

Review

Exercise during pregnancy: A review of patterns and determinants

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Abstract

The mental and physical health benefits of exercise during pregnancy highlight the importance of understanding the determinants of pregnant women's physical activity. This paper presents a review of the existing research on pregnancy and physical activity, in order to (a) summarize the existing body of literature since 1986 examining changes in physical activity during pregnancy, (b) summarize correlates and predictors of physical activity during pregnancy, and (c) present directions for future research. A literature search yielded 25 articles published from 1986 to 2009 in English peer-reviewed journals. The major findings were categorized into the following: (a) exercise patterns, (b) demographic correlates/predictors, (c) the influence of pre-pregnancy exercise on pregnancy exercise, (d) theory-based predictors and (f) other correlates of exercise (e.g. general health and safety concerns). Results indicated that pregnant women are less active than non-pregnant women and that pregnancy leads to a decrease in physical activity. Consistent demographic predictors of higher exercise participation during pregnancy include higher education and income, not having other children in the home, being white, and being more active prior to becoming pregnant. Only a few studies used theoretical models to understand physical activity during pregnancy with varied results. The review outlines demographic and theory-based correlates/predictors that should be taken into consideration when developing interventions to increase physical activity among pregnant women.

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Keywords: Exercise; Physical activity; Pregnancy; Determinants; Behavioral medicine; Health behavior

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1. Introduction

Despite the numerous physical and mental health benefits associated with regular exercise,^{1,2} many people fail to

engage in a sufficient amount of exercise.³ Although numerous factors such as pursuing higher education and entering the workforce can disrupt or interfere with regular exercise,⁴ pregnancy has been associated with the sharp decline in exercise among adult women.^{5–7} Pregnancy is a time of social, psychological, behavioral and biological change.⁸ As such, it is not surprising that it has been identified as a contributing factor to the decline in exercise behavior among women.

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Inactivity during pregnancy is cause for concern because prenatal women who do not engage in exercise forgo numerous health benefits. For example, exercise during pregnancy is associated with reduced risk of preeclampsia,^{9–11} gestational diabetes^{9,12,13} and preterm birth,^{9,14} as well as improved pain tolerance, lower total weight gain and less fat mass gain, and improved self-image.¹⁵ For these reasons, US exercise guidelines recommend that all healthy women should get at least 150 min of moderate-intensity aerobic activity a week during pregnancy.¹⁶

In a recent review of 31 pregnancy and exercise studies, Poudevigne and O'Connor concluded that as pregnancy progresses, exercise levels decrease.¹⁷ Furthermore, the authors pointed out that the causes of exercise change during pregnancy appear to be numerous and complex. The purpose of the current study is to extend Poudevigne and O'Connor's work and review the existing literature to examine changes in exercise during pregnancy as well as identify correlates and predictors associated with changes in exercise and discuss avenues for future research.

2. Method

Inclusion criteria for this review are as follows: (a) studies had to include more than one assessment of exercise during pregnancy in order to assess change in exercise, (b) studies had to examine the relationship of at least one independent variable (determinant) with exercise, (c) studies had to be published in English and (d) data had to come from independent datasets (i.e., each study analyzed a unique dataset). Studies were excluded if they measured exercise but did not include any potential correlates. Searching involved all relevant databases subscribed to by the library of the University of Western Ontario as well as Internet search engines. To maximize the number of articles retrieved, no date restrictions were set. The databases searched included Medline (earliest-end 2009), PsycInfo (earliest-end 2009), PubMed (earliest-end 2009), and Scholars Portal (earliest-end 2009) and the Internet search engines were: www.scholar.google.com, www.google.com, and www.yahoo.com. Keywords used alone and in various combinations included *exercise*, *physical activity*, *pregnancy*, *prenatal*, *demographic predictors*, *psychosocial predictors* and *correlates*. This electronic search yielded 124 articles. All abstracts were then examined for the inclusion and exclusion criteria, and 23 articles were selected as suitable. To obtain additional studies, we reviewed the references cited in each of the eligible studies. This manual cross-referencing of references yielded an additional 15 studies, two of which met the inclusion criteria. Therefore, a total of 25 studies met the inclusion criteria, and all were published between the years of 1986 and 2009.

The first and second authors performed article selection and data extraction. Both authors read each study and independently summarized each study in table format (e.g., study

design, sample size, measures and measurement time points). This procedure was undertaken to ensure that no important omissions occurred. Tables were then compared and synthesized into a single document. All studies included in this review are summarized in [Table 1 refer to online supplementary information](#), which lists the author(s) and publication year, sample size, study design, correlates/predictors examined, exercise measure, and the results pertaining to changes in exercise and significant correlates/predictors.

Twenty-five studies examined exercise patterns and determinants during pregnancy. With the exception of one study that examined energy expenditure,¹⁸ the remaining 24 studies focused on leisure-time exercise, hence our rationale for using the term exercise throughout this paper. Of the 25 studies, 13 were prospective cohort studies, six were single time-point cohort studies, one was a retrospective cohort study, four were cross-sectional and one was a case-control design. The populations sampled included pregnant women ($n = 19$), postpartum women ($n = 4$) and two studies included both pregnant and non-pregnant women. The four postpartum studies were included because they contained a retrospective measure of exercise during pregnancy. Study samples were predominantly white, however, a few studies included women from different ethnic backgrounds.^{19,20} The 25 studies produced a total of 239,983 participants, with sample sizes ranging from 53 to 150,256. Participants ranged in age from 15 to 44, although some studies only reported mean age. All studies used a self-report measure of exercise and are summarized in [Table 1 refer to online supplementary information](#).

3. Results

Data retrieved from the studies were categorized into the following result headings: (1) changes in exercise patterns, (2) demographic predictors of exercise during pregnancy, (3) the role of pre-pregnancy exercise, (4) theory-based predictors and (5) other correlates of exercise. Not all studies addressed all the headings and no other headings were identified. The findings for each heading are synthesized and presented concurrently.

Sixteen studies examined women's exercise during pregnancy. Thirteen examined changes from pre-pregnancy to pregnancy,^{18,19,21–30} two compared exercise rates between pregnant and non-pregnant women,^{31,32} and one examined only the prevalence rates of exercise during pregnancy.³³

Of the 13 studies that examined changes in exercise from pre-pregnancy to pregnancy, 11 examined changes in participation in *any* exercise.^{18,19,21–27,29,34} Eight of these 11 studies assessed pre-pregnancy exercise retrospectively and at one time point during pregnancy,^{22,23,25–30} two measured exercise at two time-points during pregnancy,^{18,19} two measured exercise at three time-points,^{24,34} and one measured exercise at four different time-points during pregnancy.²¹

All studies that examined changes in *any* exercise (regardless of intensity or duration) reported decreases from

pre-pregnancy to pregnancy. However, the results varied. For example, the percentage of women who reported exercising before becoming pregnant ranged from 63% to 87.4%. During pregnancy the range drastically widens; 38–78.4% of women reported being active during pregnancy. Furthermore, it is important to note that there were several differences between how exercise behavior was quantified and reported. For example, six studies reported the percentages of participants that were active during pre-pregnancy and pregnancy.^{21,23,24,26,27,29} two reported exercise participation as a function of METs,^{18,25} one reported exercise minutes,³⁴ and one reported KPAS scores.¹⁹ Actual exercise data and statistics for all studies are reported in [Table 1 refer to online supplementary information](#).

Two population-based studies compared exercise participation rates between pregnant and non-pregnant women. Petersen et al.³² examined cross-sectional data from 150,256 pregnant and non-pregnant women collected as part of the 1994–2000 Behavioral Risk Factor Surveillance System study of the US population. Results showed virtually no difference between pregnant and non-pregnant women when it came to moderate exercise, with 11% of pregnant women and 12% of non-pregnant women meeting guidelines. However, almost twice as many non-pregnant women met the guidelines for vigorous activity (17%) as compared to pregnant women (9%). The smaller of these studies surveyed 46,636 pregnant and non-pregnant women and found that only 15.8% of pregnant women were sufficiently active (compared to 26.1% of non-pregnant women).³¹

Finally, of the 16 studies that examined women's exercise during pregnancy, one study examined only the prevalence rates of exercise during pregnancy. This study revealed that 29% of pregnant women met the American College of Obstetricians and Gynecologists (ACOG) guidelines, although moderate and vigorous exercise participation was not examined separately.³³

Fourteen studies examined the role of maternal age in relation to exercise during pregnancy. Overall, the results were equivocal. Three studies indicated that younger age was associated with higher levels of exercise.^{30–32} In these studies, women under 24 were approximately twice as likely to be meeting ACOG guidelines compared with women over 25. Conversely, four studies indicated that greater age was associated with higher levels of exercise.^{22,23,27,35} In those studies, older women (cut-offs ranged between 26 and 35 years of age), were more likely to engage in vigorous activity,³⁵ participate in 'active recreation',²⁷ increase their exercise levels from pre-pregnancy to pregnancy,²³ and not cease their participation in sport and exercise from pre-pregnancy to pregnancy.²² Seven studies found no association between maternal age and exercise level during pregnancy.^{18,19,21,24–26,33}

Although studies have consistently shown that exercise decreases as pregnancy progresses, only two studies have examined the statistical relationship between exercise and stage of pregnancy. One study found that compared to women

in their second or third trimester, women in the first trimester of pregnancy were almost twice as likely to participate in any exercise.³³ The second study, however, did not find any relationship between number of weeks pregnant and exercise.³⁶

A total of 13 studies examined the relationship between education and exercise. Eight studies found that greater education (e.g., having completed high school, college or university) was a significant predictor of greater exercise participation^{22,25,27,29,31–33,35} while five studies found no association between education and exercise.^{19,21,24,26,36}

A total of nine studies measured the association between parity (e.g., number of children) and exercise during pregnancy. Six studies indicated that having at least one other child was significantly associated with lower levels or no exercise participation.^{22,24–27,30} In general the results of these studies were fairly consistent; first time pregnant women were 1.6–1.9 times more likely to be active when compared to women pregnant with their second or subsequent child.^{24–26,30} In terms of ceasing exercise altogether, women who had other children at home were 1.2 times more likely to stop participating in sports and exercise than women with no children at home.²² Only one study found that having at least one other child at home was associated with higher levels of exercise.¹⁸ In that study, the results demonstrated that women with other children in the household had a greater mean daily energy expenditure than women with no children in both the fourth and seventh months of pregnancy.¹⁸ According to this study, it appears that women with more than one child have less time to participate in recreational activities but greater overall energy expenditure due to increased activities of daily living (e.g., housework, playing with older children). Two studies found no significant association between parity and exercise.^{19,31}

Nine studies explored the relationship between race or ethnicity and exercise. While two studies found that white women were significantly more active than black women,^{25,32} two other studies indicated that black women were just as likely as white women to be active.^{30,33} All studies indicated that Hispanic and Asian women were most likely to be inactive.^{25,30,32,33} One study examined the relationship between acculturation (defined as language preference) and exercise among Latin women and found that women who preferred to speak only English were twice as likely to participate in sports and exercise as compared to women who preferred to speak only Spanish.¹⁹ The remaining four studies found no relationship between ethnicity and exercise.^{26,31,35,36}

The relationship between exercise and employment was measured by six different studies with varying results.^{22,26,29–32} For example, a large cross-sectional study found that women who were not employed were more likely to be meeting exercise guidelines in comparison with employed women.³² However, another study found that compared to unemployed or non-professionals, professional women were twice as likely to engage in aerobic exercise for a minimum of 20 min on two or more days of the week (41.9% vs. 22.7%).²⁹

Furthermore, Zhang and Savitz³⁰ examined type of occupation and found that women who worked in fishing or farming occupations were much more likely to be active than women in managerial and professional occupations. Given the nature of these occupations, the results are not surprising. Unfortunately, these authors failed to examine other employment categories or unemployed women. The remaining three studies found no relationship between employment and exercise.^{22,26,31}

Nine studies examined the relationship between marital status and exercise. Two studies found that women who were married were twice as likely to be meeting exercise guidelines in comparison with single women.^{25,32} A third study, however, found that divorced, separated or widowed women were 1.5 times more likely to be active compared to married and single women.³¹ The remaining six studies found no relationship between marital status and exercise.^{21,22,24,26,33,36}

A total of nine studies examined the relationship between household income *or* socioeconomic status and exercise. Five studies consistently found a positive relationship, indicating that women with greater household income are more likely to be active.^{18,25,29,32,33} For example, women with an annual household income greater than \$70,000 were 3.3 times more likely to be active than women whose income was below \$30,000 ($p = .002$).²⁵ Petersen et al.³² found an even stronger relationship, with women whose household income was above \$75,000 being 5.1 times more likely to be meeting exercise guidelines than women making under \$20,000 per year. In a comparison of exercisers vs. non-exercisers, Wallace et al.²⁹ found that 80.7% of exercisers had an income greater than \$30,000, while only 35.8% of non-exercisers were in the same income bracket.

A total of seven studies examined the relationship between smoking status and exercise.^{18,19,22,24,25,32,35} Only one study found a significant relationship between smoking status and exercise. The results from this study indicated that compared to current smokers, former smokers and women who had never smoked were twice as likely to be meeting moderate or vigorous exercise guidelines.³²

The relationship between weight or BMI and exercise during pregnancy was explored by nine studies. Six studies measured only pre-pregnancy weight or BMI as a correlate of exercise level during pregnancy.^{19,22,23,25,26,30} In general, the results are inconclusive. For example, compared with women who had a pre-pregnancy BMI under 25²² and 30,²⁴ women with a BMI of greater than 25²² and 30²⁴ or a Ponderal Index greater than 3.6³⁰ were 1.3–1.79 times more likely to discontinue their involvement in sports after becoming pregnant. Hinton and Olson²³ examined change in exercise levels from pre-pregnancy to pregnancy and found that higher pre-pregnancy BMI was predictive of increasing exercise from pre-pregnancy to pregnancy ($\beta = 0.01$, $p = .01$). The remaining four studies found no relationship between weight or BMI and exercise.^{18,19,25,26}

As well as exploring pre-pregnancy BMI, Mottola and Campbell²⁴ examined weight gain during pregnancy. The

results revealed that women who had gained more weight by their third trimester (defined as increases by 10 kg increments) were 1.54 times more likely to have discontinued their involvement in structured exercise. Furthermore, two studies examined the relationship between current weight and exercise level.^{18,35} One study found that women who characterized their usual exercise level as ‘vigorous’ were 6–10 lbs lighter than women who responded ‘moderate’ or ‘light’,³⁵ while the other found no significant relationship between current weight and exercise level.¹⁸

A total of seven studies examined the relationship between pre-pregnancy exercise levels and exercise during pregnancy. Six of the seven studies found a significant relationship between the two.^{19,21–23,25,26} Results of these studies showed that women who were more highly active prior to pregnancy remained more active during pregnancy. In the only study to examine within-woman change in exercise during pregnancy, Hinton and Olson²³ found that women who reported having exercised “often” before becoming pregnant were more likely to maintain or decrease their exercise during pregnancy, while women who reported having exercised “sometimes” or “rarely/never” were more likely to increase their level of exercise during pregnancy. It is unfortunate that these authors assessed only exercise change and did not measure actual exercise. Such a measure may have found that women who had been most active at pre-pregnancy still remained more active during pregnancy compared to their more sedentary counterparts.

Only eight studies examined theory-based predictors of exercise during pregnancy. Five examined Theory of Planned Behavior (TPB³⁸) variables,^{28,37,39–41} one examined exercise barriers coded according to a socioecologic framework,²⁰ one examined exercise barriers, exercise self-efficacy and barrier self-efficacy using social cognitive theory (SCT^{42,43}) and one examined several theory based psychosocial variables, including self-efficacy and attitude.²³

With the exception of one study,³⁹ all of the studies that examined TPB variables found intention to be a significant predictor of behavior, explaining between 16 and 47% of the variance in exercise behavior.^{37,40,41} Perceived behavioral control was also found to be a predictor of behavior ($R^2 = 0.25$).³⁹ With respect to predicting intention, Symons Downs and Hausenblas²⁸ examined behavioral, normative and control beliefs (the beliefs underlying a person’s attitude, subjective norm, and perceived behavioral control). Results showed that a majority of women believed that exercise improves mood, increases energy, and assists with staying fit. Important normative influences were husband, children, and other family members, and the most common control beliefs (obstructing factors) were physical limitations, tiredness, and time limits.

Using open-ended questionnaires, Evenson et al.²⁰ and Cramp and Bray⁴³ asked women about their primary barriers to exercise. The most commonly cited barriers were feeling too tired and not having enough time^{20,43} and physical limitations.⁴³ Cramp and Bray also examined the relationship

between actual exercise, exercise self-efficacy and barrier self-efficacy for three different prediction periods. Results indicated that exercise self-efficacy predicted exercise from weeks 18 to 24 and weeks 30 to 36, while barrier self-efficacy predicted exercise from weeks 24 to 30.

Although not based on any one particular theory, Hinton and Olson²³ examined a number of theory-based psychosocial variables, including attitudes, feelings about motherhood, locus of control, and self-efficacy. Exercise self-efficacy was the only variable to predict increased exercise from pre-pregnancy to pregnancy.

The relationship between health outcomes and exercise during pregnancy was examined by seven studies. The results consistently indicated that exercisers felt better and experienced fewer symptoms associated with pregnancy. For example, one study found that compared to women who rated their general health 'poor' or 'fair', women who rated their general health 'excellent' or 'very good' were almost two and a half times more likely to be meeting exercise guidelines.³¹ Similarly, another study found that feeling well (vs. feeling not well, tired, or depressed) was associated with higher daily energy expenditure levels,¹⁸ and exercisers were less likely to experience shortness of breath, backaches, headaches, and hot flashes²⁹ and less likely to have vomited frequently during pregnancy.²⁶

Two studies^{33,34} examined the relationship between women's beliefs about exercise safety and actual exercise and a third study examined the extent to which a woman believes that she is responsible for her unborn child's health.²¹ Duncombe et al.³⁴ found that believing that low to medium exercise was unsafe predicted fewer exercise minutes both concurrently and prospectively, and beliefs that gentle exercise and weight bearing exercise was unsafe predicted lower exercise intensity. Compared to women who felt that vigorous exercise was safe, Mudd et al.³³ found that women who believed it was unsafe were 2.0 and 2.8 times as likely to abstain from moderate and vigorous exercise, respectively, and 1.4 times more likely to not be meeting ACOG exercise guidelines.

Clark and Gross²¹ had women complete the fetal health locus of control questionnaire, which assesses the role which they (internal), powerful others, and chance plays in their unborn child's health. A significantly lower score on the internal dimension of the scale was associated with higher levels of exercise, suggesting that some women may have been concerned about the effects of exercise on their baby's health.

4. Discussion

The focus of this review was to examine changes in exercise from pre-pregnancy to pregnancy and summarize the literature examining correlates and predictors of exercise during pregnancy. Consistent with Poudevigne and O'Connor,¹⁷ our results indicated that exercise decreases in frequency

and intensity from pre-pregnancy to pregnancy and that few pregnant women are meeting exercise guidelines. While the relationship between exercise and a variety of demographic variables was examined, only a few stood out as consistent predictors of greater exercise. These included having a higher education and income, being white, not having other children in the home, and being more physically active prior to pregnancy. Several directions for future research stem from these findings. First, interventions need to be designed that target women of low income and diverse cultural backgrounds. Second, efforts to promote exercise among pregnant women need to account for the challenge of having multiple children. For example, when planning interventions researchers should consider providing childcare as well as the time of the day the program is being offered to accommodate for sleep and feeding schedules of other children. Third, the significant positive relationship between pre-pregnancy and pregnancy exercise suggests that interventions should target inactive non-pregnant women in their child bearing years. It is possible that getting women to become physically active prior to conceiving will achieve higher rates of exercise during pregnancy.

Another direction for future research is the examination of social cognitions. While demographic correlates of exercise are informative, they are largely unmodifiable, whereas social cognitions represent modifiable characteristics which could be the target for intervention. Unfortunately, our review found that only a few studies have examined social cognitive factors associated with pregnant women's exercise participation.^{23,34,39–44} For example, a few studies have examined barriers to exercise during pregnancy. Although there was little consistency in the way that barriers were elicited (e.g., some studies used open-ended while others used closed questionnaires), several different barriers to exercise emerged (e.g., feeling too tired, lack of time). However, no studies have attempted to help women overcome these barriers and only one study assessed participants' confidence for overcoming salient barriers.⁴³ In addition, a few studies have demonstrated that self-efficacy is associated with increased exercise. However, more research is necessary needed to determine how to increase exercise-related self-efficacy among pregnant women. Overall there is a lack of research examining psychosocial predictors of exercise participation during pregnancy. Furthermore, most of the research carried out thus far has been cross-sectional and atheoretical. Consequently, our understanding of whether the psychosocial variable(s) in question influences exercise behavior or vice versa is limited.

A final direction for future research pertains to the measurement of exercise. For example, it is unfortunate that none of the studies used an objective measure of exercise. While self-report instruments used to measure actual exercise are acceptable, it is also desirable that researchers use objective measures (such as accelerometers) to more accurately measure behavior.⁴⁵ Furthermore, when it comes to self-reported health behavior, research supports the idea that

social desirability bias may be even higher in pregnant samples as compared to the general population.^{46,47} Given that our society values being physically active, it is possible that women report higher exercise levels in order to appear more favorable to others.

In addition, there was little consistency among the studies in regard to the measurement of exercise. While some studies measured exercise in terms of duration/frequency or meeting guidelines, others simply asked participants to indicate whether or not they had engaged in any physical or recreational activity, and others compared activity levels between pregnant and non-pregnant women. In addition, some studies included only a single measure of exercise during pregnancy without considering stage of pregnancy (i.e., trimester). Pregnancy is characterized by a number of complex changes, and subtle and important variations in exercise may occur from trimester to trimester. While a few studies measured exercise at several time-points during pregnancy^{18,19,21,24,34,43} a greater understanding of how and when activity levels decline is needed. This information could provide important data regarding when exercise changes occur and the circumstances surrounding those changes, rather than simply how much change occurs from one discrete measurement to the next. Thus, an investigation of frequency, duration and intensity of exercise at multiple brief and regularly spaced intervals stands to advance our knowledge of women's exercise in and around pregnancy.

Although this review represents the first attempt to synthesize determinants of exercise during pregnancy into a single document, several limitations should be acknowledged. First, our review included a broad range of determinants, ranging from demographic characteristics to past exercise behavior, lifestyle habits (such as smoking status) and psychosocial theory-based predictors. While this is also a strength of the present research, the paucity of articles examining some of these areas (i.e., only two studies examined safety concerns) may limit the usefulness of any conclusions that may have been drawn. Second, while a meta-analytic approach may have been preferable, the lack of correspondence between how many of the variables of interest were defined and measured posed methodological difficulties. However, as this area of research continues to gain increasing attention and the body of research grows, a meta-analysis might be valuable. Finally, only published studies met the inclusion criteria for this review. To avoid potential bias, future reviewers may wish to contact researchers in this field and inquire whether they have any knowledge of unpublished work that meets the inclusion criteria.

5. Conclusion

Given the positive physical and mental health outcomes associated with participating in regular exercise, promoting exercise during pregnancy needs to remain a crucial objective among health promoters. However, even among

the general population, engaging in regular exercise is a complex and challenging behavior. Being pregnant presents further challenges to an already difficult behavior. This review summarizes the literature on exercise during pregnancy and presents some suggestions about when and how interventionists might best intervene to enhance pregnant women's exercise. Albeit, there are many opportunities for future research and continuous efforts to study exercise during pregnancy will increase our knowledge about the determinants and outcomes of exercise participation and improve our ability to effectively intervene.

Practical implications

- Despite the benefits of exercise during pregnancy, many women are not sufficiently active. Health professionals who interact with pregnant women need to remain aware of the importance of exercise promotion.
- Factors associated with a higher risk for inactivity include lower education and income, having other children in the home, and not being white. Health educators need to be aware of these risk factors in order to tailor their messages more effectively.
- Women who are active prior to pregnancy tend to remain more active during pregnancy. For this reason, women planning to have children should be encouraged to adopt an active lifestyle before they conceive.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jsams.2011.02.006.

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Table 1. *Studies examining physical activity patterns and determinants during pregnancy*

Study	Sample size	Design	Determinants examined	Physical activity measure	Physical activity data collection timeline	Change in physical activity	Results: Correlates/predictors of physical activity
Chasan-Taber, Schmidt, Pekow, et al., 2007 [19]	N = 1231 -Pregnant Latina women -Western Massachusetts, USA	Prospective cohort study	-maternal age -level of education -income -acculturation -parity -prepregnancy BMI -prepregnancy PA -cigarette smoking	-Kaiser Physical Activity Survey -assessed 4 domains of activity: 1) household and family care activities, 2) occupational activities, 3) active living habits, 4) participation in sports & exercise.	-prepregnancy (year prior) -early pregnancy (M = 15 wks) -mid pregnancy (M = 28 wks)	-Total activity (in all domains) decreased from prepregnancy to early pregnancy, <i>M</i> (SD) = -1.40 (1.78), then slightly increased from early to mid pregnancy, <i>M</i> (SD) = 0.16 (1.65) with the exception of a continued decrease in occupational activity. -Sports/exercise physical activity decreased from prepregnancy to early pregnancy, <i>M</i> (SD) = -0.79 (1.23), then stayed almost the same from early to mid pregnancy, <i>M</i> (SD) = 0.02 (0.93).	Predictors of greater early pregnancy PA: Sports/exercise: - Prepregnancy physical activity (in quartiles): 2 (Adj. OR = 1.9), 3 (Adj. OR = 2.6), 4 (Adj. OR = 3.4) vs. 1, $p < 0.0001$, $r = 0.28$ -Income: >30,000 (OR = 2.3), 15-30,000 (OR = 1.4) vs <\$15,000. Predictors of greater mid pregnancy PA: -Acculturation: Spanish speaking only (OR = 0.5), English & Spanish (OR = 0.6), vs English only (OR = 1.0).

Clarke & Gross, 2004 [21]	N = 57 -Nulliparous pregnant women -East Midlands, UK	Prospective cohort survey	-age -marital status -education -SES -prepregnancy physical activity (Baecke questionnaire for 12 months prepregnancy) -maternal beliefs regarding importance of exercise during pregnancy -fetal health locus of control (FHLC) scale...measures extent to which women believe they are responsible for health of unborn child (internal, powerful others, chance).	Self-report: -Baecke for prepregnancy (Sport and activity scores) -Non-standard interviewer administered 7-day recall used during pregnancy. Assessed type, intensity, and frequency of sports and exercise participation.	-prepregnancy -16, 25, 34, & 38 weeks gestation	-63% participated in sports at prepregnancy -39% who were active at prepregnancy ceased physical activity during pregnancy	Predictors of greater physical activity during pregnancy: -Prepregnancy PA: Active vs. inactive pregnant women (M (SD), 3.14 (0.57) vs. 3.67 (0.40), $t = 2.32$, $df = 22$, $p = .03$, $d = 0.95$. -significantly lower on internal dimension of the FHLC scale, (M (SD), 34.06 (4.61) vs. 40.64 (4.35), $t = 3.60$, $df = 22$, $p = .002$. $d = 1.5$.
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Cramp & Bray, 2009 [45]	N = 160 -Pregnant women	Prospective cohort study	-perceived physical activity barriers -barrier self-efficacy -exercise self-efficacy	-Modifiable Activity Questionnaire	-Four measures during pregnancy: at 18, 24, 30, and 36 weeks	-Not assessed	<i>Most commonly cited barriers among first-time and non-first-time mothers:</i> -fatigue, time constraints, & physical limitations <i>Predictors of LTPA:</i> -18-24 weeks: exercise self-efficacy ($\beta=0.32$, $R^2 = 0.26$) -24-20 weeks: barrier self-efficacy ($\beta=0.40$, $R^2 = 0.32$) -30-36 weeks: exercise self-efficacy ($\beta=0.41$, $R^2 = 0.37$)
Duncombe, Wetheim, Skouteris, et al., 2007 [34]	N = 158 -Pregnant women, Australia	Prospective cohort study	-exercise safety beliefs. Perceived safety of: 1) non-weight bearing exercise, 2) weight-bearing exercise, 3) high impact exercise, 4) low impact exercise	Seven-day exercise diary (total number of minutes of aerobic, anaerobic, & flexibility exercise)	-retrospective prepregnancy PA -Three measures during pregnancy: 16-23, 24-31, and 32-38 wks	<i>Changes from prepregnancy to pregnancy:</i> Exercise minutes decreased from prepregnancy (M = 311.49, SD = 196.08) to T1 (M = 139.79, SD = 125.32), $\eta^2 = .42$, T1-T2 (M = 126.56, SD = 130.37), $\eta^2 = .03$, T2-T3 (M = 85.44, SD = 111.99), $\eta^2 = .17$, PP vs. T3, $\eta^2 = .54$, (all p 's <.0005).	<i>Predictors of lower exercise participation:</i> T1 beliefs that <i>low to medium exercise unsafe</i> predicted fewer exercise minutes concurrently ($r = .26$, $p < .01$) and prospectively (T1 $r = .18$, T3 $r = .20$, $p < .05$). Beliefs that <i>gentle exercise unsafe</i> predicted lower exercise intensity at T1 ($r = .21$, $p < .05$) and T2 ($r = .24$). Beliefs that <i>weight bearing exercise unsafe</i> related to lower exercise intensity at T1 ($r = .21$, $p < .05$). <i>High intensity exercise safety beliefs not predictive of exercise behavior ($p >$</i>

Evenson, Moos, Carrier, et al., 2009 [20]	N = 1535 -ethnically diverse pregnant women, 27-30 wks gestation enrolled in Pregnancy, Infection, and Nutrition study - North Carolina, United States	Prospective cohort study	-open ended question about primary barrier to physical activity -coded according to socioecologic framework and by type	Not assessed	Single assessment, 27-30 wks gestation	Not assessed	<i>Most commonly reported barriers to physical activity:</i> -Intrapersonal - Health related (tiredness or lower energy during pregnancy) (52%). -Intrapersonal – not health related (lack of time, busyness) (32.7%). - Interpersonal barriers (2%). -Neighbourhood or environmental (3%), Organization and policy factors (0.5%)
Evenson, Savitz, & Huston, 2004 [31]	N = 46,636 ; n = 1979 pregnant women, n = 44, 657 non-pregnant women. All representative of US population, data from Behavioral Risk Factor Surveillance System	Cross-sectional	-race/ethnicity -education -age -employment -number of children -general health -marital status	Self report: -physical activity over past month, type, frequency & duration in minutes; physical activity measured in assigned METs. Divided into 3 categories: 1) ‘Recommended’: moderate intensity, min 30 min, 5x/wk, 2) ‘insufficient’:	-single assessment at any time during pregnancy	Participation in any leisure activity, recommended activity and insufficient activity lower for pregnant women than for nonpregnant women. Inactivity higher for pregnant women. Prevalence of any	<i>Predictors of any leisure activity:</i> -Education: college+ (OR=3.6), some college (OR= 3.0), high school (OR= 1.3) vs. less than high school. -Younger age: 18-24 (OR=2.3), 25-34 (OR= 1.6) vs. with 35-44. -general health: excellent/very good (OR= 2.4) vs. fair or poor. <i>Predictors of activity meeting guidelines:</i>

randomized telephone survey	-All States, USA	some activity but not meeting guidelines, 3) 'inactive': no leisure activity in past month.	leisure activity: 65.6% for pregnant women, 73.1% for non-pregnant women. 15.8% of pregnant women & 26.1% of non-pregnant women meeting moderate guidelines.	-increased education: college+ (OR=4.8), some college (OR= 3.3), high school (OR= 4.6) vs. less than HS. -Younger age: 18-24 (OR=1.3), 25-34 (OR= 1.2) vs. with 35-44. -general health: excellent/very good (OR=2.3) vs. fair or poor. -marital status: divorced/separated/widowed (OR = 1.5) vs. single/unmarried and married.
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Fell, Joseph, Armson, et al., 2009 [22]	N = 1737 -pregnant women, <20 wks gestation -Halifax, NS, Canada	Prospective cohort study	-maternal age -education -marital status -annual family income -household index score -employment status -occupational index -prepregnancy BMI -smoking status -parity -multiple	Self-report: Kaiser Physical Activity Survey -assessed 4 domains of activity: 1) household and family care activities, 2) occupational activities, 3) active living habits, 4) participation in sports & exercise.	-1 year prepregnancy -first 20 wks of pregnancy	-Sports & exercise index decreased from prepregnancy to pregnancy, <i>M</i> difference = -0.71, <i>p</i> < .05 -71.3% participated in sports & exercise before pregnancy, 47.4% during pregnancy	<i>Predictors of discontinuing sports:</i> -Age <35: 25-34 (OR = 1.2), <25 (OR = 1.3) -Less than University education: Community college/trade school (OR = 1.5), High school (OR = 1.2) -Pregpregnancy BMI: ≥ 30 (OR = 1.3) -Other children: ≥1 (OR = 1.2) -Pregpregnancy physical activity <75 th Percentile (OR = 1.6)
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gestation
 -history of early pregnancy loss, stillbirth, or preterm delivery
 -bleeding during the first trimester
 -prepregnancy PA

Hausenblas & Symons Downs, 2004 [41]	N = 104 -pregnant women, first trimester, -Florida, USA	Prospective cohort study	Theoretical Model: -Theory of Planned Behavior (TPB) Variables: -Intention -Attitude -Perceived Behavioral Control -Subjective Norm	Self-report: -LTPA: Godin and Shephard's 7-day recall	Single assessment during 1 st trimester	Not examined	<i>TPB variables correlated with exercise: Intention (r=.43) and perceived behavioral control r=.49). Variables predicting exercise: Perceived behavioral control (R²=0.25, β = .37, p=.00). Intention was not a significant predictor when regressed together with PBC.</i>
Hausenblas, Symons Downs, Giacobbi, et al., 2008	N = 61 -pregnant women, first and second	Prospective cohort study	Theoretical Model: -Theory of Planned Behavior (TPB)	Prepregnancy: Self-report: -LTPA: Godin and Shephard's 7-day recall	-first trimester (TPB variables & prepregnancy questionnaire) -second trimester (TPB variables)	Not examined	<i>Predictor of exercise behavior: Pre-exercise behavior intention (R²=0.16, p < .001). None of the other variables were significant</i>

[39]	trimester, -Gainesville, Florida, USA		Variables: -Intention -Attitude -Perceived Behavioral Control -Subjective Norm Moderator: Self-report past exercise behavior	During pregnancy: Self-report:non-standard. PA: # times engaging in physical activity per week over the course of each trimester	-second trimester (assessed first trimester behavior) -third trimester (assessed second trimester behavior)		predictors.
Hinton & Olson, 2001 [23]	N = 622 -pregnant women, part of Bassett Mothers' Health Project (BMHP) -rural upstate New York, USA	Prospective cohort study	-age -prepregnancy BMI <i>Psychosocial variables:</i> -attitudes toward weight gain during pregnancy -feelings about motherhood -career role orientation -self-efficacy (food, exercise, & weight control) -locus of control (external and internal)	Self-report: -derived from Godin and Shepherd's 7-day recall. Assessed frequency of engaging in exercise strenuous enough to make one sweat (often/everyday, sometimes, never/rarely) -non-standardized question assessing change in physical activity from prepregnancy to pregnancy (much less active, a little	-once during pregnancy (at any point) -assessed change between prepregnancy and pregnancy using a single item question administered	-39.8% of women decreased their physical activity prepregnancy to pregnancy -20.4% of women increased their physical activity from prepregnancy to pregnancy	<i>Predictors of decreased physical activity compared to prepregnancy:</i> -exercising frequently prior to pregnancy <i>Predictors of increased PA:</i> -Higher prepregnancy BMI ($\beta = 0.01, p = .04$) -older age ($\beta = -0.01, p = .06$) -higher self-efficacy ($\beta = .09, p = .03$)

			-body image -social support	less active, about the same, a little more active, much more active)			
Horns, Ratcliffe, Leggett, et al., 1996 [36]	N = 101 -primiparous pregnant women, 20-30 years of age, no complications, minimum 32 weeks pregnant	Cohort	-weight gain -weeks of gestation -length of labor -common discomforts of pregnancy -occurrence of cesarean section -birth weight -Apgar scores -race -marital status -education -cesarean birth	Self-report: -Investigator developed Physical activity index. Assessed frequency, duration and type (7-day recall). Meeting guidelines defined as 15-30 minutes of moderate to vigorous activity 3 or more times a week.	Single assessment	Not examined	<i>Predictors of meeting guidelines:</i> -more education, $\chi^2 = 12.64$, $p < .01$, Active: 38% with post bachelor's education, sedentary: 9%. -active/sedentary: fewer symptoms: -vaginal discharge (52% vs. 79%, $\chi^2 = 7.15$, $p < .01$) -5 or fewer symptoms ($\chi^2 = 6.15$, $p = .01$)
Mottola & Campbell, 2003 [24]	N = 529 - women, 2 weeks postpartum -London, Ontario, Canada	Prospective cohort	-marital status -age -parity -maternal education -maternal height -weight prior to pregnancy -weight gain during pregnancy -alcohol consumption	Questions adapted from Health and Welfare Canada Survey (1993). Captured frequency, duration, & intensity of activity. Two headings : structured exercise & recreational	Retrospective data for 4 timepoints: (questionnaire completed 2 weeks postpartum) -before pregnancy -1 st trimester -2 nd trimester -3 rd trimester	Prevalence of no structured exercise increased from 30.2% (prepregnancy) to 51.2% (3 rd trimester) Prevalence of no recreational exercise increased from 18.7% (prepregnancy) to	Significant predictors of inactivity by third trimester: -having other children (multiparas) (aOR = 1.54) -having a prepregnancy BMI of ≥ 25 (aOR = 1.79) vs. <21 and 21-24.9 -higher weight gain in pregnancy (aOR = 1.54)

			-smoking -household activities -activities in the workplace -leisure activities -structured exercise routines -BMI	activities		34.2% (3 rd trimester)	-all structured exercise decreased except walking
Mudd, Nechuta, Pivarnik, et al., 2009 [33]	N = 296	Cohort	-age -education -race/ethnicity -income -marital status -parity -trimester of pregnancy -pregnancy length -intention to exercise -perceived safety of moderate PA -perceived safety of vigorous PA	Self report: -physical activity over past month, type, frequency & duration in minutes. Participants divided into: meeting ACOG guidelines (150 min/week of moderate/vigorous PA) vs. not meeting guidelines.	Single measure (M = 11 wks)	88% reported some participation in moderate/vigorous 29% met ACOG guidelines	<i>Determinants of any physical activity during pregnancy:</i> -education OR = 0.4 (< high school) OR = 1.0 (≥ high school) <i>P</i> < .05 -Race/ethnicity OR = 0.3, <i>p</i> < .05 (Hispanic) OR = 1.0 (White) -Income OR = 0.5, <i>p</i> < .05 (<\$25,000) OR = 1.0 (≥\$25,000) -Trimester of Interview: OR = 0.6 (>1 st trimester) OR = 1.0 (1 st trimester) <i>Predictors of feeling unsafe/unsure about vigorous physical activity during pregnancy:</i>

							-Moderate physical activity in past month: OR = 2.0 (No), OR = 1.0 (Yes) - Vigorous physical activity in past month: OR = 2.8 (No), OR = 1.0 (Yes) -ACOG physical activity guidelines: OR = 1.4 (Does not meet), OR = 1.0 (Meets)
Ning, Williams, Dempsey, et al., 2003 [25]	N = 386 -postpartum women who had recently delivered -Washington State, USA	Cohort study	-Prepregnancy BMI -age -race/ethnicity -education -marital status -smoking status -parity -Prepregnancy PA	Self-report: -PA: non-standardized questions regarding intensity, duration, frequency and type of exercise	-general physical activity patterns as a teen (13-18 yrs) -year before pregnancy -first 20 weeks of pregnancy	-Total MET-hours/week decreased from 5.0 (0.2) prepregnancy to 3.3 (0.2) first 20 weeks of pregnancy ($p < .001$) -Hours of exercise/week decreased from 5.1 (0.4) prepregnancy to 1.8 (0.3) first 20 weeks of pregnancy ($p < .001$) -Miles walked decreased from 15.5 (0.9) prepregnancy to	<i>Determinants of any physical activity during pregnancy:</i> -Education: postgraduate (Adj. OR = 3.1); college graduate (Adj. OR = 3.6); some college (Adj. OR = 1.8) vs. high school or less ($p = .008$). -Annual household income: 30,000-49,999 (Adj. OR = 1.5); 50,000-69,999 (Adj. OR = 2.8); $\geq 70,000$ (Adj. OR = 3.3 vs. $< 30,000$ ($p = .002$)) -Race/ethnicity: African American (Adj. OR = 0.6); Other (Adj. OR = 0.4) vs. White ($p = .002$) -Marital Status: Other (Adj. OR = 0.41) vs. Married -Being active year before

14.1 (0.8) first 20 weeks of pregnancy ($p = 0.04$)

pregnancy (Adj. OR = 48.9)
-Being active during teen years (Adj. OR = 4.0)
-First pregnancy (Adj. OR = 1.9) vs. second or subsequent.
-Calories from protein (%): 14.61-16.55 (Adj. OR = 1.7); 16.56-18.32 (Adj. OR = 2.7); > 18.32 (Adj. OR = 3.2) vs. ≤ 14.60 . ($p = .001$)
-Dietary fiber (g): 13.1-19.0 (Adj. OR = 1.6); 19.1-24.0 (Adj. OR = 2.8) vs. ≤ 13.0 , ($p = .051$).

Determinants of High intensity physical activity:
-race/ethnicity: African-American (Adj. OR = 0.4); Other (Adj. OR = 0.3) vs. White ($p = .001$)
-Education: some college (Adj. OR = 2.9); college graduate (Adj. OR = 8.8); postgraduate (Adj. OR = 10.2) vs. high school or less ($p < 0.001$).
-Annual household income: 30,000-49,999 (Adj. OR = 1.5); 50,000-69,999 (Adj. OR = 3.7); $\geq 70,000$ (Adj.

							OR = 4.0) vs. < 30,000 ($p = .008$).
							-Marital status: Other (Adj. OR = 0.4) vs. Married.
							-Active during teen years (Adj. OR = 12.6)
							-Calories from protein (%): 14.61-16.55 (Adj. OR = 1.8); 16.56-18.32 (Adj. OR = 3.2); 16.56-18.32 (Adj. OR = 3.9) vs. ≤ 14.60 , ($p < .001$).
Pereira, Rifas-Shiman, Kleinman, et al., 2007 [26]	N = 1442 - pregnant women -Boston, Mass.	Cohort study	-Age -Race/ethnicity -Prepregnancy BMI -Prepregnancy PA -depression during pregnancy -marital status -education -income -employment in early pregnancy -employment change during pregnancy -number of children -nausea and	Modified Physical Activity Scale for the Elderly	- Retrospective data for 12 months prior to pregnancy - 2 nd trimester physical activity behavior (completed between 26-28 wks) - 6 months postpartum	Prevalence of insufficiently active lifestyle increased from 12.6% prepregnancy to 21.6% during pregnancy (Insufficient activity defined as less than 150 min/week)	<i>Significant predictors of inactivity:</i> -Total prepregnancy physical activity (each increment of 1 hour): (aOR = 0.86) -at least one child in the home (aOR = 1.58) -vomiting frequency (total during pregnancy): 1-2 (aOR = 1.04); 3-10 (aOR = 0.82); 11-20 (aOR = 0.59); 20+ (aOR = 0.55) vs. 0.

vomiting during pregnancy

<p>Petersen, Leet, & Brownson, 2005 [32]</p>	<p>N = 150,256 n = 6,528 pregnant, n = 143, 731 non-pregnant women (18-44 yrs of age) from 1994, 1996, 1998 & 2000 Behavioral Risk Factor Surveillance System (BRFSS) -USA</p>	<p>Population-based, cross-sectional</p>	<p>-age -race -education -employment -income -marital status -smoking status</p>	<p>Self-report: -PA: average frequency, duration and type of physical activity in past month</p>	<p>-single assessment, telephone interview</p>	<p>-1994: 11% of pregnant women, 11% of non-pregnant meeting moderate guidelines; 9% of pregnant, 17% of non-pregnant meeting vigorous guidelines; 35% of pregnant, 25% of non-pregnant women inactive -SIMILAR DATA AVAILABLE FOR 1996, 1998, 2000.</p>	<p><i>Predictors for meeting moderate or vigorous activity recommendation:</i> -Age: 25-29 (aPOR = .64), 30-34 (aPOR = 0.50), 35-44 (aPOR = 0.39) vs. 18-24. -Race: Non-Hispanic black (aPOR = 0.42), Asian/Pacific islander (aPOR = 0.46), American native (aPOR = 0.85), Hispanic (aPOR = 0.63) vs. Non-Hispanic White. -Education (yr): 12 (aPOR = 1.99), >12 (aPOR = 4.43) vs. < 12. -Employment: Not employed/student (aPOR = 1.18, Homemaker (aPOR = 1.01) vs. Employed. -Income \$20,000-\$34,999 (aPOR = 1.59), \$35,000-\$49,999 (aPOR = 2.39), \$50,000-\$74,999 (aPOR = 3.01, ≥ \$75,000 (aPOR = 5.10). -Marital Status: Not married</p>
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							(aPOR = 0.55) vs. Married. -Smoking status: Former (aPOR = 2.11), Never (aPOR = 1.67) vs. Current.
Rose, Haddow, Palomaki, et al., 1991 [35]	N = 21,342 -pregnant women, 2 nd trimester, recruited through MFAS screening clinic -Maine, USA	Cohort study	-age -current height -current weight -race -date of last menstrual period -gravidity -vaginal bleeding with present pregnancy -number of cigarettes smoked per day -years of completed education	Self-report: -Single item, non-standard. Asked women to rate their usually physical activity levels as: light, moderate, or vigorous.	Single time point assessed.	N/A	Predictors of vigorous activity: -greater age (M age = 27.7 yrs for light, 25.5 yrs for Moderate, 26.6 yrs for Vigorous), $p < .001$ -greater education: Complete years (M = 13.0 for Light, 13.0 for moderate, 13.5 for vigorous), $p < .001$ -lower weight (M = 150 lbs for light, 146 lbs for moderate, 140 lbs for vigorous), $p < .001$ -more vaginal bleeding(result of or predictor) %: 12.8 for light, 10.6 for moderate, 14.2 for vigorous, $p < .001$
Rutkowska & Lepecka-Klusek, 2002 [27]	N = 266 -pregnant women, third trimester -Southeast Poland	Cross-sectional	-age -education -site of living (country vs. city) -parity	Self-report: -PA: non-standardized, single item assessing involvement in 'active recreation' and 'passive recreation'	-retrospective data collected during 3 rd trimester for prepregnancy -during pregnancy, assessment during 3 rd trimester	-Participation in active recreation decreased from 69.9% before pregnancy to 42.1% from prepregnancy to 3 rd trimester	Predictors of being active during pregnancy: -Age: $\leq 29/30+$ (34.4% vs. 61.3%, $p < .001$) -Education: primary or technical/secondary or university (37.0% vs. 45.2%) -Site of living: Country/City

				prepregnancy and during pregnancy			(21.8% vs. 56.4%) -Parity: Primipara/Multipara (68.8% vs. 17.4%)
Symons Downs & Hausenblas, 2003 [42]	N = 89 -pregnant women -Florida, USA	Prospective cohort study	-Attitude (TPB) -Subjective norm (TPB) -Perceived behavioral control (TPB) -intention	Self-report: -non-standardized single item question regarding weekly frequency of participation in minimum 20min of moderate or strenuous PA.	-1 st trimester PA -2 nd trimester PA	Not examined	<i>Relationship of TPB variables and exercise:</i> -Intention ($r = .67, p < .01$) -PBC ($r = .49, p < .01$) Predictors of higher 2nd trimester PA: -Intention $R^2 = 0.47, p < .01$.
Symons Downs & Hausenblas, 2004 [28]	N = 74 -postpartum women within 1 year of child's birth -New Britain, Connecticut, USA	Retrospective cohort study	Open-ended questions to assess: -behavioral beliefs assessing advantages of exercise -normative beliefs eliciting important others -control beliefs obstructing exercise	Self-report: -Godin and Shephard's 7-day recall	-prepregnancy -pregnancy -postpartum	Exercise decreased during pregnancy: Strenuous: prepregnancy higher than pregnancy, $L(3) = 19.44, p < .001$. (METs), $M(SD) = 13.81(16.39), 3.38(9.45), p < .001, \eta^2 = .54$. Moderate ES. Moderate: prepregnancy higher than pregnancy, $L(3) = 14.25, p < .01$. (METs), $M(SD) =$	Salient behavioral beliefs: -improves mood (33.8%) -increases energy/stamina (29.7%) -assists with staying fit (21.6%) -controls weight (18.9%) Normative beliefs (Influences): -Husband or fiancé (26.5%) -Children (17.6%) -Other family members (14.9%) -Friends (12.2%) Control beliefs (obstructing factors) -Physical limitations/nausea (56.8%) -Tiredness and fatigue

						13.07 (10.02), (27.0%) 8.10 (8.54), $p < .01$, $\eta^2 = .41$. Small- moderate ES. Mild: prepregnancy higher than pregnancy $L(3) =$ 10.64, $p < .05$. (METs), $M(SD) =$ 9.57 (7.50), 7.20 (6.72), $p < .05$, $\eta^2 =$.32. Small- Medium ES.	-Time limits (25.7%) -Gaining weight (13.5%)
Symons Downs & Hausenblas, 2007 [43]	N = 62 -pregnant women in third trimester	Prospective cohort study	Theoretical Model: -Theory of Planned Behavior (TPB) Variables: -Intention -Attitude -Behavioral beliefs about exercise benefits -Normative Beliefs -Control beliefs -Perceived Behavioral Control -Subjective	Self-report:non- standard. PA: # times engaging in physical activity per week in moderate or vigorous exercise over the course of third trimester (Completed 6wks postpartum)	Single assessment – only third trimester PA	Not assessed	<i>Correlations of beliefs with behavior:</i> Behavioral beliefs: -Improve overall mood ($r = 0.29$, $p < .05$) -Increase energy/stamina ($r = 0.36$, $p < .001$) -Assist in my labor/delivery ($r = 0.41$, $p < .001$) -Keep fit ($r = 0.32$, $p < .05$) -Keep weight in check ($r = 0.26$, $p < .05$) -Provide stress relief ($r = 0.32$, $p < .05$) Normative beliefs: -Husband/partner/fiancée ($r = 0.44$, $p < .001$) -Friends ($r = 0.40$, $p < .001$)

			Norm -BMI				-Children ($r = 0.43, p < .001$) -Other family members ($r = 0.10, p < .001$) -Doctors ($r = 0.44, p < .001$) -Nurses ($r = 0.46, p < .001$) <i>Predictors of exercise behavior:</i> -Intention ($R^2 = .24, p < .001$) <i>Exercising vs. Non-exercising pregnant women:</i> -Intention ($F(8, 43) = 16.55, p = .00$) -Attitude ($F(8, 43) = 11.76, p = .01$) -Subjective norm ($F(8, 43) = 20.59, p = .00$) -Perceived behavioral control ($F(8, 43) = 14.53, p = .00$) -Behavioral beliefs ($F(8, 43) = 11.44, p = .01$) - Normative beliefs ($F(8, 43) = 23.15, p = .00$)
Wallace, Boyer, Dan, et al., 1986 [29]	N = 53 n = 31 (exercising) n = 22 (nonexercising) -pregnant (min 27wks)	Preexperimental using “non-equivalent control group posttest only”	-Physical discomfort checklist (29 symptoms) -Global self-esteem (Rosenberg Self-Esteem	Self-report. Not described. -Exercisers: aerobic for at least 20 minutes, min 2x/wk	-prepregnancy -pregnancy	Changes in exercise patterns from prepregnancy to pregnancy: -33.3% increased -46.7% decreased -20% remained	<i>Predictors of exercise:</i> Exercisers/control group: -Education, college degree or more (80.6% vs 40.9%) -Income, \$30,000+ (80.7% vs. 35.8%) -Occupation, 41.9% of exercisers were

-Chicago,
Illinois, USA

Scale)
-Education
-Occupation

the same

professionals vs. 22.7% who
were non-professionals
-lower self-esteem, $p = .026$
-Exercisers/control group:
-Significantly fewer
symptoms, First trimester
 $M(SD) = 19.4(9.7)$,
 $28.4(9.1)$, $p = .05$; Second
trimester $M(SD) =$
 $21.1(8.7)$, $32.6(9.8)$, $p =$
.001, third trimester $M(SD)$
 $= 28.1(8.6)$, $38.9(13.6)$, $p =$
.018; Total pregnancy,
 $M(SD) = 68.2(23.8)$,
 $96.6(30.2)$.

Specific symptoms,
exercisers/control group:

Shortness of breath, ($M =$
 2.94 vs. 4.57 , $p = .01$),
Fatigue ($M = 4.61$ vs. 6.76 ,
 $p = .00$), Backache ($M =$
 3.14 vs. 4.52), Headache,
($M = 2.17$ vs. 3.76 , $p = .02$),
Hot flashes ($M = 1.80$ vs.
 3.62 , $p = .02$)

Watson & McDonald, 2007 [18]	N = 197 -Pregnant women	Prospective cohort study	-SES (welfare, low, high) -age -smoking status	Self-report: 3-day minute by minute 24 h diaries and	-beginning of 4 th month of pregnancy -beginning of 7 th month of pregnancy	- Median METs declined from 4 th to 7 th month in all SES groups:	Predictors of greater physical activity: -SES – low 35% more active than welfare and
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-New Zealand	-number of pregnancies -number of children in household -yeast of post-primary education -body mass -body height -BMI -presence of other adults in home (grandparents) -general health throughout day	structured interview (4 th and 7 th month) Total mean daily activity levels in METs was calculated from this information	-2 months postpartum	High/low/welfare (2.1%, 1.7%, 4.7%). Welfare vs. Low, $p = 0.013$.	welfare 19% less than high in the 4 th ($p = 0.022$) and 7 th ($p = 0.007$). -having other children in household (7.4% higher in 4 th month, $p = 0.001$; 4.3% higher in 7 th month, $p = 0.021$) as compared to women with no children in the house. - -Well-being: 7 th months feeling well/not tired ($M = 1.91$ METs vs. 1.81 METs, $p = 0.027$); 4 th month feeling tired/not tired ($M = 1.92$ METs vs. 1.99 , $p = 0.048$). Feeling depressed/not depressed ($M = 1.71$ METs vs. 1.89 METs, $p = 0.048$). -increased gestational age ($p = 0.047$)
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Zhang & Savitz, 1996 [30]	N = 9953 - postpartum women ($M = 17$ months postpartum) -1988 National	Cross-sectional survey	-Place of residence -Race -Occupation -Age -Parity -Ponderal Index -History of	Self-report: -PA: non-standardized questions regarding intensity, duration, frequency and	-prepregnancy: meeting guidelines (yes/no) -during pregnancy (meeting guidelines, yes/no, number of months during pregnancy to meet guidelines, types of exercise performed	-45% of women did not exercise before or during pregnancy -13% exercised before but stopped when they found out they were	<i>Predictors of higher exercise during pregnancy:</i> -Residence: Middle Atlantic (Adj. OR = 0.7), South Atlantic (Adj. OR = 0.9); Northeast Central (Adj. OR = 0.7); Northwest Central (Adj. OR = 0.8); Southeast
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Maternal and
Infant Health
Survey
-48 states,
USA/

previous still
birth
-History of
previous
miscarriage
-Plurality

type of exercise
during a typical
week.
-4 items

during pregnancy).

pregnant
-7% did not
exercise before
pregnancy but
exercised during
pregnancy
-35% exercise
before and during
pregnancy
-Overall, 42% of
women reported
exercising during
pregnany

Central (Adj. OR = 1.0);
Southwest Central (Adj. OR
= 0.8); Mountain (Adj. OR
= 1.0); Pacific (Adj. OR =
1.0) vs. New England (Ref.)
-Race: Black (Adj. OR =
1.1); Asian (Adj. OR = 0.5);
Other (Adj. OR =1.3); vs.
White.
-Occupation: Technical and
administrative (Adj. OR
=0.9); Service (Adj. OR
=1.0); Farming, Fishing
(Adj. OR =1.7); Craft,
repair (Adj. OR =1.3);
Operator, labor (Adj. OR
=0.8); Armed force (Adj.
OR =1.4) vs. Managerial
and professional.
-Age: 20-24 (Adj. OR
=0.8); 25-29 (Adj. OR
=0.8); 30-34 (Adj. OR
=0.7); 35+ (Adj. OR =0.7)
vs. < 20.
-Parity: Primiparous (Adj.
OR =1.6) vs. Multiparous.
-Ponderal Index: ≥ 3.6 (Adj.
OR =0.8) vs. < 3.6.
-History of previous still
birth: Yes (Adj. OR = 0.8)
vs. No.
-History of previous

miscarriage: Yes (Adj. OR
= 0.9) vs. No.

-Plurality: Multiple (Adj.
OR = 0.8) vs. Singleton.

Note. ACOG = American College of Obstetricians and Gynecologists; BMI = Body mass index; LTPA = Leisure time physical activity; METs = Metabolic equivalent of task; OR = Odds ratio; PA = Physical activity; SES = Socioeconomic status.