exercise in the 2nd trimester was a significant predictor of TRI 3EXB of OW/OB women and explained 8% of the variance in TRI 3 EXB. In the model predicting TRI 3 EXB in the NW group, the TRI 2 CB “no time to exercise” predicted TRI 3 EXB and explained 15% of the variance in TRI 3 EXB. Including the TRI 2 CB “feeling lazy” in model two explained an additional 2% of the variance in TRI 3 EXB among the NW group with “no time to exercise” providing the greatest overall contribution followed by “feeling lazy.”

Belief Advocacy Analyses

The percent of women that endorsed the significant beliefs below advocacy are reported in Table 4. Examining ceiling effects with significant BB predictors of TRI 2 EXB revealed that the unique significant predictor BB “decrease discomfort/soreness” displayed moderate advocacy in the NW group (62% advocacy) and the OW/OB (65% advocacy). The significant CB predictors of TRI 2 EXB in the NW group “tired or fatigued” (52% advocacy) and “family responsibilities” (29% advocacy) displayed moderate to low advocacy, respectively. The significant CB predictor of TRI 2 EXB in the OW/OB group “no motivation to exercise” (37% advocacy) displayed low advocacy. The TRI 2 BB predictor of TRI 3 EXB for the OW/OB group “control weight” displayed high advocacy (81% advocacy). The significant NB predictor of TRI 3 EXB that “friends” approve of exercise in the 2nd trimester presented with high advocacy in the OW/OB group (85% advocacy). Both significant CB predictors of TRI 3 EXB in the NW group “no time to exercise” (25% advocacy) and “feeling lazy” (14% advocacy) displayed low advocacy.

Discussion

The study purposes were to examine TPB belief-level predictors of exercise behavior in pregnant women across trimesters and by weight status and to identify salient belief predictors with the greatest potential for impact in a future exercise intervention. Overall, TRI 1 beliefs explained 58% of the total variance (22% NW, 36% OW/OB) in TRI 2 EXB whereas TRI 2 beliefs explained 32% of the total variance (17% NW, 15% OW/OB) in TRI 3 EXB. The salient individual belief predictors varied by weight status and trimester. The behavioral belief that exercise decreases discomfort/soreness during pregnancy was the strongest predictor of TRI 2 EXB in NW and OW/OB pregnant women whereas controlling weight most strongly predicted TRI 3 EXB in OW/OB women. Friends had the strongest normative influence of TRI 3 EXB in only OW/OB women. The most salient control beliefs predicting low EXB among NW women were being tired/fatigued (TRI 2) and no time (TRI

3). Among OW/OB women, having no motivation most strongly predicted low TRI 2 EXB. All significant behavioral and normative belief predictors were endorsed by most of the women. However, significant control belief predictors were not; thus indicating that both NW and OW/OB pregnant women may be unaware that control belief barriers were actually keeping them from exercising. These findings suggest the need to target these beliefs in prenatal exercise interventions and to tailor intervention efforts by weight status. Several findings warrant further discussion.

Our first hypothesis that both affective (i.e., behavioral) and control beliefs would be associated with EXB was partially supported. In the NW group, all TRI 1 behavioral beliefs except “keep me in shape” and “improve overall health” were positively associated with TRI 2 EXB; however, no TRI 2 behavioral beliefs were significantly associated with TRI 3 EXB. The belief-behavior relationship was more consistent for control beliefs among NW women. All control beliefs except “being afraid to harm self” and “experiencing pain” were significantly (negatively) correlated with TRI 2 and TRI 3 EXB. There were fewer significant belief-EXB relationships for OW/OB. For example, “decrease discomfort/ soreness” was the only TRI 1 behavioral belief that was positively correlated with TRI 2 EXB. Only two TRI 2 behavioral beliefs (“help control weight” and “improve overall health”) were positively correlated with TRI 3 EXB. While three TRI 1 control beliefs (“experiencing soreness,” “no motivation to exercise,” and “feeling lazy”) were significantly (negatively) associated with TRI 2 EXB; no significant TRI 2 control belief-TRI 3 EXB associations were observed. Furthermore, Fishers *r-to-Z* tests indicated a significant difference between the weight status groups for the relationship between TRI 1 control belief “no motivation to exercise” and TRI 2 control belief “no time to exercise.” Notably, while the correlation coefficients of affective belief-EXB associations for the NW women decreased from TRI 2 to TRI 3, most of the correlation coefficients for affective beliefs among OW/OB women increased from the TRI 2 to TRI 3. This suggests a difference in the affective belief mechanisms in association with the unique physical changes (e.g., body shape and size) that occur over pregnancy between weight status groups. These findings and suggest the need for trimester specific, as well as weight-status-specific, prenatal EXB interventions.

We also found support for our second hypothesis that behavioral and control beliefs would predict EXB. In summary, TRI 1 beliefs explained 58% of the total variance (22% in NW women, 36% in OW/OB women) in TRI 2 EXB whereas TRI 2 beliefs explained 32% of the total variance (17% in NW women, 15% in OW/OB women) in TRI 3 EXB. Among the significant behavioral belief predictors, “decrease discomfort/ soreness” emerged as a significant predictor in both the NW and OW/OB groups predicting TRI 2 EXB. The stability of this belief as a predictor of EXB in both weight status groups suggests that it is a consistent and important factor in determining a pregnant women’s EXB during early pregnancy regardless of her weight status. Interestingly, less than 30% of NW and 22% of OW/OB women were meeting national activity guidelines in TRI 2 and TRI 3; suggesting that the belief-behavior pathway may be one avenue for targeting exercise promotion. That is, strengthening positive beliefs about exercise may help to promote sufficient activity to meet the guidelines of 150 min of moderate-intensity exercise.

The TRI 1 control beliefs predicting TRI 2 EXB varied across weight status groups with "tired or fatigued" and "family responsibilities" emerging as significant predictors for NW women whereas "no motivation" was the only significant control belief predictor of OW/OB women. This finding is consistent with past researchers who found that while OW/OB women understand that prenatal exercise has health benefits, they could not identify any specific benefits.[35] Increasing both the maternal and infant benefits of exercise in pregnancy may motivate OW/OB women, and in turn, promote higher exercise levels.

The TRI 2 belief predictors of TRI 3 EXB also varied across weight status groups. For NW women, the control beliefs of "no time to exercise" and "feeling lazy" were significant predictors of TRI 3 EXB. Among OW/OB pregnant women, the behavioral belief "control weight" and normative belief "friends" significantly predicted TRI 3 EXB. The normative influence of friends as a predictor and positive correlate of OW/OB women's EXB during the third trimester is a unique finding, as previous research has reported that OW/OB women view family/friend encouragement as a barrier, and not a benefit to engaging in physical activity.[33] Understanding the underlying physical (e.g., symptoms of fatigue, nausea, weight gain), psychological (e.g., stress, anxiety), and social (i.e., friends, significant others) mechanisms influencing these belief predictors of EXB over the course of pregnancy is an important area for future research.

The third hypothesis that control beliefs would display lower belief advocacy than behavioral and normative beliefs was also supported. The significant behavioral beliefs at both time points were endorsed by the majority of women in both weight status groups (i.e., displaying high advocacy). The one emergent normative belief predicting TRI 3 EXB among OW/OB women that "friends" approve of exercise in the 2nd trimester was endorsed by 85% of OW/OB women. In contrast, all but one of the emergent control beliefs were endorsed by the majority of participants at both time points. Over half of NW women endorsed the TRI 1 control belief "being tired or fatigued" (51%) in other words, indicating that they acknowledge that is extremely difficult to exercise because of feelings of fatigue. However, the significant TRI 1 control belief predictor "family responsibilities" was only acknowledged as a barrier by 28% of NW women. Similarly, The TRI 2 control beliefs "no time to exercise" (25%) and "feeling lazy" (14%), though salient predictors of EXB in NW women, were not endorsed as barriers to EXB by a majority of NW women. For OW/OB pregnant women, only 18% endorsed the significant TRI 1 control belief predictor "having no motivation to exercise" as a primary barrier to engaging in EXB. In summary, at both time points, control beliefs were endorsed by less than or nearly half of the women, which suggests that these women may not have been aware of the possibility that these beliefs (e.g., no motivation, family responsibilities) were actually impeding their EXB.

The low endorsement of the control belief predictors demonstrates their potential for intervention[17] as they are related to EXB and have low support by the population. The combination of internal (i.e., fatigue, no motivation, feeling lazy) and external (i.e., family responsibilities, no time) barriers to EXB that emerged as below advocacy is consistent with other studies.[14, 21, 36] Thus, future prenatal exercise interventions should be designed to increase self-awareness of these potential barriers and provide behavioral strategies (e.g.,

self-monitoring, reflection, etc.) to overcome both internal and external exercise barriers in pregnant women.

The change in belief predictors and belief advocacy across trimesters is consistent with past research showing that beliefs about physical activity during pregnancy are trimester-specific. [11, 12,15]A unique contribution of the current study to the literature is that our study findings suggest the exercise beliefs are both trimester-specific and weight status-specific. Prior research comparing attitudes and affective responses toward exercise in non-pregnant women has shown that OW/OB women experience significantly less pleasure, and while exercising due to increased perceived exertion by OW/OB women as a result of increased oxygen uptake.[37] One reason for the weight-status specific changes in belief predictors during pregnancy may be that the rapid physical growth that occurs during pregnancy impact NW and OW/OB women physiologically in different ways. Thus, feelings of perceived exertion in both NW and OW/OB women are increased, but prenatal weight-status differences exacerbate these changes and impact women's exercise motivation. This finding provides additional support for tailoring prenatal exercise interventions to women's weight status and targeting specific individual beliefs and barriers within the behavioral modification content.

This study provides a novel contribution to the literature as it is the first study to our knowledge that identifies weight-status specific TPB beliefs impacting EXB that are modifiable targets for intervention. This is particularly important because identifying strategies for intervention to promote prenatal EXB in NW and OW/OB women is particularly challenging as most pregnant women are inactive regardless of the known public health recommendations to be active for maternal and infant health benefits.[1, 2] There are, however, some study limitations worthy of mention. The sample population consisted of mostly married, middle income Caucasian women, and the good response rate indicated that our sample was motivated. Thus, the findings are limited in their generalizability to other populations, and the methodology should be replicated in more heterogeneous samples to extend the applicability of the findings. Also, while pre-pregnancy EXB, physical symptoms, and psychological health have been found to be associated with prenatal EXB,[38, 39] these factors were not examined in the current study. Examining these factors as potential moderators or mediators of the beliefs-EXB associations is an avenue for future research. In addition, all measures were assessed with reliable self-report questionnaires; however, the use of objective exercise measures and body weight may provide a more accurate estimate of these constructs. Future research is needed to examine the underlying mechanisms of belief endorsement specific to weight status groups using more intensive measurement (e.g., weekly over the trimesters) to fully depict the changing dynamics of the associations in order to have a more concrete understanding of how and when exactly the beliefs change over the course of pregnancy and influence EXB. Lastly, although the TPB's utility is a topic of debate with diverse opinions,[16,17] experimental and intervention research is needed before its usefulness can be fully determined. Our study findings suggest the TPB is useful for identifying specific belief-level targets for EXB promotion among a special population of pregnant women, and therefore, testing these belief targets in a future intervention is warranted.

Conclusion

These preliminary study findings indicate that TPB beliefs are important predictors of prenatal EXB among both NW and OW/OB pregnant women and they illustrate that control beliefs may be modifiable targets for intervention to promote exercise. Identifying strategies to help NW and OW/OB women overcome exercise barriers, especially early in pregnancy, may help them to begin or maintain EXB throughout the course of pregnancy that in turn, may provide health benefits (e.g., manage weight gain in pregnancy, improve psychological health) for both mothers and their babies.

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References

1. IOM (Institute of Medicine). Rasmussen, KM.; Yatkine, AL. Weight gain during pregnancy: re-examining the guidelines. Committee to Reexamine Institute of Medicine Pregnancy Weight Guidelines. 2009. Accessed on February 4th, 2014 at: http://www.cbsnews.com/htdocs/pdf/052809_pregnancy.pdf
2. U.S. Department of Health and Human Services. 2008 Physical Activity Guidelines for Americans. U.S. Department of Health and Human Services; Washington, DC: 2008.
3. Evenson KR, Wen F. National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999-2006. Prev Med. 2010; 50(3):123–8. [PubMed: 20053370]
4. Loustalot F, Carlson SA, Kruger J, Buchner DM, Fulton JE. Muscle-strengthening activities and participation among adults in the United States. Res Q Exerc Sport. 2013; 84(1):30–8. [PubMed: 23611006]
5. Rhodes RE, Blanchard CM, Benoit C, et al. Physical activity and sedentary behavior across 12 months in cohort samples of couples without children, expecting their first child, and expecting their second child. J Behav Med. 2014; 37(3):533–42. [PubMed: 23606310]
6. Downs DS, Lemasurier GC, Dinallo JM. Baby steps: pedometer-determined and self-reported leisure-time exercise behaviors of pregnant women. J Phys Act Health. 2009; 6(1):63–72. [PubMed: 19211959]
7. Vahratian A. Prevalence of overweight and obesity among women of childbearing age: results from the 2002 National Survey of Family Growth. Matern Child Health J. 2009; 13(2):268–73. [PubMed: 18415671]
8. Ornoy A. Prenatal origin of obesity and their complications: Gestational diabetes, maternal overweight and the paradoxical effects of fetal growth restriction and macrosomia. ReprodToxicol. 2011; 32(2):205–12.
9. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991; 50(2):179–211.
10. Kieffer EC, Villarruel AM, Sinco BR. Predicting the Exercise Intention of Pregnant Latina Women. Hisp Hlth Care Int. 2007; 5(1):5–12. JE.
11. Hausenblas HA, Symons Downs D. Prospective examination of the Theory of Planned Behavior applied to exercise behavior during women's first trimester of pregnancy. J Reprod Infant Psychol. 2004; 22(3):199–210.
12. Hausenblas H, Downs DS, Giacobbi P, Tuccitto D, Cook B. A multilevel examination of exercise intention and behavior during pregnancy. Soc Sci Med. 2008; 66(12):2555–61. [PubMed: 18372085]

13. Symons Downs D, Hausenblas HA. Exercising for two: examining pregnant women's second trimester exercise intention and behavior using the framework of the theory of planned behavior. Women's Health Issues. 2003; 13(6):222–228. [PubMed: 14675791]
14. Symons Downs D, Hausenblas HA. Women's exercise beliefs and behaviors during their pregnancy and postpartum. Journal of Midwifery & Women's Health. 2004; 49(2):138–144.
15. Symons Downs D, Hausenblas HA. Pregnant women's third trimester exercise behaviors, body mass index, and pregnancy outcomes. Psychol Health. 2007; 22(5):545–559.
16. Sniehotta FF, Presseau J, Araújo-soares V. Time to retire the theory of planned behaviour. Health Psychol Rev. 2014; 8(1):1–7. [PubMed: 25053004]
17. Rhodes,, RE. Will the new theories (and theoreticians!) please stand up? A commentary on Sniehotta, Presseau, and Araujo-Soares. Health Psychol Rev. 2014. Available at: http://dx.doi.org/10.1080/17437199.2014.882739
18. Ajzen, I. Behavioral interventions based on the theory of planned behavior. 2002. [cited 28 Feb 2014.] Available from URL: http://people.umass.edu/aizen/pdf/tpb.intervention.pdf
19. Fishbein M, von Haeften I, Appleyard J. The role of theory in developing effective interventions: Implications from Project SAFER. Psychol Health Med. 2001; 6(2):223–238.
20. Rhodes RE, Blanchard CM, Courneya KS, Plotnikoff RC. Identifying belief-based targets for the promotion of leisure-time walking. Health Educ Behav. 2009; 36(2):381–93. [PubMed: 18077658]
21. Weir Z, Bush J, Robson SC, Mcparlin C, Rankin J, Bell R. Physical activity in pregnancy: a qualitative study of the beliefs of overweight and obese pregnant women. BMC Pregnancy Childbirth. 2010; 10:18. [PubMed: 20426815]
22. Rhodes RE. Belief-level markers of physical activity among young adult couples: Comparisons across couples without children and new parents. Psychol Health. In press.
23. Hamilton K, White KM. Identifying key belief-based targets for promoting regular physical activity among mothers and fathers with young children. J Sci Med Sport. 2011; 14(2):135–42. [PubMed: 20800540]
24. World Health Organization. Global database on body mass index. 2006. Available at: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed February 24, 2014
25. Ransdell LB. Maximizing response rate in questionnaire research. Am J Health Behav. 1996; 20:50–6.
26. Kelley, K, Clark, B, Brown, V, Sitzia, J. Good practice in the conduct and reporting of survey research. Int J Qual Health Care . 2003; 15(3):261–266. [PubMed: 12803354]
27. Ajzen, I. Constructing a theory of planned behavior questionnaire. 2002. [Cited 28 Feb 2014.] Available from URL: http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf
28. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. Can J Appl Sport Sci. 1985; 10(3):141–6. [PubMed: 4053261]
29. Godin G, Shepard RJ. Godin Leisure Time Exercise Questionnaire. Med Sci Sports Exerc. 1997; 29(suppl6):S36–38.
30. Symons Downs D, Ulbrecht JS. Understanding exercise beliefs and behaviors in women with gestational diabetes mellitus. Diabetes Care. 2006; 29(2):236–240. [PubMed: 16443866]
31. Blanchard CM, Kupperman J, Sparling P, et al. Ethnicity and the theory of planned behavior in an exercise context: A mediation and moderation perspective. Psychol Sport Exerc. 2008; 9(4):527–545.
32. Rhodes RE, Dickau L. Experimental evidence for the intention-behavior relationship in the physical activity domain: a meta-analysis. Health Psychol. 2012; 31(6):724–7. [PubMed: 22390739]
33. Aiken LS, West SG. Multiple Regression: Testing and Interpreting Interactions. Sage. 1993
34. Hornik R, Woolf KD. Using cross-sectional surveys to plan message strategies. Social Marketing Quarterly. 1999; 5(2):34–41.
35. Sui Z, Turnbull DA, Dodd JM. Overweight and obese women's perceptions about making healthy change during pregnancy: a mixed method study. Matern Child Health J. 2013; 17(10):1879–87. [PubMed: 23263891]

36. Evenson KR, Moos MK, Carrier K, Siega-riz AM. Perceived barriers to physical activity among pregnant women. Matern Child Health J. 2009; 13(3):364–75. [PubMed: 18478322]

37. Ekkekakis P, Lind E. Exercise does not feel the same when you are overweight: the impact of self-selected and imposed intensity on affect and exertion. Int J Obes (Lond). 2006; 30(4):652–60. [PubMed: 16130028]

38. Skouteris H, Wertheim EH. Changes in body image satisfaction during pregnancy: a comparison of high exercising and low exercising women. Aust N Z J Obstet Gynaecol. 2003; 43(1):41–5. [PubMed: 12755346]

39. Rodriguez A, Bohlin G, Lindmark G. Psychosocial predictors of smoking and exercise during pregnancy. J Reprod Infant Psychol. 2000; 18(3):203–223.

Table 1

Sample Characteristics by Weight Status

	NW	OW/OB
N	174	75
Age (SD)	30 (4)	31 (4)
Pre-pregnancy BMI (SD)	21.8 (2)	**30.5** (5)
Parity		
1st pregnancy	60%	64%
2nd + pregnancy	40%	36%
Race/Ethnicity		
Non-Hispanic White	91%	95%
Asian American	5%	0%
Hispanic	2%	3%
African American	0%	1%
Other	2%	1%
Marital Status		
Married/Common Law	94%	87%
Divorced	1%	2%
Single	3%	3%
Other	2%	8%
Education		
High school	2%	10%
College	55%	41%
Graduate/Professional	45%	43%
Other	1%	3%
Family Income/Year		
< $9,999	2%	0%
$10-19,999	6%	9%
$20-39,999	17%	25%
$40-99,999	51%	50%
$100,000 +	24%	15%
Other	0%	1%
Occupational Status		
Full-time	70%	75%
Part-time	14%	13%
Homemaker	9%	7%
Self-employed	3%	4%
Unemployed	1%	0%

Note. NW = Normal Weight; OW/OB = Overweight/Obese; SD = standard deviation; BMI = body mass index; Age and percent values were rounded to nearest whole number. There were no significant differences in age, parity, race/ethnicity, marital status, education level, family income, or occupational status by group.

Table 2

Minutes of Exercise Reported and % Meeting National Guidelines[a] by Weight Status

	Trimester 2		Trimester 3	
	LTEQ Total Min M(SD)[b]	**% Meeting Guidelines[b]**	**LTEQ Total Min M(SD)[b]**	**% Meeting Guidelines[b]**
NW	109.97 (82.7)	27.7%	101.05 (94.4)	21.8%
OW/OB	89.39 (73.2)	21.3%	84.22 (67.4)	18.7%

Notes. LTEQ = Leisure Time Exercise Questionnaire; NW = Normal weight; OW/OB = overweight/obese;

[a] 150 minutes of moderate intensity physical activity/week per 2008 U.S. Department of Health and Human Services recommendations;[2]

[b] no significant differences between weight status groups at significance level of $p < .05$.

Table 3

Pearson Correlations between TPB Beliefs and Exercise Behavior by Weight Status

	Normal Weight	Overweight/Obese
Behavioral Beliefs	(*N* = 150, **172)**	(*N* = 68, **74)**
Help to control my weight	.24**, **.09**	.19, **.29***
Help to keep me in shape	.15, **.08**	.03, **.20**
Improve my overall mood	.18*, **.14**	.21, **.11**
Increase my energy and stamina	.16*, **.11**	.15, **.14**
Decrease my discomfort /soreness	.24**, **.15**	.31*, **.20**
Improve my overall health	.16, **.14**	.16, **.26***
Provide stress relief	.18*, **.14**	.23, **.22**
Normative Beliefs (*N* = 150, **169)**		(*N* = 67, **73**)
Husband / partner / fiancé	.06, **.14**	.12, **.27***
Friends	.15, **.08**	.09, **.28***
Nurses	.10, **.08**	.19, **.12**
Doctors / nurse-midwives	.10, .05	.14, .12
Control Behefs (*N* = 150, **172)**		(*N* =68, **73**)
Having no time to exercise[b]	−.27**,−.**39****	−.02, −**.14**
Experiencing soreness	−.23**, −**.20***	−.27*, −**.02**
Being afraid to harm self	−.12, −.07	−.24, −.01
Having no motivation to exercise [a]	−.26**,−**.26****	−.51**,−**.17**
Experiencing pain	−.16, −**.06**	−.09, −**.07**
Being tired or fatigued	−.33**, −**.18***	−.15,−**.16**
Having family responsibilities	−.32**, −**.28****	−.12, −**.14**
Having to work	−.21**,−.25**	−.02, −**.06**
Feeling lazy	−.33**, −**.22****	−.35*, −**.10**

Note. **Bold text** =second trimester beliefs correlated with third trimester exercise behavior; NW = normal weight; OW = overweight; OB = obese;

[a] correlations differed significantly between weight status groups during the first trimester ($p < .05$);

[b] correlations differed significantly between weight status groups during the second trimester ($p < .05$) Plain text = first trimester beliefs correlated with second trimester trimester exercise behavior;

* $p<0.05$;

** $p<.01$.

Table 4

Stepwise Regression Analyses Predicting Second and Third Trimester Exercise Behavior with TPB Beliefs.

Variable	R^2	*df*	*F*	β_1	β_2	% below advocacy[d]
Predicting Second Trimester EX Behavior						
T1 Behavioral Beliefs						
NW (*N*=149)						
Model 1	0.06	1, 147	9.26**			
Decrease discomfort/soreness				0.24**		38%
OW/OB (*N*=68)						
Model 1	0.10	1, 172	*1.11***			
Decrease discomfort/soreness				0.32**		35%
T1 Control Beliefs						
NW (*N*=148)						
Model 1	0.11	1, 146	18.81**∗			
Being tired or fatigued				−0.34***	−0.25**	49%
Model 2	0.16	2, 145	13.48**			
Having family responsibilities					−0.23**	72%
OW/OB (*N*=68)						
Model 1	0.26	1,66	22.81***			
Having no motivation to exercise				−0.51**		64%
Predicting Third Trimester PA Behavior						
T2 Behavioral Beliefs [b]						
OW/OB (*N*=73)						
Model 1	0.08	1,71	6.23*			
Control my weight				0.28*		19%
T2 Normative Beliefs [c]						
OW/OB (*N* = 71)						
Model 1	0.07	1,69	5.39*			
Friends				0.27*		15%
T2 Control Beliefs						
NW (*N*=172)						
Model 1	0.15	1, 170	30.52***			
No time to exercise				−0 39***	−0.36***	75%
Model 2	0.17	1, 174	17.68***			
Feeling lazy					−0.15*	86%

Notes. TPB = Theory of Planned Behavior; EX = exercise; NW = normal weight, OW = overweight, OB = obese;

[a] no T1 normative beliefs emerged as significant predictors of T2 EX behavior in the NW or OW/OB groups;

[b] no T2 behavioral beliefs emerged as significant predictors of T3 EX behavior in the NW group;

[c] no T2 normative beliefs emerged as significant predictors of T3 EX behavior in the NW group;

[d]There were no significant differences between parity groups in belief advocacy; **Bold** % below advocacy indicates low advocacy (i.e., >50% below advocacy);

[*] $p < 0.05$

[**] $p < 0.01$

[***] $p < 0.001$.