Published in final edited form as:

Womens Health Issues. 2018 ; 28(6): 502–508. doi:10.1016/j.whi.2018.09.003.

A Prospective Examination of Physical Activity Predictors in Normal and Overweight/Obese Pregnant Women

Erica L. Rauff¹ [Assistant Professor] and Danielle Symons Downs² [Professor]

¹Kinesiology Department, Seattle University

²Department of Kinesiology, Pennsylvania State University

Abstract

Background.—Scant research has examined the relationship between exercise behavior and weight status in pregnant women.

Method.—A prospective study was conducted in which pregnant women ($N = 332$) completed self-report measures at each trimester. Repeated measures MANCOVA (controlling for race, education, and parity) examined changes in the motivational determinants of exercise over time and by weight status. Regression analyses were conducted to understand how the motivational determinants predicted exercise behavior and to examine the impact of pre-pregnancy weight status.

Results.—A significant main effect for time was observed, with an increase in early pregnancy followed by a decrease in late pregnancy for the motivational determinants of exercise and exercise behavior. A significant main effect for weight status was observed such that normal weight pregnant women had significantly greater attitude and intention for exercise when compared to pregnant women with overweight/obesity. The primary predictors of intention were perceived behavioral control (1st to 2nd trimester) and attitude (2nd to 3rd trimester). The primary predictor of exercise behavior was intention. Pre-pregnancy weight status provided no unique contributions.

Conclusions.—Findings from this study suggest that interventions designed to promote exercise in pregnancy should consider targeting perceived behavioral control in early pregnancy and attitude in later pregnancy. Improving exercise attitude in women with overweight or obesity may further strengthen their motivation to be active in pregnancy. Customized interventions may need

Correspondence: Danielle Symons Downs, Ph.D., Professor of Kinesiology and Obstetrics and Gynecology, Department of Kinesiology, 266 Recreation Building, The Pennsylvania State University, University Park, PA 16802-5701, Office: (814) 863-0456, Fax: (814) 865-1275, dsd111@psu.edu.

Author Descriptions

Erica Rauff is an Assistant Professor of Kinesiology in the Department of Kinesiology at Seattle University. Research interests include evidence-based behavioral interventions for managing weight and physical activity promotion across the lifespan.

Danielle Symons Downs is a Professor of Kinesiology and Obstetrics & Gynecology in the Department of Kinesiology at the Pennsylvania State University. Research interests include theoretical determinants of exercise motivation, evidence-based behavioral interventions to promote physical activity and health in prenatal women.

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to be designed to address the unique needs of women as their motivational determinants change over the course of pregnancy.

Keywords

Exercise; Pregnancy; Weight Status; Theory

Introduction

The health benefits of exercise in pregnancy have been well documented, including a reduced risk of pregnancy complications (e.g., preeclampsia, gestational diabetes) and improved cardiorespiratory fitness and stamina during delivery (U.S. Department of Health & Human Services, 2008). Despite the health benefits that exercise provides, evidence from epidemiological studies indicates that only 15% of pregnant women meet the national physical activity guidelines of 150 minutes/week of moderate intensity physical activity (USDHHS, 2008; Evenson & Wen, 2010). A number of factors that are non-modifiable through intervention mechanisms such as high maternal age, low education, low income, not being married, and multiparity have been associated with little or no leisure-time exercise during pregnancy (Evenson, Savitz, & Huston, 2004; Mottola & Campbell, 2003; Ning, Williams, Dempsey, Sorensen, Frederick, & Luthy, 2003; Petersen, Leet, & Brownson, 2005). While these are important factors to take into consideration, there is a need to understand what modifiable factors, such as women's motivational determinants, are necessary for promoting and increasing exercise during pregnancy.

One theory that has been used previously to understand pregnant women's exercise behavior is the Theory of Planned Behavior (TPB; Hausenblas, Symons Downs, Giacobbi, Tucitto, & Cook, 2008; Hausenblas, & Symons Downs, 2003; Symons Downs & Hausenblas, 2003; Symons Downs & Hausenblas, 2004; Symons Downs & Hausenblas, 2007). The TPB (Ajzen, 1991), a social-cognitive theory, is particularly relevant for use with pregnant women because it includes personal (attitude), normative (subjective norm), and control (perceived behavioral control) factors that may be influenced by pregnancy specific variables (i.e., fatigue, nausea; Hausenblas et al., 2008). The main premise of the TPB is if a woman evaluates her behavior positively (attitude), believes that important people want her to participate in the behavior (subjective norm), and perceives it to be under her control (perceived behavioral control), she will be more likely to engage in that behavior.¹

Although the validity of the TPB has recently been criticized for not explaining sufficient variability in behavior (Sniehotta, Pressau, Araújo-Soares, 2014), prior research using the TPB with pregnant women has suggested it has good utility for predicting and explaining prenatal exercise intention and behavior. More specifically, attitude and subjective norm have explained 68% of 1st trimester intention (Hausenblas & Symons Downs, 2004), attitude and perceived behavioral control have explained 37% of 2nd trimester intention (Symons Downs & Hausenblas, 2003), and subjective norm has explained 31% of 3rd trimester intention (Symons Downs & Hausenblas, 2007). Also, perceived behavioral control and

¹Abbreviations Used: TPB = Theory of Planned Behavior; Min = Minutes; HRA = Hierarchical Regression Analysis

intention have emerged as strong predictors across the 1st, 2nd, and 3rd trimesters, explaining between 25–47% of the variance in exercise behavior (Hausenblas & Symons Downs, 2003; 2004; 2007). In sum, these studies suggest the salient influences of the motivational determinants of exercise intention and behavior vary across the trimesters, likely due to the unique factors influencing exercise motivation and behavior in early (e.g., nausea, vomiting) versus late (e.g., weight gain, soreness) pregnancy.

Furthermore, few studies have examined how the motivational determinants for exercising in pregnancy may differ based on a woman's weight status group (i.e., pregnant women who are normal weight vs. pregnant women with overweight/obesity). Weir and colleagues (2010) conducted a qualitative study to examine the TPB beliefs and exercise intention in pregnant women with overweight/obesity and found that while pregnant women with overweight/obesity were aware of the benefits of prenatal exercise, they felt they were given inadequate information and support for exercise behavior. Also, low self-confidence and motivation were primary barriers to engaging in prenatal exercise behavior. Additionally, Symons Downs and colleagues (2015) examined differences in salient TPB belief predictors for pregnant women with normal weight compared to pregnant women with overweight/obesity. In early pregnancy, it was found that control beliefs of "family responsibilities" and "tired or fatigued" were significant predictors of exercise behavior in pregnant women with normal weight while the control belief of "no motivation" was the only significant predictor of exercise behavior for pregnant women who were overweight/obese (Symons Downs, Devlin, & Rhodes, 2015). They also found that in late pregnancy, control beliefs of "no time to exercise" and "feeling lazy" were significant predictors of exercise behavior for pregnant women with normal weight. For pregnant women with overweight/obesity, the behavioral belief of "controlling weight" and the normative belief of having the support of "friends" were significant predictors of exercise behavior (Symons Downs et al., 2015). These findings provide evidence for weight status specific TPB beliefs in pregnant women, which are likely to have an impact on the motivational determinants (i.e., subjective norm, perceived behavioral control, and attitude).

Thus, the purpose of this study was twofold: to examine: (1) weight status group differences in exercise behavior and its motivational determinants over time (i.e., across 1st, 2nd, 3rd pregnancy trimesters) and (2) how the motivational determinants of exercise behavior predict intention and exercise behavior across the pregnancy trimesters. We hypothesized that independent effects for weight status and time would be observed for exercise behavior and its motivational determinants such that pregnant women with normal weight would have higher motivational determinants and exercise behavior compared to pregnant women with overweight/obesity. We also hypothesized that over the course of pregnancy, women's motivational determinants of exercise behavior would decline. Lastly, we hypothesized the motivational determinants of exercise behavior would significantly predict exercise intention, and intention and perceived behavioral control would significantly predict exercise behavior (Hausenblas et al., 2008; Hausenblas & Symons Downs, 2004; Symons Downs & Hausenblas, 2003; 2004; 2007).

Methods

Participants

Participants were 332 pregnant women ($M_{age} = 30$, age range 19–43 years) residing in and around Central Pennsylvania, an area made up of largely small townships and rural communities. Most women were Caucasian (91%), married (88%), had a college degree (50%), worked full time (70%), and were of middle to high income (54%; See Table 1 for complete demographic information for the total sample and by weight status groups).

Study Design and Procedure

A prospective study design was used to conduct this research. Pregnant women were recruited as part of a longitudinal study examining women's pregnancy and postpartum exercise beliefs and behaviors. The Pennsylvania State University's IRB approved this study and consent was obtained from a local OBGYN clinic to recruit the participants. Pregnant women (8–12 weeks gestation) received a flyer about the study at their clinic visit. Women provided their contact information on a study form and these forms were collected on a weekly basis by the first author. Participants were then sent a packet in the mail containing a cover letter explaining the study and the survey instruments. To improve the response rate, Ransdell's recommendations (1996) were followed, including the use of personalized cover letters, business-reply envelopes, and multiple phone call reminders. Three hundred and thirty two women completed a 1st trimester survey. From this group, 290 women (87%) had complete data in the 2nd trimester and 281 women (85%) had complete data at the 3rd trimester. These response rates are better than average for survey research (Yammariono, Skinner, & Childers, 1991) but consistent with past research with prenatal women (Hausenblas & Symons Downs, 2003; 2004; 2007). Some women did have missing data. If a participant had < 5% of missing data from incomplete question items on the questionnaires, their data were mean replaced (Downey & King, 1998). Women with complete data for the 1st, 2nd, and 3rd trimester and 6-weeks postpartum were used to build regression models for later analyses providing a final sample size of $n = 146$.

Measures

Leisure-Time Exercise Questionnaire (LTEQ).—The LTEQ (Godin & Shephard, 1985) was used to determine the frequency of strenuous (e.g., exercise that causes your heart to beat rapidly such as running, aerobic dance, vigorous swimming, long distance bicycling), moderate (e.g., exercise that is not exhausting and causes light sweating such as brisk walking, swimming, easy dancing), and mild (e.g., exercise that requires minimal effort and no sweating such as easy walking, golf, yoga) exercise that was done in the past seven days during women's 1st, 2nd, and 3rd trimesters. Participants were provided a definition of leisure-time exercise, i.e., exercise done in their free time and not physical activity for work or travel. Participants were also given example activities that were considered strenuous, moderate, or mild to allow for a greater understanding of the different types of leisure-time exercise. Participants were asked “*how many times per typical week do you perform strenuous/moderate/mild exercise for 15 minutes or longer.*” Total minutes were determined by summing each participant's strenuous, moderate, and mild scores (i.e., bout x 15 min). Previous research using this measure has modified the quantification of exercise to include

average min rather than metabolic equivalents across a week to better examine whether or not participants were meeting exercise guidelines (Courneya, Friedenrich, Quinney, Fields, Jones, & Fairey, 2004; Courneya, Segal, & Gelmon, 2007). The validity and reliability of the LTEQ has been previously established (Jacob, Ainsworth, Hartman, & Leon, 1993) and it has been used in prior research with pregnant women (Hausenblas et al., 2008; Symons Downs & Hausenblas, 2004; Hausenblas & Symons Downs, 2005; Symons Downs, DiNallo, & Kirner, 2008).

Theory of Planned Behavior Measures

Participants were provided the following statement before completing any of the TPB questions: “*Regular exercise behavior = participating in 30 minutes of accumulated moderate exercise on most, if not all days of the week. This exercise can be done at one time (e.g. 30 min of continuous walking or jogging) or accumulated in the day (e.g. walking 10 min in the morning and 20 min in the evening).*” This statement was provided to participants to facilitate a standardized understanding of regular exercise behavior. The following TPB exercise constructs were assessed:

Attitude.—Based on Ajzen’s recommendations (Ajzen, 1991; Ajzen, 2002) and previous research (Symons Downs & Hausenblas, 2003; 2005) the following seven semantic differential pairs were used to assess pregnant women’s attitude about exercise: 1) useless–useful, 2) harmful–beneficial, 3) bad–good, 4) foolish–wise, 5) unpleasant–pleasant, 6) unenjoyable–enjoyable, and 7) boring–interesting. The statement “For me to exercise regularly in my 1st/2nd/3rd trimester will be” preceded these item pairs, and they were assessed with a seven-point unipolar scale ranging from 1 (i.e., useless, harmful, bad, foolish, unpleasant, unenjoyable, boring) to 7 (i.e., useful, beneficial, good, wise, pleasant, enjoyable, interesting). The internal consistency scores of these seven attitude items was good ($\alpha = 0.87, 0.87, \text{ and } 0.74$ at the 1st, 2nd, and 3rd trimesters respectively).

Subjective Norm.—Subjective norm was assessed with the following three items: “Most people who are important to me think that I should: “exercise regularly in my 1st/2nd/3rd trimester;” “want me to exercise in my 1st/2nd/3rd trimester;” and “approve of me exercising regularly in my first/second/third trimester” ranging from 1 (strongly disagree/disagree) to 7 (strongly agree/ agree; Symons Downs & Hausenblas, 2003; 2005; Ajzen, 1991; 2002). The internal consistency scores of these three subjective norm items was good ($\alpha = 0.74, 0.93, \text{ and } 0.96$ at 1st, 2nd, and 3rd trimesters respectively).

Perceived Behavioral Control.—Consistent with previous TPB research (Symons Downs & Hausenblas, 2005; Courneya, Freienreich, Arthur, & Bobick, 1999), the following three items were used to measure perceived behavioral control: 1) “For me to exercise at least 3 days per week in my 1st/2nd/3rd trimester of pregnancy will be” ranging from 1 (extremely difficult) to 7 (extremely easy); 2) “How much control do you have over exercising at least 3 days per week in your first/second/third trimester?” ranging from 1 (very little control) to 7 (complete control); and 3) “If I wanted to, I could easily exercise regularly during my first/second/third trimester.” ranging from 1 (strongly disagree) to 7

(strongly agree). The internal consistency scores for these three perceived behavioral control items was good ($\alpha = 0.90, 0.70$, and 0.70 at 1st, 2nd, and 3rd trimesters respectively).

Intention.—To assess exercise intention, the following three items were used: 1) “I intend to exercise regularly in my first/second/third trimester” ranging from 1 (strongly disagree) to 7 (strongly agree); 2) “I intend to exercise at least 3 days per week in my 1st/2nd/3rd trimester” ranging from 1 (definitely not) to 7 (definitely); and 3) “I intend to exercise with the following regularity in my 1st/2nd/3rd trimester” ranging from 1 (not at all) to 7 (very much). Previously, one item was used to assess intention, and as a result, internal consistency for these items has not been reported in pregnancy. However, Rhodes, Courneya, and Jones (2005) used three items to assess intention in undergraduate students and reported good internal consistency ($\alpha = 0.89$). Three items were used in the current study to be able to better understand women’s exercise intention. The internal consistency scores for these three intention items were excellent ($\alpha = 0.93, 0.91$, and 0.94 in the 1st, 2nd, and 3rd trimester, respectively).

Data Analyses

The study analyses were conducted using SPSS data software (version 20.0). Descriptive data analyses were averaged and examined across the total sample ($N = 332$) and by pre-pregnancy weight status groups. From the women who completed a first trimester survey ($N = 332$), women with a BMI ≥ 25.0 were classified as having overweight/obesity ($n = 110$) and women with a BMI < 24.9 were classified as having normal weight ($n = 222$). One repeated-measures MANCOVA and one repeated-measures ANCOVA controlling for race, education, and parity were conducted to examine changes in exercise behavior and its motivational determinants over time and by weight status. In both analyses, pre-pregnancy weight status was entered as the between-subjects factor and time (i.e., 1st, 2nd, 3rd trimester) was entered as the within-subjects factor.

Hierarchical regression analyses (HRA) were used following the TPB guidelines to determine the order of blocks for each model. The models examined the following contributions: 1) 1st trimester attitude, subjective norm, and perceived behavioral control predicting 2nd trimester exercise intention; 2) 1st trimester intention and perceived behavioral control predicting 2nd trimester exercise behavior; 3) 2nd trimester attitude, subjective norm, and perceived behavioral control predicting 3rd trimester exercise intention; and 4) 2nd trimester exercise intention and perceived behavioral control predicting 3rd trimester exercise behavior. To reduce the impact of multicollinearity among the independent variables, the means for the predictor variables were centered (i.e. the mean of each independent predictor variable – sample mean) before they were entered into each of the regression analyses (Aiken, & West, 1991). To examine the moderating influence of pre-pregnancy weight status group on the contributions of the predictors, the interaction terms for pre-pregnancy weight status were entered in each model as block three (e.g., 1st trimester subjective norm*pre-pregnancy weight status, 1st trimester attitude*pre-pregnancy weight status).

Results

Chi square analyses were used to examine differences for participant demographics across weight status groups, revealing significant differences in education (i.e., > high school, high school, college, graduate/professional, other), race (i.e., African American, American Indian, Caucasian, Asian, Hispanic, other) and parity (i.e., first pregnancy, second pregnancy or greater). Among Asian women, significantly more had normal weight ($n = 15$) and among African American women, significantly more had overweight/obesity ($n = 8$) than normal weight. ($n = 1$). Significantly more pregnant women with normal weight also had a college ($n = 149$) or graduate/professional degree ($n = 126$), and were in their first pregnancy ($n = 172$) compared to pregnant women with overweight/obesity (n 's = 65, 45, and 78 respectively). Thus, education, race, and parity were entered as covariates into subsequent MANCOVA's and ANCOVA's.

The repeated measures MANCOVA revealed that Mauchly's test of sphericity was violated for attitude, intention, and perceived behavioral control and, therefore, the Huynh-Feldt correction factor was used. A significant main effect for weight status was observed such that pregnant women with normal weight had significantly greater attitude and intention for exercise when compared to pregnant women with overweight/obesity (see Table 2). A significant main effect for time was observed for attitude, subjective norm, and intention such that women's motivational attitude, subjective norm, and intention increased from the 1st to 2nd trimester and then decreased from the 2nd to 3rd trimester. A significant main effect of time was also observed for perceived behavioral control, indicating that perceived behavioral control decreased from the 1st to the 2nd trimester and from the 2nd to the 3rd trimester. No significant time x weight status interaction effects were observed. A significant main effect for time was observed for exercise behavior such that exercise behavior increased from the 1st to 2nd trimester and then decreased from the 2nd to 3rd trimester (see Table 3). No significant main effects for weight status or time x weight status interaction effects were observed for exercise behavior.

In the 1st regression model, 1st trimester attitude and subjective norm in block one significantly predicted 2nd trimester intention and explained 22% of the variance in 2nd trimester exercise intention (see Table 4). Block two explained an additional 4% of the variance in 2nd trimester intention, with 1st trimester perceived behavioral control providing the greatest overall contribution followed by attitude and subjective norm. Only 2% additional variance in 2nd trimester intention was explained in block 3, with only 1st trimester perceived behavioral control maintaining significant contribution. Attitude and subjective norm lost their significance, and the interaction terms did not significantly predict 2nd trimester intention.

In the 2nd regression model, 1st trimester perceived behavioral control (block one) explained 12% of the variance in 2nd trimester exercise behavior (see Table 4). Including 1st trimester intention in block two explained another 7% of the variance in exercise behavior, but 1st trimester perceived behavioral control no longer provided a significant contribution. An additional 0.6% of the variance in exercise behavior was explained when interaction terms

were added in block 3. Only intention provided significant contribution. The interaction terms did not significantly predict exercise behavior.

In the 3rd regression model, 2nd trimester attitude and subjective norm in block one significantly predicted 3rd trimester intention and explained 22% of the variance in 3rd trimester intention (see Table 4). Including 2nd trimester perceived behavioral control in block two explained an additional 4% of the variance in 3rd trimester intention, with attitude providing the greatest overall contribution followed by perceived behavioral control. An additional 3% variance in third trimester intention was explained when the interaction terms were added (block 3), with only 2nd trimester attitude and perceived behavioral control maintaining significant contribution. The interaction terms did not significantly predict 3rd trimester intention.

In the 4th regression model, 2nd trimester perceived behavioral control (block one) explained 6% of the variance in 3rd trimester exercise behavior (see Table 4). Including 2nd trimester intention in block two explained another 8% of the variance in 3rd trimester exercise behavior, but 2nd trimester perceived behavioral control no longer provided a significant contribution. An additional 0.6% variance in exercise behavior was explained when the interaction terms were added (block 3). Only 2nd trimester intention provided significant contribution. The interaction terms did not significantly predict exercise behavior.

Discussion

The purpose of this study was to examine women's motivational determinants for exercise across pregnancy trimesters using the TPB framework and to understand how they may differ based on a woman's pre-pregnancy weight status. A significant main effect for time was observed, with an increase in early pregnancy followed by a decrease in late pregnancy for the motivational determinants of exercise behavior. Weight status differences in the motivational determinants of exercise behavior were observed such that pregnant women with normal weight had significantly greater attitude and intention to exercise when compared to pregnant women with overweight/obesity. Despite a lack of findings regarding any weight status differences in the motivational determinants predicting exercise intention and behavior, these study findings provide greater understanding of the prospective influence of the motivational determinants and intention on exercise behavior across pregnancy trimesters. The primary predictors of intention were perceived behavioral control (1st to 2nd trimester) and attitude (2nd to 3rd trimester). The primary predictor of exercise behavior was intention (from 1st to 2nd and 2nd to 3rd trimesters).

In support of the hypothesis that weight status differences would be observed for the motivational determinants of exercise behavior, pregnant women with normal weight reported significantly greater attitude and intention to engage in exercise behavior when compared to pregnant women with overweight/obesity. This finding is novel as no studies to date have examined weight status differences in the motivational determinants of exercise behavior in pregnancy. However, previous research in adults has indicated that adults with overweight have more negative beliefs about exercise when compared to adults with normal weight (Miller, & Miller, 2010). Additionally, non-pregnant women with obesity have

reported being less likely to enjoy exercise and that their weight makes exercise more difficult (Leone & Ward, 2013). It is likely that pregnant women with overweight/obesity have similar beliefs and, thus, a more negative attitude in regards to exercise during pregnancy, especially given the additional challenges that pregnancy presents. Thus, future interventions should consider strategies that target women's attitude so that they can understand the many benefits of exercise during pregnancy and can begin to evaluate exercise more positively and furthermore engage in greater exercise behavior.

In contrast to the hypothesis and prior research (Symons Downs & Hausenblas, 2003), the strongest predictor of 2nd trimester intention was first trimester perceived behavioral control rather than 2nd trimester attitude and perceived behavioral control. Previously, Symons Downs and Hausenblas (2003) predicted 2nd trimester intention with variables from the same trimester, whereas the current study prospectively predicted 2nd trimester intention with first trimester variables. However, it is important to note that in the previous study, 2nd trimester attitude was only slightly stronger in predicting 2nd trimester intention than 2nd trimester perceived behavioral control (Symons Downs & Hausenblas, 2003). This finding suggests that it is important to examine women's perceptions of their ease or difficulty for engaging in exercise behavior in early pregnancy. Targeting women's perceived behavioral control may enable them to feel a sense of control over their behaviors, particularly when faced with barriers common in early pregnancy (i.e., fatigue, nausea) so that they have the necessary self-efficacy to overcome these barriers and engage in exercise behavior. Intervention strategies such as action planning and goal setting could be utilized to increase women's perceived behavioral control as a mechanism for increasing their exercise intention, which in turn may lead to greater exercise behavior.

In contrast to the hypothesis and previous research (Symons Downs & Hausenblas, 2007), only 2nd trimester attitude and perceived behavioral control significantly predicted 3rd trimester intention, with 2nd trimester attitude emerging as the strongest predictor of 3rd trimester intention. Second trimester subjective norm lost significance once perceived behavioral control was added to the model. While this finding was contradictory to those of Symons Downs and Hausenblas (2007), who found that only 3rd trimester subjective norm was a significant predictor of 3rd trimester intention, the finding that 2nd trimester attitude was the strongest predictor of 3rd trimester intention is consistent with research indicating that attitude is the strongest determinant of intention in other populations (Symons Downs & Hausenblas, 2005). This finding also suggests that in later pregnancy, intervention strategies should be focused on positively influencing women's attitude about exercise behavior (e.g., identifying the benefits of exercise behavior and helping women restructure negative thoughts about engaging in exercise during pregnancy) to increase women's intention, which in turn, may increase their exercise behavior.

Consistent with previous research (Symons Downs & Hausenblas, 2003; 2007), but in contrast with the hypothesis, 1st and 2nd trimester intention and not perceived behavioral control significantly predicted 2nd and 3rd trimester exercise behavior. Previous work in pregnancy found that 2nd trimester intention and not perceived behavioral control was a significant predictor of 2nd trimester exercise behavior and again that only 3rd trimester intention was a significant predictor of 3rd trimester exercise behavior (Symons Downs &

Hausenblas, 2003; 2007) These findings illustrate that women's motivational plans (intention) to exercise in the 1st and 2nd trimester had a greater influence than their feelings of personal control on 2nd and 3rd trimester exercise behavior. Intervention strategies aiming to improve women's intention for exercise behavior early in pregnancy are necessary for increasing women's exercise behavior since evidence from the current study indicates that the motivational determinants of exercise behavior decrease across pregnancy trimesters. Strengthening women's motivational determinants in early pregnancy may further increase women's intention for exercise behavior, which may in turn lead to greater exercise behavior across pregnancy trimesters. Potential strategies include teaching women how to set appropriate exercise goals during pregnancy and techniques to strengthen their exercise plans so that they are more likely to engage in exercise behavior.

This study contributes to the literature, as it is one of the first studies to examine weight status differences in the motivational determinants of exercise and exercise behavior using the TPB. However, there were also some limitations. Participants in this study were a homogenous sample (i.e., predominantly Caucasian, middle-upper income, married, well educated). While the sample was representative of the population residing in Central Pennsylvania, the study findings cannot be generalized to all pregnant women. Replication of the study findings with other samples is warranted to extend generalizability. Also, while the study measures were obtained with valid, reliable self-report measures, the use of activity monitors for an additional assessment of exercise may capture some aspects of movement that self-report measures do not and improve measurement accuracy and reduce missing data. Also, the motivational determinants for exercise behavior were examined across women with normal weight compared to women with overweight and obesity. Future work should examine the motivational determinants across women with overweight and obesity separately to determine if there are contextual differences in their motivational determinants. Finally, we did not directly assess women's safety beliefs for exercise in this study or their eating behaviors. Future studies should examine the combined influences of the motivational determinants of exercise behavior and these factors to better understand the complex interactions that may occur with these variables and how they influence weight gain in pregnancy.

Implications for Practice and/or Policy

In summary, weight status differences were observed for attitude and intention. The primary predictors of intention were perceived behavioral control (1st to 2nd trimester) and attitude (2nd to 3rd trimester). The primary predictors of exercise behavior were intention from 1st to 2nd and 2nd to 3rd trimesters. Findings from this study suggest that interventions aimed at increasing prenatal exercise behavior should focus on different strategies for women depending on their weight status and what trimester they are in. Interventions for pregnant women with overweight/obesity should focus on improving women's attitudes about exercise. Also, in early pregnancy, women should be taught behavioral strategies (i.e., goal setting, action planning) that may enable them to feel a sense of control over their behaviors, particularly when faced with barriers common in early pregnancy. However, in later pregnancy, information about the benefits of exercise may be more effective for strengthening attitude. Finally, an important next step will be to develop a tailored,

theoretically based exercise intervention that targets these constructs and provides unique information to women based on their weight status. A tailored intervention is needed to determine the efficacy for increasing prenatal exercise behavior and potentially the important role this may play in helping women better manage their weight gain in pregnancy.

Acknowledgments

Funding Source: National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health through grant 1R01HL119245-01

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Table 1

Demographic Characteristics of the Entire Sample (N = 332) and by Weight Status and Chi Square Analyses

Variable	Entire Sample (N = 332)			OW/OB (n = 110)			NW (n = 222)			χ^2	p
	M	SD	%	M	SD	%	M	SD	%		
Race										23.8	0.00***
Caucasian			91.4%			88.6%			91.2%		
Asian			3.6%			0.8%			5.4%		
Hispanic			1.7%			3.0%			1.7%		
African American			1.5%			6.1%			----		
American Indian			0.2%						0.3%		
Other			1.5%			1.5%			1.7%		
Education										12.6	0.01**
Less than High School			0.8%			1.5%			0.3%		
High School			6.7%			12.8%			4.7%		
College			49.7%			48.9%			50.5%		
Graduate/ Professional			40.8%			33.8%			42.7%		
Other			2.1%			3.0%			1.7%		
Marital Status										9.1	0.06
Married			88.3%			82.7%			89.9%		
Single			7.0%			12.0%			5.4%		
Divorced			1.9%			3.0%			1.4%		
Common Law			0.9%			----			1.4%		
Other			1.9%			2.3%			2.0%		
Family Income										6.8	0.23
< \$10,000			2.2%			4.6%			3.2%		
\$10–20,000			6.5%			9.0%			10.6%		
\$20–40,000			16.8%			20.8%			18.3%		
\$40–100,000			53.8%			53.1%			48.9%		
>\$100,000			20.4%			11.5%			0.4%		
Other			0.4%			0.8%			---		
Parity										9.6	0.03*
1 st Pregnancy			58.3%			39.1%			59.3%		
2 nd Pregnancy or Greater			41.7%			56.5%			40.7%		
Age	29.8	4.2		30.1	4.4		29.6	4.1			
Pre-pregnancy BMI	24.3	5.2		30.6	5.1		21.8	1.6			
Pre-pregnancy Weekly Ex Min	131.4	96.0		129.4	107.9		135.7	95.7			

* Note. OW/OB = overweight/obesity; NW = normal weight; M = mean; SD = standard deviation; BMI = body mass index; EX= exercise; Min = minutes;

*
 $p < 0.05$;

**
 $p < 0.01$;

 $p < 0.001$

Table 2

Repeated-Measures MANCOVA Findings for the Motivational Determinants of Exercise Behavior Over Time and by Weight Status Controlling for Race, Education, and Parity (N = 208)

Measure	MS	df	F	p	Huynh-Feldt
Within-Subjects Effects for Time					
ATT	227.2	2	5.9	---	< 0.01
SN	48.8	2	3.6	< 0.05	---
PBC	39.4	2	3.5	---	< 0.05
INT	100.7	2	9.1	---	< 0.001
Between-Subject Effects for Weight Status					
ATT	911.6	1	7.8	< 0.01	---
SN	47.1	1	1.3	0.25	---
PBC	71.5	1	1.8	0.19	---
INT	281.3	1	5.1	< 0.05	---

* Note. EX = exercise behavior; MS = mean square; df = degrees of freedom; ATT = attitude; SN = subjective norm; PBC = perceived behavioral control; INT = intention; *p* values for within Subjects effects for time assume sphericity

Table 3

Repeated-Measures ANCOVA Findings for Exercise Behavior Over Time and by Weight Status Controlling for Race, Education, and Parity (N = 208)

Measure	MS	df	F	p	Huynh-Feldt
Within-Subjects Effects for Time					
EXB	18192.5	2	5.7	---	< 0.01
Between-Subject Effects for Weight Status					
EXB	31916.5	1	1.3	0.26	---

* Note. EXB = exercise behavior; MS = mean square; df = degrees of freedom.

Table 4

Linear Hierarchical Regression Analyses

Variable	R ²	df	F	p value	β_1	β_2	β_3
<i>Predicting Second Trimester Exercise Intention</i>							
Block 1	0.22	2, 248	34.7	< 0.001 ***			
T1 SN					0.15 *	0.16 *	0.13
T1 ATT					0.36 ***	0.18 *	0.05
Block 2	0.26	1, 247	14.7	< 0.001 ***			
T1 PBC						0.28 ***	0.39 ***
Block 3	0.28	3, 244	2.1	0.10			
T1SN*PPWS							0.03
T1 ATT*PPWS							0.17
T1 PBC*PPWS							-0.12
<i>Predicting Second Trimester Exercise Behavior</i>							
Block 1	0.12	1, 250	57.5	< 0.001 ***			
T1 PBC					0.35 ***	0.07	0.226
Block 2	0.19	1, 249	0.78	< 0.001 ***			
T1 INT						0.38 ***	0.30 **
Block 3	0.20	2, 247	0.79	0.45			
T1 PBC*PPWS							-0.05
T1 INT*PPWS							0.09
<i>Predicting Third Trimester Exercise Intention</i>							
Block 1	0.22	2, 249	34.1	< 0.001 ***			
T2 SN					0.15 *	0.10	0.04
T2 ATT					0.39 ***	0.32 ***	0.47 ***
Block 2	0.25	1, 248	15.3	< 0.001 ***			
T2 PBC						0.23 ***	0.30 **
Block 3	0.29	3,245	3.6	0.01 **			
T2SN*PPWS							0.12
T2 ATT*PPWS							-0.20
T2 PBC*PPWS							-0.15
<i>Predicting Third Trimester Exercise Behavior</i>							

Variable	R ²	df	F	p value	β_1	β_2	β_3
Block 1	0.06	1, 247	14.5	< 0.001 ***			
T2 PBC					0.24 ***	0.01	0.14
Block 2	0.14	1, 246	25.4	< 0.001 ***			
T2 INT						0.38 ***	0.27 *
Block 3	0.15	2, 244	0.93	0.40			
T2 PBC * PPWS							-0.14
T2 INT * PPWS							0.10

* Note. T1 = first trimester; T2 = second trimester; T3 = third trimester; PPWS = prepregnancy weight status; SN = subjective norm; ATT = attitude; PBC = perceived behavioral control; INT = intention

*
 $p < 0.05$

**
 $p < 0.01$

 $p < 0.001$