

The Influence of Risk Perceptions and Efficacy Beliefs on Leisure-Time Physical Activity During Pregnancy

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Background: Pregnancy risk perceptions and physical activity efficacy beliefs may facilitate or impede pregnancy leisure-time physical activity (LTPA). We examined the separate and joint influence of these variables on LTPA behavior among pregnant women. **Methods:** Pregnant women ($n = 302$) completed a survey containing questions on LTPA efficacy beliefs and behavior, as well as pregnancy risk perceptions with respect to the health of the unborn baby. As stipulated by the Risk Perception Attitude (RPA) Framework, 4 attitudinal groups were created: Responsive (High Risk+High Efficacy), Proactive (Low+High), Avoidant (High+Low), and Indifferent (Low+Low). Moderate LTPA and vigorous LTPA were dichotomized for study analyses. **Results:** A total of 82 women (27.2%) met the moderate physical activity guideline and 90 women (30.1%) performed any vigorous LTPA. Responsive and proactive pregnant women (those with high efficacy) were most likely to meet the moderate guideline and participate in vigorous LTPA. Hierarchical logistic regression did not reveal an interactive effect of pregnancy risk perceptions and LTPA efficacy beliefs for meeting the moderate guideline ($OR = 0.94$, 95% $CI = 0.66-1.36$) or any vigorous LTPA participation ($OR = 1.41$, 95% $CI = 0.86-2.29$). **Conclusions:** LTPA efficacy beliefs appear important in facilitating greater levels of pregnancy LTPA. Significant interactive effects between pregnancy risk perceptions and LTPA efficacy beliefs were not found.

Keywords: self-efficacy, pregnancy exercise, Risk Perception Attitude Framework

Physical activity during pregnancy provides numerous health benefits to both mother and fetus. For the mother, these include a reduced risk of gestational diabetes,¹⁻³ preeclampsia,^{4,5} unhealthy gestational weight gain,⁶ and prolonged labor.^{7,8} Fetal health benefits include prevention of high birth weight,⁹ as well as a reduced risk of preterm delivery^{10,11} and operative delivery.¹² Despite these benefits, many pregnant women do not participate in sufficient amounts of physical activity throughout pregnancy, with only 14% to 16% meeting the minimum guideline of at least 150 minutes of moderate-intensity activity per week.^{13,14} Physical activity performed in one's leisure-time is typically an important means of achieving this recommendation, particularly among pregnant women. Various barriers to pregnancy leisure-time physical activity (LTPA) have been identified, including lack of time, fatigue, physical discomfort, and childcare responsibilities.¹⁵⁻²⁰ A further group of barriers to pregnancy LTPA includes a myriad of psychosocial factors, including a pregnant woman's perceptions.^{21,22} In general, how pregnant women perceive the pregnancy experience and physical activity participation may dictate their LTPA behavior.

Results from previous investigations indicate it is common for women to have some level of concern or worry about the health and safety of their babies during pregnancy.^{19,23} This concern may be more likely for women with "high risk" pregnancies or those who

have experienced pregnancy complications previously.²⁴ Such feelings of risk can theoretically comprise perceptions of the likelihood of an adverse outcome (perceived susceptibility) and how severe it would be (perceived severity). The perception that LTPA is protective against adverse prenatal health outcomes (response efficacy) may be a powerful motivator for pregnant women to be physically active, particularly if women believe the risk of such outcomes to be great. Only a few investigators have attempted to assess these perceptions among pregnant women. In general, research indicates the majority of pregnant women believe moderate LTPA to be somewhat safe and beneficial.^{16,22,25} In contrast, it appears that fewer pregnant women believe in the safety and health benefit of vigorous LTPA, despite evidence that it is not detrimental and may be protective to mother and baby. Given the unique and challenging experience that pregnancy presents for some women and the barriers they face to being physically active, the perception that they are able to perform LTPA (self-efficacy) would seem equally important. Findings from preliminary investigations indeed suggest the importance of LTPA self-efficacy in facilitating LTPA behavior at various time points throughout pregnancy.^{17,26}

According to Rimal and Real's Risk Perception Attitude (RPA) Framework,²⁷ risk perceptions (perceived susceptibility and perceived severity) and efficacy beliefs (response efficacy and self-efficacy) are crucial determinants for self-protective behavior. More specifically, the RPA stipulates that perceptions for a specific risk and efficacy beliefs for a health behavior to protect against that risk, jointly determine the participation in that behavior. Theoretically, those with the highest risk perceptions and the highest efficacy beliefs are most likely to act, given they are both motivated (from the risk) and able (from the efficacy) to do so.²⁷ Originally designed as an audience segmentation theory to predict attitudes toward information-seeking,²⁸ the RPA has been more recently used to examine individuals' perceptions that a specific health behavior can prevent a specific health risk. Although the RPA has not yet been applied within a physical activity context, it is an ideal tool to use

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when studying pregnant women, given the protective feelings that an expectant mother may feel for her unborn child. Utilizing the RPA may reveal the specific combinations of pregnancy risk perceptions and physical activity efficacy beliefs that drive pregnancy LTPA.

Perceptions that women have about the health risks to their baby during pregnancy and the efficacy of physical activity to prevent those health risks are complex and difficult to assess. However, a more precise understanding of these perceptions and how they interact will likely enable researchers and practitioners to be more successful in helping pregnant women achieve recommended levels of physical activity. Therefore, the purpose of this investigation was to determine the joint influence of risk perceptions specific to the health of the baby during pregnancy (perceived severity and susceptibility) and LTPA efficacy beliefs (response efficacy and self-efficacy) on pregnancy LTPA behavior. In line with the RPA, we hypothesized that an interactive effect would be found for pregnancy risk perceptions and LTPA efficacy beliefs on LTPA for both moderate and vigorous-intensity activity.

Methods

Participants

Pregnant women ($n = 360$) were recruited from prenatal healthcare clinics affiliated with Michigan State University (East Lansing, MI) and the University of Utah (Salt Lake City, UT) as well as via word-of-mouth within the mid-Michigan area. Inclusion criteria for participation consisted of pregnant women of any gestational age, ethnic or educational background, socioeconomic status, or religious identification who were 18 to 45 years of age. Pregnant women were excluded if they were carrying more than 1 baby, unable to communicate fluently in either English or Spanish, or received prescribed bed rest from a prenatal healthcare provider (HCP) during the current pregnancy. Participants were recruited at the clinics before or after a regularly-scheduled appointment with a prenatal healthcare provider and were invited by a member of the prenatal nursing staff to complete a 15-minute electronic or paper copy survey. Although both electronic and paper versions of the survey were available, participants were provided with the option that best accommodated their situation (ie, number of potential participants at one time or technology issues with the tablet device or online survey platform). At every data collection site, potential participants were informed as to the study procedures, the content of the survey, and the compensation they would receive as thanks for their participation. The procedures for this investigation were approved by Institutional Review Boards at Michigan State University and the University of Utah.

Procedures

Following recruitment, a trained study investigator explained to participants the basic format and components of the survey and reminded them of their option to discontinue participation at any point if desired. After agreeing to take the survey, participants were provided with an iPad computer tablet (or paper survey) by the study investigator and asked to complete the survey at their self-selected pace. Following survey completion, participants were compensated with a \$10 gift card. In the rare instance when a participant was called in for her appointment before survey completion, the study investigator collected the computer tablet (or paper survey) and informed the participant and prenatal nurse of the opportunity to finish their survey immediately following the prenatal care appointment.

The survey was developed by Michigan State University investigators with the intent of gaining a more precise understanding of the perceptions and beliefs that pregnant women have with respect to LTPA. To ensure that this survey was ready for use as a part of this investigation, 9 cognitive interviews were conducted among pregnant women who matched the inclusion criteria for this investigation. The survey was designed to take no longer than 15 minutes to complete so that pregnant women could participate as they awaited their regularly scheduled appointment with their prenatal healthcare provider. The survey included questions regarding LTPA behavior, pregnancy risk perceptions, LTPA efficacy beliefs, personal pregnancy history, prenatal healthcare provider interactions, and basic demographics.

Measures

Participants were asked to report current pregnancy LTPA as well as LTPA before pregnancy by answering questions about how many days per week and for approximately how many minutes per day they typically participated in both moderate and vigorous-intensity LTPA. For both moderate and vigorous LTPA, typical days per week and minutes per day of reported activity were multiplied, providing total minutes per week at each intensity. LTPA questions were adapted from items within the Global Physical Activity Questionnaire (GPAQ) and from the 2013 to 2014 National Health and Nutrition Examination Survey (NHANES). Among nonpregnant individuals, these questions have demonstrated excellent test-retest reliability [ICC = 0.90 (moderate); ICC = 0.96 (vigorous)] and acceptable criterion validity [$r = .36$ (moderate); $r = .48$ (vigorous)] with respect to objective monitoring (Actigraph GTM1 accelerometer).²⁹

Pregnancy risk severity and susceptibility were assessed via single questions adapted from the Risk Behavior Diagnosis Scale,³⁰ with harm to the baby at some point during pregnancy considered as the specific perceived risk and LTPA participation as the specific behavior to potentially mitigate that risk. For each pregnancy risk perception and LTPA efficacy belief survey question, study participants reported how strongly they agreed or disagreed with the given statement using a 7-point Likert-type scale (1 = Strongly Disagree; 7 = Strongly Agree). For risk susceptibility, each participant indicated how strongly she agreed or disagreed that her baby could experience harm during pregnancy. For risk severity, each participant indicated how severe she felt that harm to her baby would be. In accordance with RPA-based investigations, perceived pregnancy severity and susceptibility were averaged into a single pregnancy risk perceptions score.

Response efficacy and self-efficacy for LTPA were assessed for both moderate and vigorous intensity via single questions adapted from the Risk Behavior Diagnosis Scale.³⁰ In accordance with the most current guideline of 150 minutes of moderate-intensity activity per week,³¹ each participant indicated for response efficacy how strongly she agreed or disagreed that participating in 30 minutes of moderate-intensity activity, 5 times per week would help protect her baby from harm. Likewise for self-efficacy, each participant indicated how strongly she agreed or disagreed that she can participate in 30 minutes of moderate physical activity, 5 times per week. The current vigorous physical activity guideline stipulates that pregnant women may exercise at high intensities if they have regularly done so previously throughout their pregnancy.³¹ Given this guideline is intended for pregnant women who are consistently active at this intensity, the response efficacy item for vigorous physical activity was hypothetically framed. Therefore, each participant indicated how strongly she agreed or disagreed with the belief that

if a pregnant woman has been vigorously active pre-pregnancy, and continues to be vigorously active during pregnancy, this activity will help protect her baby from harm. For self-efficacy of vigorous LTPA, each participant indicated how strongly she agrees or disagrees that she can participate in some vigorous-intensity activity during pregnancy. Response efficacy and self-efficacy were then averaged into single efficacy belief scores for both moderate and vigorous LTPA.

As described previously, perceived pregnancy risk (harm to the baby at some point during pregnancy) was assessed to examine its interactive effect with LTPA efficacy on LTPA behavior. Because this relationship may be confounded by perceptions that LTPA itself is harmful to the baby, we also assessed moderate and vigorous LTPA risk perception. Participants were asked to report how strongly they agreed or disagreed (7-point Likert-type scale) that participating in 30 minutes of moderate-intensity activity, 5 times per week, is harmful to the baby. Likewise, participants reported how strongly they agreed or disagreed that participating in any vigorous LTPA is harmful to the baby. LTPA risk perception was assessed for the purpose of adjustment within this study's statistical analyses.

Statistical Analyses

For moderate LTPA, a median split of both pregnancy risk perceptions (high/low) and moderate LTPA efficacy beliefs (high/low) allowed for the creation of 4 attitudinal groups: *responsive* (high risk+high efficacy), *proactive* (low risk+high efficacy), *avoidant* (high risk+low efficacy), and *indifferent* (low risk+low efficacy) (Figure 1). Moderate LTPA was dichotomized as "meeting the moderate physical activity guideline" (≥ 150 minutes/week) and "not meeting the moderate guideline." Chi-square analyses with pairwise comparisons and Bonferonni adjustment were performed to determine if relative frequency of meeting the moderate guideline differed among attitudinal groups. Logistic regression analyses were performed to examine the odds of meeting the moderate guideline for each of the attitudinal groups. Odds ratios and 95% confidence intervals were calculated for the responsive, proactive, and avoidant groups, with the indifferent group serving as the referent category. For vigorous LTPA, the same procedure was followed for the creation of the 4 attitudinal groups. Vigorous LTPA was dichotomized as "participating in any vigorous LTPA" and "not participating in vigorous LTPA." As described for moderate LTPA, the same

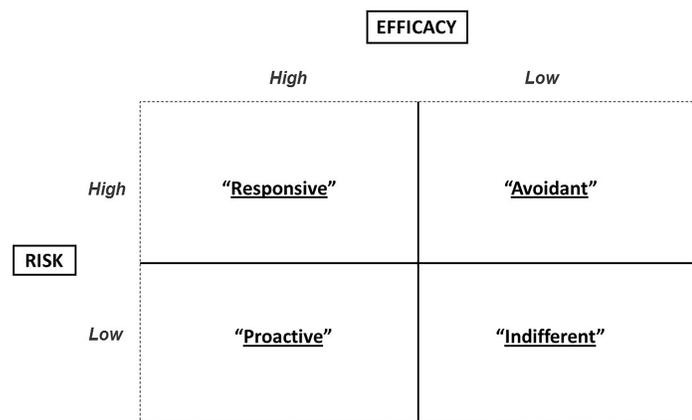


Figure 1 — Risk perception and efficacy belief attitudinal groups created within the Risk Perception Attitude (RPA).

chi-square and logistic regression analyses were performed to determine the relationship of vigorous LTPA attitudinal groups on participating in any vigorous LTPA. Due to the lack of literature examining the relationship between physical activity perceptions and LTPA behavior during pregnancy, only LTPA risk perception was definitively identified as a potentially important variable to adjust for in these analyses. Therefore, chi-square and Kruskal-Wallis analyses were performed to determine other participant characteristics that were significantly related ($P < .05$) to our attitudinal groupings and could possibly confound findings. Significant variables were examined systematically via a forward stepwise method (by examining Wald statistics) to determine whether they significantly entered ($P < .05$) the regression model. Those that did enter, were kept in the model for analysis, while those that did not enter, were excluded.

Hierarchical logistic regression was additionally used to examine both the main and interaction effects of pregnancy risk perceptions and moderate LTPA efficacy beliefs on meeting the moderate physical activity guideline. An interaction term for pregnancy risk perceptions and moderate LTPA efficacy beliefs (pregnancy risk \times LTPA efficacy) was created. To reduce multicollinearity, variables used to create this interaction term were mean centered and then standardized before the formation of the interaction term, as recommended by Aiken and West.³² Pearson and Spearman correlation coefficients were calculated to determine the relationships for potentially important covariates with the independent variables (pregnancy risk perceptions, moderate LTPA efficacy beliefs, pregnancy risk \times LTPA efficacy interaction) as well as dependent variable (meeting moderate physical activity guideline). First added to the model were the demographic control variables (step 1) and psychosocial control variables (step 2). Next, main effects were explored with the addition of pregnancy risk perceptions and moderate LTPA efficacy beliefs (step 3). Finally, the pregnancy risk \times LTPA efficacy interaction term was added to the model (step 4). The statistical significance of change in variance (ΔR^2) was explored for each step. Hierarchical logistic regression was likewise performed to determine the main and interaction effects of pregnancy risk perceptions and vigorous LTPA efficacy beliefs on participating in any vigorous LTPA. The previously described procedure (for moderate LTPA) was also followed for vigorous LTPA.

Results

Of the 360 pregnant women who participated in this investigation, 58 were excluded as a result of not completing portions of the survey. Thus, complete data were obtained from 302 participants. In total, 27.2% ($n = 82$) of the sample reported meeting the current moderate physical activity guideline (≥ 150 minutes per week) as compared with 41.1% ($n = 124$) of participants who achieved this guideline before pregnancy. Likewise, 30.1% ($n = 91$) reported participating in any vigorous LTPA as compared with 62.9% ($n = 190$) who participated in any vigorous LTPA before pregnancy. The total analytic sample for this investigation had a median age of 28 (range 18 to 45) and a median gestational age of 27 weeks (range 5 to 40) when the survey was administered. Participants were primarily Caucasian (72.8%, $n = 220$) and multiparous (63.9%, $n = 193$), with the majority having at least some college education (59.3%, $n = 179$). Nearly two-thirds of participants ($n = 199$) reported having discussed LTPA with their prenatal HCP sometime during the current pregnancy. Overall, pregnancy risk perceptions were low, moderate LTPA efficacy beliefs were high, and vigorous LTPA efficacy beliefs were fairly evenly distributed.

Moderate LTPA

Descriptive characteristics for each moderate LTPA attitudinal group are displayed in Table 1. The frequency of participants meeting the moderate physical activity guideline during pregnancy significantly differed among groups [$\chi^2(3) = 13.50, P = .004$]. Pairwise comparisons with Bonferonni adjustment revealed that the frequency of meeting the moderate guideline was significantly greater for the responsive group compared with the indifferent group (Figure 2). No other significant group differences in meeting the moderate guideline were found. Logistic regression was performed to determine the odds of meeting the moderate guideline during pregnancy for each attitudinal group (Table 2). Of the participant characteristics that varied by groups (Table 1), only income and having met the moderate guideline before pregnancy significantly entered the regression

model, and therefore were adjusted for. After adjustment for these and moderate LTPA risk perception, the responsive group showed 3.23 times the odds (95% CI = 1.35–7.74) of meeting moderate guideline as compared with the indifferent group. The difference between the proactive and indifferent groups bordered on statistical significance ($P = .052$).

Bivariate correlations revealed the likelihood of meeting the moderate physical activity guideline was associated with meeting the guideline before pregnancy ($r = .43, P < .05$) and inversely associated with moderate LTPA risk perception ($r = -0.12, P < .05$), although weakly. Table 3 displays the results of our moderate LTPA hierarchical logistic regression analysis. Step 1 showed those who met the guideline before pregnancy had 8.20 times the odds (95% CI = 4.56–14.88) to do so during pregnancy compared with those who did not. For step 2, the single psychosocial control variable

Table 1 Participant Characteristics of Attitudinal Groups (Moderate LTPA)

	Responsive (n = 87)	Proactive (n = 72)	Avoidant (n = 67)	Indifferent (n = 76)	P-value
Median (range)					
Age (years)	28 (19, 39)	28.5 (19, 40)	28 (19, 40)	26 (15, 45)	0.191
Gestational Age (weeks)	24 (8, 40)	28 (5, 40)	24.5 (8, 40)	29.5 (6, 40)	0.062
Frequency (percentage)					
Parity					0.356
Nulliparous	33 (37.9)	21 (29.2)	29 (43.3)	26 (34.2)	
Multiparous	54 (62.1)	51 (70.8)	38 (56.7)	50 (65.8)	
Race					<0.001*
Caucasian	78 (89.7)	51 (70.8)	48 (71.6)	43 (56.6)	
Non-Caucasian	9 (10.3)	21 (29.2)	19 (28.4)	33 (43.4)	
Education					<0.001*
High school or less	21 (24.1)	28 (38.9)	26 (38.8)	48 (63.2)	
Some college	66 (75.9)	44 (61.1)	41 (61.2)	28 (36.8)	
Income					0.003*
≤\$30,000	31 (35.6)	31 (43.1)	27 (40.9)	47 (63.5)	
>\$30,000	56 (64.4)	41 (56.9)	39 (59.1)	27 (36.5)	
Previous miscarriage	23 (26.4)	23 (31.9)	22 (32.8)	23 (30.3)	0.823
Previous preterm birth	13 (14.9)	5 (6.9)	13 (19.4)	9 (11.8)	0.037*
Previous C-section	13 (14.9)	14 (19.4)	11 (16.4)	16 (21.1)	0.841
Discussed LTPA with HCP	58 (66.7)	46 (63.9)	47 (70.1)	48 (63.2)	0.815
Pre met guideline	43 (49.4)	34 (47.2)	20 (29.9)	27 (35.5)	0.044*

* Significant differences comparing Risk Perception Attitude groups ($P < .05$).

Abbreviations: LTPA, leisure-time physical activity; HCP, healthcare provider.

Table 2 Odds of Meeting Moderate Physical Activity Guideline by Attitudinal Groups

	OR (95% CI)	P-value	aOR ^a (95% CI)	P-value
Indifferent				
Avoidant	1.28 (0.54–3.05)	0.571	1.94 (0.72–5.21)	0.188
Proactive	2.67 (1.21–5.86)	0.015*	2.44 (0.99–6.01)	0.052
Responsive	3.26 (1.53–6.92)	0.002*	3.23 (1.35–7.74)	0.008*

* Significantly different compared with indifferent group ($P < .05$).

^a Adjusted for income, moderate LTPA risk perception, and meeting moderate physical activity guideline before pregnancy.

Abbreviations: LTPA, leisure-time physical activity.

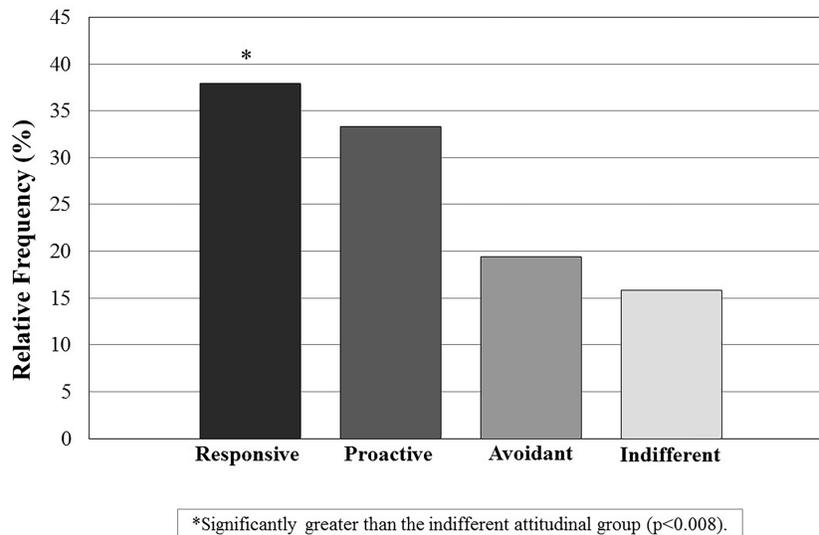


Figure 2 — Relative frequency of meeting moderate activity guideline by attitudinal groups.

(moderate LTPA risk perception) was entered into the model and explained an additional 1.6% of the variance. Main effects were tested in step 3 and explained an additional 6.4% of the variance in meeting the moderate guideline. Those with higher pregnancy risk perceptions (per 0.5 increase on 1 to 7 agreement scale) had significantly greater odds (OR = 1.37, 95% CI = 1.02–1.84) of meeting the guideline compared with those with lower risk perceptions. Likewise, those with higher efficacy beliefs for moderate LTPA (per 0.5 increase on 1 to 7 agreement scale) had significantly greater odds (OR = 1.82, 95% CI = 1.24–2.68). In the final step, the interaction term for pregnancy risk and moderate LTPA efficacy was entered into the model but was not found to be significant. In total, the model explained 34% of the variance in meeting the moderate physical activity guideline during pregnancy.

Vigorous LTPA

Descriptive characteristics for each vigorous LTPA attitudinal group are displayed in Table 4. The frequency of participating in any vigorous LTPA during pregnancy significantly differed among groups [$\chi^2(3) = 40.34, P < .001$]. Pairwise comparisons with Bonferroni adjustment showed the frequency of participating in vigorous LTPA was significantly greater for the responsive group compared with both the avoidant and indifferent groups (Figure 3). In addition, both proactive and indifferent groups had a higher frequency of participating in vigorous LTPA than did the avoidant group. Logistic regression was performed to determine the odds of participating in any vigorous LTPA during pregnancy for each attitudinal group (Table 5). Of the participant characteristics that varied by groups (Table 4), only education and vigorous LTPA participation before pregnancy significantly entered the regression model, and therefore were adjusted for. After adjustment of these and vigorous LTPA risk perception, the responsive group showed 3.65 times the odds (95% CI = 1.60–8.36) of participating in vigorous LTPA compared with the indifferent group, with the avoidant group showing significantly lower odds (aOR = 0.25, 95% CI = 0.07–0.86).

Vigorous LTPA participation was associated with prepregnancy vigorous LTPA participation ($r = .44, P < .05$) and inversely associated with vigorous LTPA risk perception ($r = -.16, P < .05$),

although at a very weak level. Participating in vigorous LTPA before pregnancy was associated with vigorous LTPA participation during the current. Table 6 shows the results from our vigorous LTPA hierarchical logistic regression analyses. Step 1 revealed that those who participated in vigorous LTPA before pregnancy had significantly greater odds (OR = 25.29, 95% CI = 8.86–72.19) to continue this behavior during pregnancy compared with those who did not. However, pregnant women with some level of college education had significantly lower odds (OR = 0.48, 95% CI = 0.27–0.85) of participating in vigorous LTPA compared with those with lower education levels. For step 2, the single psychosocial control variable (vigorous LTPA risk perception) was entered into the model and explained an additional 2.1% of the variance. Step 3 tested the main effects, which explained an additional 16.6% of the variance. The pregnancy risk perceptions score was not significantly related to vigorous LTPA participation during pregnancy. However, those with higher vigorous LTPA efficacy beliefs (per 0.5 increase on 1 to 7 agreement scale) had 4.09 times greater odds (95% CI = 2.57–6.49) compared with those with lower vigorous LTPA efficacy. In the final step, the interaction term for pregnancy risk and vigorous LTPA efficacy was entered into the model, but was not significant. In total, the model explained 51.5% of the variance in vigorous LTPA participation.

Discussion

The purpose of this investigation was to examine the joint influence of pregnancy risk perceptions and LTPA efficacy beliefs on pregnancy LTPA behavior for both moderate and vigorous intensities. This was accomplished by utilizing the Risk Perception Attitude Framework (RPA). Just over 27% ($n = 82$) of pregnant women who participated in this investigation reported meeting the current physical activity guideline of at least 150 minutes of moderate physical activity per week, which is a noticeably higher prevalence than population-based investigations (14% to 16%).^{13,14} Additionally, 30.1% of our analytic sample reported vigorous LTPA participation. The findings of Evenson et al³³ reflect a substantially lower prevalence of participation in vigorous LTPA, namely 14% in the first trimester and 8% in the second trimester. However, Evenson

Table 3 Predictors of Meeting Moderate Physical Activity Guideline

	OR	95% CI	ΔR^2
Step 1: Demographic controls			.259***
Income	0.69	(0.39–1.21)	
Pre met guideline	8.20***	(4.56–14.88)	
Step 2: Psychosocial controls			.016*
LTPA risk perception	0.74	(0.54–1.01)	
Step 3: Risk and efficacy effects			.064***
Pregnancy risk perceptions ^a	1.37*	(1.02–1.84)	
LTPA efficacy beliefs ^a	1.82**	(1.24–2.68)	
Step 4: Interaction			NS
Pregnancy risk × LTPA efficacy ^a	0.94	(0.66–1.36)	
Total R^2			.340***

Abbreviations: LTPA, leisure-time physical activity.

* Significant correlation ($P < .05$).

** Significant correlation ($P < .01$).

*** Significant correlation ($P < .001$).

^a Variables centered and standardized according to Aiken & West.³²

Table 4 Participant Characteristics of Attitudinal Groups (Vigorous LTPA)

	Responsive (n = 81)	Proactive (n = 68)	Avoidant (n = 73)	Indifferent (n = 80)	P-value
Median (range)					
Age (years)	27 (19, 39)	29 (17, 40)	29 (19, 40)	25 (15, 45)	0.006*
Gestational age (weeks)	23 (8, 40)	32 (5, 40)	26 (8, 40)	27.5 (6, 40)	0.020*
Frequency (percentage)					
Parity					0.161
Nulliparous	31 (38.3)	17 (25.0)	31 (42.5)	30 (37.5)	
Multiparous	50 (61.7)	51 (75.0)	42 (57.5)	50 (62.5)	
Race					<0.001*
Caucasian	69 (85.2)	51 (75.0)	57 (78.1)	43 (53.8)	
Non-Caucasian	12 (14.8)	17 (25.0)	16 (21.9)	37 (46.3)	
Education					
High school or less	26 (32.1)	25 (36.8)	21 (28.8)	51 (63.7)	<0.001*
Some college	55 (67.9)	43 (63.2)	52 (71.2)	29 (36.3)	
Income					0.003*
≤\$30,000	32 (40.0)	28 (41.8)	26 (35.6)	50 (63.3)	
>\$30,000	48 (60.0)	39 (58.2)	47 (64.4)	29 (36.7)	
Previous miscarriage	15 (18.5)	25 (36.8)	30 (41.1)	21 (26.3)	0.010*
Previous preterm birth	10 (12.3)	5 (7.4)	16 (21.9)	9 (11.3)	0.009*
Previous C-section	13 (16.0)	14 (20.6)	11 (15.1)	16 (20.0)	0.903
Discussed LTPA with HCP	54 (66.6)	41 (60.3)	51 (69.9)	53 (66.3)	0.685
Pre any vigorous LTPA	62 (76.5)	45 (66.2)	37 (50.7)	46 (57.5)	<0.006*

* Significant differences comparing RPA groups ($P < .05$).

Abbreviations: LTPA, leisure-time physical activity; HCP, healthcare provider.

Table 5 Odds of Participating in Any Vigorous LTPA by Attitudinal Groups

	OR (95% CI)	P-value	aOR ^a (95% CI)	P-value
Indifferent				
Avoidant	0.17 (0.06–0.54)	0.001*	0.25 (0.07–0.86)	0.028*
Proactive	1.86 (0.92–3.75)	0.080	2.24 (0.95–5.27)	0.064
Responsive	3.08 (1.58–5.99)	0.002*	3.65 (1.60–8.36)	0.002*

Abbreviations: LTPA, leisure-time physical activity.

* Significantly different compared with indifferent group ($P < .05$).

^a Adjusted for education, vigorous LTPA risk perception, and participating in vigorous LTPA before pregnancy.

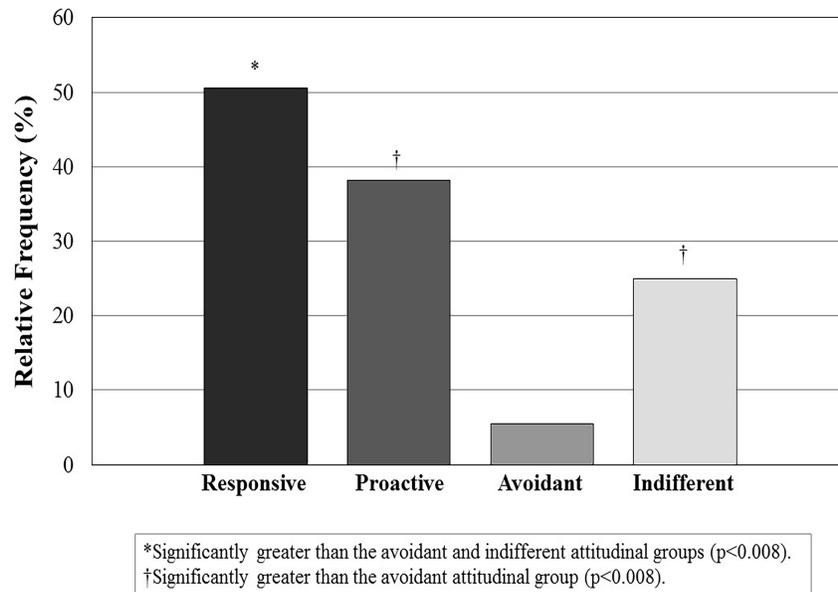


Figure 3 — Relative frequency of participating in any vigorous leisure-time physical activity (LTPA) by attitudinal groups.

Table 6 Predictors of Participating in Vigorous LTPA

	OR	95% CI	ΔR^2
Step 1: Demographic controls			.328***
Education	0.48*	(0.27–0.85)	
Pre any vigorous LTPA	25.29***	(8.86–72.19)	
Step 2: Psychosocial controls			.021*
LTPA risk perception	0.79*	(0.65–0.96)	
Step 3: Risk and efficacy effects			.166***
Pregnancy risk perceptions ^a	1.04	(0.75–1.46)	
LTPA efficacy beliefs ^a	4.09***	(2.57–6.49)	
Step 4: Interaction			NS
Pregnancy risk \times LTPA efficacy ^a	1.41	(0.86–2.29)	
Total R^2			.515***

Abbreviations: LTPA, leisure-time physical activity.

* Significant correlation ($P < .05$).

** Significant correlation ($P < .01$).

*** Significant correlation ($P < .001$).

^a Variables centered and standardized according to Aiken & West.³²

et al asked participants whether they participated in vigorous LTPA activities at least twice a week (in contrast to our asking for self-report of number of days and minutes/day). It is possible that the higher prevalence of any vigorous LTPA participation we found is partially a result of not defining “any” as multiple bouts of activity per week.

Our findings showed that our responsive and proactive groups were more likely to meet the moderate physical activity guideline compared with the indifferent group. Adjustment for potential confounding variables had minimal impact on RPA group effect estimates. These findings are partially consistent with RPA theory in that responsive pregnant women appear more likely than pregnant women of other attitudinal groups to achieve the moderate

guideline. The RPA also posits that those with low risk perceptions and low efficacy beliefs will be least likely to act. Although the current study’s findings suggest the avoidant group was more likely to meet the moderate guideline compared with the indifferent group, this difference was not statistically significant. The lack of difference between these 2 attitudinal groups may be a result of the low efficacy beliefs consistent in both groups. Given the numerous barriers to regular LTPA during pregnancy, expectant mothers, particularly those with little exercise history, may have little motivation to perform moderate physical activity if they do not perceive a protective benefit for their babies. More specifically, avoidant pregnant women may not participate in sufficient moderate LTPA if they do not believe in its positive impact, and if they must

simultaneously cope with other pregnancy-related difficulties (eg, fatigue, discomfort, lack of time).

With respect to vigorous LTPA, our findings suggest that responsive pregnant women were most likely to participate, followed by proactive pregnant women. However, we also found the avoidant group to be less likely than all other groups to be vigorously physically active, which was unexpected. This finding is not in agreement with results from previous RPA-based investigations, which have revealed the indifferent group to be the least likely to act.²⁷ For vigorous LTPA, it is plausible that high pregnancy risk perceptions in the presence of low efficacy beliefs (found in the avoidant group) are associated with extreme fear control responses, possibly including defensive avoidance or denial. Thus, our results indicate that pregnant women who worry about the health of their unborn babies and who do not believe in the health benefit of vigorous LTPA likely avoid vigorous LTPA participation. Interestingly, the same high risk perceptions coupled with high efficacy beliefs appear to trigger high motivations to participate in vigorous LTPA as a protective mechanism, as theorized by Rimal and Real.²⁷

Hierarchical regression was also used to explore main and interactive effects of pregnancy risk perceptions and LTPA efficacy beliefs on LTPA behavior. Main effects were shown for both pregnancy risk and moderate LTPA efficacy on meeting the moderate guideline. In addition, a main effect was shown for vigorous LTPA efficacy on participating in vigorous LTPA (although not for pregnancy risk). After controlling for potential confounding variables, including prepregnancy LTPA, pregnancy risk and moderate LTPA efficacy explained a relatively minor share of the variance (6.4%) in meeting the moderate guideline during pregnancy. Efficacy beliefs explained a more sizable amount (16.6%) of the variance for participating in vigorous LTPA. This finding suggests efficacy may play a somewhat larger role for vigorous LTPA compared with moderate LTPA participation. This is plausible, given that pregnant women may be more likely to regularly engage in moderate LTPA for reasons other than the health of their babies compared with vigorous LTPA. Reasons may include social interaction with other mothers, alleviation of minor physical discomforts, or improving psychological mood. Whereas, vigorous LTPA, presumably perceived to be more difficult, may be performed if expectant mothers are more firmly convinced that it offers a protective health benefit to their babies. Thus, vigorous LTPA response efficacy would theoretically be a stronger predictor of vigorous LTPA behavior compared with moderate LTPA response efficacy predicting moderate LTPA behavior. In seeking to investigate this presumption, post hoc logistic regression analyses were performed examining the dimensions of efficacy (response and self) as individual predictors of LTPA (data not shown). These analyses indicated self-efficacy to be a significant predictor of meeting moderate physical activity guidelines, but not response efficacy. In contrast, both self-efficacy and response efficacy have influence on participating in vigorous LTPA, supporting this hypothesis.

Previous RPA investigations have shown risk/efficacy interactions for HIV and remaining monogamous,³⁴ workplace accidents and wearing protective equipment,³⁵ and breast cancer and self-examinations.³⁶ While these interactions accounted for a relatively minor percentage of the overall variance explained, they were all statistically significant. Although we found LTPA differences among attitudinal groups (combinations of high/low risk and efficacy), our hierarchical logistic regression results showed no significant interactive effect for pregnancy risk or LTPA efficacy beliefs for both moderate and vigorous LTPA. Lack of interaction may be related to extremely low pregnancy risk perceptions overall within the sample. Had there been more variability in perceived pregnancy risk

(ie, higher risk perceptions), it is possible that an interaction would have been found. The current study's findings suggest that efficacy beliefs have stronger influence on LTPA behavior than do pregnancy risk perceptions, but especially with respect to vigorous LTPA.

Interventions designed to increase pregnancy LTPA may be most effective by targeting women who are attitudinally similar. To generate positive health behavior change, the RPA posits that researchers focus on moving individuals from the indifferent, avoidant, and proactive groups to the responsive group.²⁸ The caveat is that messages should be designed with specific consideration of which attitudinal group study participants are moving from, given the previously described group differences. This study's findings indicate that efficacy beliefs play a major role in determining moderate and vigorous LTPA behavior, but that pregnancy risk perceptions are of less importance. This suggests the RPA attitudinal groupings to not be completely effective in predicting pregnancy LTPA. However, our results show that pregnancy LTPA interventions should aim to increase efficacy beliefs, or within the RPA context, move pregnant women in the avoidant group to the responsive group or those in the indifferent group to proactive group (Figure 1). The avoidant group, which has high-risk perceptions and low efficacy beliefs, is perhaps most challenging. Individuals in this group are most likely to engage in "fear control processes," or behaviors that will control their fears (ie, defensive avoidance, denial, issue derogation) as opposed to behavior which will control the perceived risk (ie, LTPA).³⁰ For such individuals, messages designed to increase efficacy beliefs (without increasing perceived risk) are essential.

Limitations and Strengths

Although this investigation provides novel information with respect to the perceptions that pregnant women have toward LTPA, the study had several limitations. First, a cross-sectional design was used, with data collection occurring when the majority of participants were in the second or third trimesters. A longitudinal design following pregnant women from their first trimester through delivery would have added strength to our findings, particularly given the impact of gestational age on LTPA participation. Another limitation to this investigation involves the assessment of moderate and vigorous LTPA behavior via self-report. Survey questions assessing LTPA were adapted from items within the Global Physical Activity Questionnaire (GPAQ). These questions have demonstrated acceptable criterion validity and excellent test-retest reliability,²⁹ and therefore have been integrated into the National Health and Nutrition Examination Survey (NHANES), a highly cited population-based initiative used to track LTPA and other health behaviors in the United States. Despite this, self-reporting physical activity via questionnaire has its limitations.³⁷ Specifically, this investigation's LTPA questions are limited in that they did not specify an exact recall time period (eg, past week, past month), but rather inquired about "current" pregnancy LTPA. It should also be acknowledged that this study's findings with respect to perceived risk and LTPA efficacy are limited by single-item assessments. Although these questions were adapted from the often-cited Risk Behavior Diagnostic Scale, Witte et al³⁰ recommends 3 items for each of the risk (severity, susceptibility) and efficacy (response and self) dimensions. This study aimed to create a survey instrument that could be completed within 15 minutes. Given this and the variety of additional factors that were deemed important to assess, the survey instrument for this investigation could not realistically include more than 1 item per risk/efficacy dimension. Finally, this study is limited by the generalizability of our study findings. Participants were recruited via a mixed recruitment strategy (prenatal clinics as well as word-of-mouth). However, our

total analytic sample lacked heterogeneity, being predominantly Caucasian and fairly well educated. It is unknown if the findings would be similar among ethnically diverse and low SES populations.

This investigation represents a multisite effort, which involved data collection at several locations in the mid-Michigan area and Salt Lake City, Utah. Another notable strength to this investigation is that we used the RPA, a well-respected theoretical framework in the health communication literature. Although relatively new, the RPA originates from and is theoretically similar to the Extended Parallel Process Model (EPPM), a highly-regarded fear appeal theory which has remained unchanged over the years.³⁸ To our knowledge this is the first investigation to use the RPA within a physical activity or prenatal health context. A final strength to this investigation is that we defined pregnancy risk in this investigation in a specific manner, namely as a harmful pregnancy effect on the baby. Previous investigations examining pregnant women's perceptions of risk and benefits of physical activity have done so generally, and have not specified whether the "risk" and "benefits" pertain to the mother or the baby.^{23,39} Thus, an important and previously unaddressed issue, namely concern a mother feels for her baby, has been specifically applied to the methodological examination of LTPA behavior.

Conclusions

Findings from this investigation indicate that LTPA efficacy beliefs are extremely important in facilitating greater levels of moderate and vigorous LTPA during pregnancy. However, pregnancy risk perceptions appear to be less important. Contrary to RPA theory, pregnancy risk perceptions (with respect to the health of the baby) and LTPA efficacy beliefs did not have an interactive effect on moderate or vigorous LTPA participation. Given the substantial maternal-fetal health benefits of regular LTPA during pregnancy, health promotion efforts should focus on increasing LTPA self- and response efficacy to increase rates of LTPA participation among pregnant women.

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