

Physical Activity Beliefs, Barriers, and Enablers among Postpartum Women

Kelly R. Evenson, Ph.D.,¹ Semra A. Aytur, Ph.D.,¹ and Katja Borodulin, Ph.D.,^{1,2}

Abstract

Background and Methods: Physical activity during postpartum is both a recommended and an essential contributor to maternal health. Understanding the beliefs, barriers, and enablers regarding physical activity during the postpartum period can more effectively tailor physical activity interventions. The objective of this study was to document self-reported beliefs, barriers, and enablers to physical activity among a cohort of women queried at 3 and 12 months postpartum. Five questions about beliefs and two open-ended questions about their main barriers and enablers regarding physical activity and exercise were asked of 667 women at 3 months postpartum. Among the sample, 530 women answered the same questions about barriers and enablers to physical activity at 12 months postpartum.

Results: Agreement on all five beliefs statements was high ($\geq 89\%$), indicating that women thought that exercise and physical activity were appropriate at 3 months postpartum, even if they continued to breastfeed. For the cohort, the most common barriers to physical activity at both 3 and 12 months postpartum were lack of time (47% and 51%, respectively) and issues with child care (26% and 22%, respectively). No barrier changed by more than 5% from 3 to 12 months postpartum. For the cohort, the most common enablers at 3 months postpartum were partner support (16%) and desire to feel better (14%). From 3 to 12 months postpartum, only one enabler changed by $>5\%$; women reported baby reasons (e.g., baby older, healthier, not breastfeeding, more active) more often at 12 months than at 3 months postpartum (32% vs. 10%). Environmental/policy and organizational barriers and enablers were reported less often than intrapersonal or interpersonal barriers at both time points.

Conclusions: A number of barriers and enablers were identified for physical activity, most of which were consistent at 3 and 12 months postpartum. This study provides information to create more successful interventions to help women be physically active postpartum.

Introduction

FOR ADULTS, AT LEAST 30 MINUTES of moderate intensity physical activity is recommended on most, if not all, days of the week,¹⁻⁴ and greater health benefits are noted for those who include more vigorous intensity or longer duration of physical activity.³ Physical activity throughout the postpartum period (1 year following birth of the baby) is particularly important to the mother's health, as pregnancy is a time when the risk of becoming overweight or obese is high.^{5,6} The postpartum period may also be a time when women not only retain gestational weight but also gain additional weight.⁷ Exercise and diet together may be more effective than diet alone in helping women lose weight after childbirth.⁸ A return to physical activity after pregnancy is also associated with

other positive health benefits, including improved psychosocial well-being, less anxiety and depression, improved cardiovascular fitness, less lactation-induced bone loss, and less urinary stress incontinence.^{7,9,10}

Although there are general guidelines for physical activity during pregnancy from the American College of Obstetricians and Gynecologists (ACOG),¹¹ they lack specificity for physical activity during the postpartum period. The current ACOG guidelines for pregnant and postpartum women, published in 2002, state that prepregnancy exercise routines may be resumed gradually after giving birth, as soon as it is medically and physically safe to do so.¹¹ The guidelines note that many of the physiological and morphological changes of pregnancy persist 4-6 weeks postpartum but do not provide any other specific information. In 2008, the Physical Activity Guidelines

¹Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina-Chapel Hill, Chapel Hill, North Carolina.

²National Public Health Institute, Department of Health Promotion and Chronic Disease Prevention, Helsinki, Finland.

for Americans was released, which included a recommendation for healthy pregnant and postpartum women of at least 150 minutes of moderate intensity aerobic activity spread throughout the week.⁴ Others have tried to provide more detailed physical activity recommendations for postpartum women.¹² However, the lack of clarity may lead to inconsistent or inaccurate recommendations made by health practitioners to mothers.

Even though physical activity is recommended during the postpartum period, several studies indicate that women often are not meeting these recommendations. Most of the prospective and retrospective studies report generally decreasing levels of physical activity in late pregnancy compared with the levels either before pregnancy^{13–16} or in early pregnancy.^{17–19} The findings on change in physical activity from prepregnancy or pregnancy to postpartum are more diverse, as some studies have found higher activity levels at postpartum, and others report decreased or unchanged levels during this period.^{15,20–24} These findings may be explained by different physical activity measurement methods, measurement time points, and recall periods.

Promotion of physical activity during the postpartum period is important,¹² but data are lacking on the beliefs women have about physical activity postpartum and the common barriers and enablers to their behavior during this period. Barriers and enablers to physical activity may change during the course of the postpartum period. Few intervention studies have focused on increasing physical activity postpartum, and none have explored mediators of successful change in activity.^{25,26} Thus, the purpose of this article was to better understand the beliefs, barriers, and enablers to physical activity among 3 and 12 month postpartum women to better inform interventions during this critical time period. We used a socioecological perspective to more clearly understand the barriers and enablers to physical activity, according to various dimensions: (1) intrapersonal, (2) interpersonal, (3) neighborhood or environmental, and (4) organizational and policy factors.^{27,28}

Materials and Methods

Study

The third phase of the Pregnancy, Infection, and Nutrition (PIN3) Study recruited pregnant women at <20 weeks' gestation seeking prenatal care at clinics associated with the University of North Carolina Hospitals. Trained staff identified women through review of all medical charts of new prenatal patients. Women were not enrolled if they were non-English speaking, <16 years of age, carrying multiple gestations, not planning to continue care or deliver at the study hospital, or did not have a telephone from which they could complete the telephone interviews. Recruitment began in January 2001 and continued through 2005, with the last birth occurring in December 2005. During this time, 3203 women were eligible for the study, 2006 were successfully recruited, and 1868 delivered at the University of North Carolina Hospital. The PIN3 Postpartum Study extended the PIN3 Study by adding data collection for a subset of study participants during the postpartum period. The study website (www.cpc.unc.edu/pin) provides greater detail on the protocols and measures. All data collection described herein was approved by the University of North Carolina–Chapel Hill Institutional

Review Board, and each participant provided informed consent prior to participation in the studies.

Self-reported measures on beliefs, barriers, and enablers to physical activity

During the 3-month postpartum home interview, women were asked whether they strongly agreed, agreed, disagreed, or strongly disagreed with five questions about their beliefs about exercise and physical activity. The belief statements were developed to ask questions regarding current U.S. guidelines for physical activity among postpartum women.¹¹ The response options were collapsed from four categories to two categories (e.g., agree or disagree) for analysis.

During both the 3-month and 12-month postpartum home interviews, women were asked two open-ended questions about barriers and enablers to physical activity. The barrier question asked: Since delivery, what is the one main reason that makes it harder for you to be more active, either during work or nonworking time? The enabler question asked: What is the one main reason that helps you to be more active since delivery, either during work or nonworking time? Responses were coded by two investigators, and any discrepancies were resolved by consensus. These items were then grouped into meaningful categories considering the socioecological framework, with intrapersonal, interpersonal, neighborhood or environmental, and organizational or policy categories. Several responses, particularly child care issues, could be assigned to more than one domain and were grouped under multiple domains. Some women provided more than one answer, so responses were not mutually exclusive.

Physical activity measure

At the time PIN3 began, there were no physical activity questionnaires tailored to pregnant women, and a 1-week recall questionnaire was developed to be used consecutively during pregnancy and the postpartum period. The questionnaire was interviewer administered and designed to capture moderate and vigorous activity in the past week.^{17,29} The questionnaire assessed frequency and duration of all moderate and vigorous physical activities the woman participated in, including activity done at work, at leisure, for transportation, child care, adult care, and both indoor and outdoor household activities. Intensity of activity was assessed (1) using a modified Borg scale³⁰ to capture the participant's perception of intensity and (2) using published metabolic equivalent (MET) tables.^{31,32} This physical activity questionnaire provided an estimate of (1) the total number of hours in the past week of moderate and vigorous physical activity, based on their perceived intensity of the activity, and (2) the total number of MET-hours per week spent in physical activity, based on established MET intensities. The questionnaire also provided information by mode (e.g., leisure, work, outdoor/indoor household, child/adult care, and transportation activity), for specific activities or groups of activities (e.g., walking, outdoor activities), and by intensity (e.g., moderate, vigorous). This questionnaire was collected at both the 3-month and 12-month postpartum in-home interviews, but only the 3-month results were used for these analyses. Women were also given a take-home questionnaire at 24–29 weeks' gestation that included questions about regular exer-

cise 3 months before pregnancy and during the first and second trimester.

Other measures

Women were asked about their race/ethnicity, education, and parity (live plus stillbirths) during pregnancy. At the 3-month postpartum in-home interview, women were asked to report their work status, marital status, and breastfeeding. Marital status was grouped into partnered (married or living with partner) or not partnered. Breastfeeding was grouped into three categories: currently, past but stopped, and never breastfed. Women were also asked: At any time since delivery, has a doctor, nurse, or other health professional or have family members or friends given you advice about physical activity or exercise? Responses were grouped as affirmative or not, separately for doctor, nurse, or other health professional compared with nonhealth professionals, such as family, friends, or the internet. Weight and height were measured at the 3-month postpartum in-home visit for determination of body mass index (BMI). BMI values were grouped into low ($<18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}25.0 \text{ kg/m}^2$), overweight ($25.0\text{--}30.0 \text{ kg/m}^2$), and obese ($\geq 30.0 \text{ kg/m}^2$).³³

Other covariates measured during pregnancy were included in order to assess selection bias of our sample. These measures included working status, general health, and the following health-related conditions: depressive symptoms, gestational diabetes, chronic hypertension, pregnancy-induced hypertension, preeclampsia, and preterm birth. An explanation for how these variables were assessed is available at the study website (www.cpc.unc.edu/pin) and elsewhere.³⁴

Statistical analysis

Women available for recruitment into the postpartum study ($n = 1169$) included those enrolled in PIN3 who delivered liveborn infants between October 2002 and December 2005 and who lived in the study's catchment area (required for home visits). A total of 231 women were excluded for the following reasons: 24 had medical constraints, 153 were unreachable, and 54 were >5 months postpartum by the time we located them. Of the 938 women who were asked to participate, 688 (73.3%) agreed to participate and complete a 3-month interview in their homes. We compared those who participated in the 3-month interview with those who did not on a variety of measures using chi-square statistics.

Beliefs were reported overall and explored by covariates using a chi-square test statistic or Fisher's exact test when sample strata were small. We used unconditional logistic regression to explore if any covariates remained significant in models predicting whether or not a woman disagreed with each of the five belief statements. Covariates considered included age (continuous), race/ethnic group (non-Hispanic white, other), education (≤ 15 , ≥ 16 years), BMI (low or normal, overweight, obese), parity (0, 1 or more), partnered (yes or no), working status (yes or no), breastfeeding at 3 months postpartum (yes, yes but not currently, or no), advice on physical activity from health professional (yes or no), advice on physical activity from friends or family members (yes or no), year of the interview (2003–2004 or 2005–2006), and total hours per week in physical activity (tertiles).

Binomial regression models with generalized estimating equations for repeated count measures were used to test

whether the percent reporting barriers and enablers was different between 3 months and 12 months postpartum, with compound symmetry as the working correlation structure.³⁵ All statistical analyses were conducted using SAS version 9.1.3 (Cary, NC).

Results

Description of sample

For the PIN3 Postpartum Study, 688 pregnant women enrolled. Among these women, 21 were excluded because they were in the PIN Study for more than one pregnancy, leaving 667 women for these analyses at 3 months postpartum. From 3 to 12 months postpartum, 137 either dropped out of the study or were ineligible (45 became pregnant, 72 were unreachable or moved out of the area, 8 requested to leave the study, and 12 had other reasons, e.g., medical issues, unsafe environment for staff, outside of time window), leaving 530 women for analysis at 12 months postpartum.

Among the 2006 women recruited into the study, we compared women who completed the 3-month postpartum visit and were included in our analyses ($n = 667$) with women who did not complete the 3-month postpartum visit but were eligible for recruitment ($n = 485$, excluding 17 women who enrolled a second or third time into the cohort). Using the chi-square statistic ($p < 0.05$), women who were included in the 3-month analyses were more likely to be married, to be non-Hispanic white, to have completed college, to not report depressive symptoms, and to have reported excellent general health compared with those not in the analyses. They were also more likely to report any regular exercise 3 months before pregnancy. There were no differences found ($p > 0.05$) in the following characteristics assessed during pregnancy: age, parity, work status during pregnancy, gestational diabetes, chronic hypertension, pregnancy-induced hypertension, preeclampsia, and preterm birth. There were also no differences in percent reporting any regular exercise during the first and second trimesters of pregnancy.

Almost 72% of the postpartum participants were between the ages of 20 and 34 years, and 75% reported a race/ethnicity of non-Hispanic white (Table 1). Most were partnered (91%), 52% were working, 65% were college graduates, and 50% of the women reported that this was their first live birth. Twenty-seven percent were overweight, and another 26% were obese. At 3 months postpartum, 64% of the women were still breastfeeding, and 27% had stopped breastfeeding. Thirty-six percent of the women reported having received advice on physical activity or exercise during the 3 months since having the baby. Specifically, 18% of women reported receiving advice from a health professional, 14% reported receiving advice from family, friends, or the internet, and 4% reported receiving advice from both sources.

On average, women reported a median of 1.5 hours of moderate to vigorous physical activity in the past week at 3 months postpartum (interquartile range 0.0–4.5) and 1.6 hours at 12 months postpartum (interquartile range 0.0–4.0). These activities included any type of physical activity (e.g., occupational, recreational, transportation, child and adult care, indoor household and outdoor household activity) that increased breathing and heart rate and were perceived as somewhat hard or hard/very hard.

TABLE 1. DESCRIPTIVE CHARACTERISTICS OF STUDY PARTICIPANTS AT 3 MONTHS POSTPARTUM

Characteristic	n = 667	%
Mother's age in years		
<20	19	2.9
20–<35	477	71.5
≥35	171	25.6
Partnered		
Not partnered	62	9.3
Partnered	605	90.7
Race/ethnicity		
Non-Hispanic white	499	75.0
Non-Hispanic black	99	14.9
Other	67	10.1
Education (years)		
Less than or equal to high school graduate/GED (≤12)	117	17.5
Some technical school/college (13–15)	115	17.2
College graduate (16+)	435	65.2
BMI (kg/m ²)		
Low (<18.5)	3	0.5
Normal (18.5–<25.0)	312	46.9
Overweight (25.0–<30.0)	181	27.2
Obese (≥30.0)	170	25.5
Parity reported during pregnancy		
0	334	50.1
1	224	33.6
2	75	11.2
3+	34	5.1
Working status		
No	319	47.8
Yes	348	52.2
Breastfeeding		
Yes, currently	427	64.0
Yes, had breastfeed but stopped	179	26.8
Never	61	9.2
Any advice received on physical activity or exercise postpartum		
No	425	63.7
Yes	242	36.3

Beliefs

Table 2 provides the five belief statements verbatim that were asked at the 3-month postpartum visit. Approximately 89% of the women agreed that at 3 months postpartum, most women could continue or resume their regular exercise routine, and 92% agreed that for those who had never exercised, they could begin. More than 95% of the women agreed that it was acceptable for 3-month postpartum women to increase physical activity or exercise and that participating in activity might make women feel more energetic. Almost all women also agreed that it was acceptable to participate in regular exercise or activity while breastfeeding (99%) and that exercise might make a woman feel more energetic (98%).

We further explored whether women agreed with the statement that it is acceptable to increase physical activity or exercise at 3 months postpartum. Indeed, 3.8% (total $n = 635$) of women who agreed with this statement increased their total hours of moderate to vigorous physical activity at least a 1 standard deviation (SD) (at least 7.8 hours/week) from 3 to 12 months postpartum, and no women who disagreed with this statement increased their activity by this amount

(total $n = 32$). The differences were minimized when comparing women who increased their moderate to vigorous MET-hours per week by at least 1 SD (at least 21.7 MET-hours per week) from 3 to 12 months postpartum (1.2% vs. 0%).

We explored whether agreement with these five belief statements differed by physical activity (data not shown). For all five questions, no differences were found by either total activity or recreational activity based on tertiles of hours per week or MET-hours per week. The percent who agreed with each of the five statements was higher among non-Hispanic whites compared with non-Hispanic black participants (Table 2), with three statements reaching statistical significance (acceptable to increase physical activity or exercise, physical activity or exercise might make a woman feel more energetic, acceptable to continue physical activity or exercise when breastfeeding). For four of the five belief statements, the proportion of agreement was higher across each higher level of education and reached statistical significance (the exception was the statement that most women who have never exercised can begin an exercise program).

Logistic regression models were used to explore whether any covariates of interest predicted disagreement with each of the statements. The final model predicting beliefs about exercise while breastfeeding had convergence problems because small cell sizes and, thus, is not reported. For each of the other four belief statements, the covariates (age, race/ethnic group, education, BMI, parity, partnered, working status, breastfeeding, advice on physical activity by professional, advice on physical activity from friends or family members, year, and total hours per week in physical activity) were not associated with disagreeing with any of the statements, with a few exceptions reported at $p < 0.05$. Participants interviewed in 2005–2006 were more likely to disagree that at 3 months postpartum, women who had never exercised could begin an exercise program as compared with women enrolled interviewed in 2003–2004 (OR = 2.59, 95% CI 1.46–4.62). Participants who received health professional advice on physical activity during the postpartum period were less likely to disagree that it was acceptable to increase physical activity or exercise compared with those who had not received advice from health professionals (OR = 0.23, 95% CI 0.05–0.98). Participants who were working were less likely than women who were not working to disagree that at postpartum, physical activity or exercise might make a woman feel more energetic (OR = 0.25, 95% CI 0.07–0.92).

Barriers and enablers to physical activity

The barriers and enablers to activity that women reported at 3 and 12 months postpartum are reported in Table 3 and 4, respectively. The information on those who answered the questions at both 3 and 12 months postpartum is presented as a cohort to explore changes over time among the same women. Intrapersonal barriers were most common at both 3 and 12 months postpartum, reported by almost three fourths of the sample at both times. The most common barrier for the cohort at both the 3 month and 12-month time periods was lack of time (47% and 51%, respectively), followed by issues with child care (26% and 22%, respectively). No barrier changed by >5% (calculated by subtracting the 3-month percent from the 12-month percent). Environmental/neighborhood and organizational/policy barriers were reported less often.

TABLE 2. BELIEFS ABOUT EXERCISE DURING POSTPARTUM PERIOD, OVERALL AND BY RACE/ETHNICITY AND EDUCATION

Belief statement (Verbatim)	Race/ethnicity			Education, years			p value
	Overall n = 667 % Agree (n)	Non-hispanic white n = 499 % Agree (n)	Non-hispanic black n = 99 % Agree (n)	≤12 n = 117 % Agree (n)	13-15 n = 115 % Agree (n)	16+ n = 435 % Agree (n)	
At 3 months postpartum, most women can continue or resume their regular exercise routine.	88.9 (593)	89.1 (445)	83.8 (83)	80.3 (94)	89.6 (103)	91.0 (396)	0.005
At 3 months postpartum, most women who have never exercised can begin an exercise program.	91.5 (610)	92.2 (460)	87.9 (87)	93.2 (109)	90.4 (104)	91.3 (397)	0.74
At 3 months postpartum, it is ok to increase physical activity or exercise.	95.2 (635)	96.4 (481)	90.9 (90)	89.7 (105)	94.8 (109)	96.8 (421)	0.007
At 3 months postpartum, physical activity and exercise might make a woman feel more energetic.	97.9 (653)	98.8 (493)	92.9 (92)	94.0 (110)	97.4 (112)	99.1 (431)	0.003 ^a
It is ok to continue regular exercise or physical activity even if a woman is still breastfeeding her baby.	98.5 (654)	99.2 (494)	94.9 (93)	93.9 (107)	97.4 (112)	100.0 (435)	<0.0001 ^a

^ap values are from Fisher's exact test rather than the Pearson chi-square statistic because of small cell sizes.

Intrapersonal enablers were also most commonly reported among the cohort (58% at 3 months postpartum and 67% at 12 months postpartum). The most common enablers at 3 months postpartum were support of partner (15%) and to feel better (13%). For the cohort, only one enabler changed by >5%. Women reported baby reasons that affected the mother (e.g., baby older, healthier, not breastfeeding, more active) more often at 12 months than at 3 months postpartum (32% vs. 10%). Environmental/neighborhood and organizational/policy enablers were reported less often.

Discussion

This study explored the beliefs, barriers, and enablers to physical activity during postpartum.

Beliefs about physical activity

Generally, most postpartum women agreed with several statements about being able to continue, resume, or increase physical activity or exercise. The differences in beliefs by race/ethnicity and education level in the categorical analysis were not evident in the multivariate models. The multivariable models demonstrated only a few variables (e.g., health professional advice on physical activity, working status, and survey year) for which some differences were identified. Participants who received health professional advice on physical activity during the postpartum period were much more likely to agree that it was acceptable to increase physical activity or exercise compared with those who had not received advice. This highlights the role of the health professional during the requisite postpartum visit and emphasizes the importance of including physical activity guidance in the discussion. Interestingly, advice from friends and family members was not associated with any of the belief statements. In addition, women who were working were more likely than women who were not working to agree that at postpartum, physical activity or exercise might make a woman feel more energetic. Interestingly, women working at 3 months postpartum reported a lower median moderate to vigorous physical activity compared with their nonworking peers (1.3 vs. 1.8 hours in the past week).

Although another study indicated that most women may be unaware of the benefits of regular exercise in the postpartum period,³⁶ we found that when directly asked, most women agreed that physical activity might make a postpartum woman feel more energetic, especially among working women. Even so, some evidence indicates that most women do not receive enough information about lifestyle behaviors postpartum from their healthcare provider, with women reporting a desire for more information about exercise.^{37,38} With the lack of information, women may not be resuming physical activity at an appropriate time.

The U.S. Department of Health and Human Services dietary guidelines, which were released toward the end of our data collection period, state that neither acute nor regular exercise adversely affects the mother's ability to successfully breastfeed.³⁹ We found that most women agreed that it was acceptable to participate in regular exercise or activity while breastfeeding. The benefits of breastfeeding are widely recognized,⁴⁰ and although it is encouraging that such a high percentage of women agreed that it was acceptable to continue exercise, a notable 6% of women with less than a high

TABLE 3. BARRIERS TO PHYSICAL ACTIVITY REPORTED BY WOMEN AT 3 AND 12 MONTHS POSTPARTUM, GROUPED BY THE SOCIOECOLOGICAL FRAMEWORK^a

Barrier	Cohort						p value ^b
	3 months postpartum		3 months postpartum		12 months postpartum		
	n = 667	%	n = 530	%	n = 530	%	
Domains							
Intrapersonal	503	75.4	396	74.7	400	75.5	0.76
Interpersonal	27	4.1	21	4.0	26	4.9	0.46
Neighborhood or environmental	31	4.7	21	4.0	25	4.7	0.51
Organizational or policy	3	0.5	1	0.2	7	1.3	0.03
Multiple domains	276	41.4	231	43.6	191	36.0	0.005
Intrapersonal							
Not enough time, scheduling, single parent, more responsibilities	305	45.7	249	47.0	270	50.9	0.14
Too tired, don't have the energy	89	13.3	61	11.5	67	12.6	0.52
Baby reasons, such as fussy, feeding schedule, caring for baby, having a baby, watching the child	51	7.7	44	8.3	20	3.8	0.002
Ill or physically unable, physical reason, medical limitations, recovering from cesarean section, depression	31	4.7	23	4.3	16	3.0	0.24
Already get enough activity	18	2.7	12	2.3	13	2.5	0.83
Nursing issues	17	2.6	12	2.3	0	0.0	^c
Don't enjoy or want to be active, hard to be active, motivation, attitude, lazy	20	3.0	16	3.0	26	4.9	0.08
Overweight, obese, gained too much weight, weight	4	0.6	4	0.8	6	1.1	0.53
Interpersonal							
Having other children (plus baby), children's schedule	23	3.5	20	3.8	17	3.2	0.61
Would rather spend time with baby/family during free time	4	0.6	1	0.2	5	0.9	0.10
Don't have anyone to be active with	0	0.0	0	0.0	4	0.8	^c
Neighborhood or environmental							
Weather, length of daylight	30	4.5	21	4.0	18	3.4	0.58
Lack of facilities or places to go, lack of sidewalks or trails	1	0.2	0	0.0	6	1.1	^c
Too expensive	0	0.0	0	0.0	2	0.4	^c
Organizational or policy							
Work or school	3	0.5	1	0.2	7	1.3	0.03
Multiple domains							
Lack of child care, child care issues, baby doesn't like child care, don't want to leave baby with others	159	23.8	138	26.0	116	21.9	0.08
Other	3	0.5	2	0.4	0	0.0	^c
No reason	0	0.0	0	0.0	3	0.6	^c

^aAt 3 months postpartum, 583 women reported one barrier, 77 women reported two barriers, and 7 women reported three barriers. At 12 months postpartum, 476 women reported one barrier, 43 women reported two barriers, 10 women reported three barriers, and 1 woman reported four barriers.

^bp value from generalized estimating equation compares cohort between 3 and 12 months postpartum.

^cp value cannot be calculated from the generalized estimating equation models.

school education and 5% of non-Hispanic blacks indicated that physical activity and breastfeeding were not compatible.

Barriers and enablers to physical activity

Barriers and enablers were reported at 3 and 12 months postpartum. Almost half of the women reported lack of time,

and one quarter cited child care issues as barriers to physical activity at both time points. Several studies have noted lack of time as a barrier to physical activity postpartum.⁴¹⁻⁴³ Child care issues have also been reported,⁴³ and in one study, those who reported child care as a barrier were more likely to be insufficiently active at 6 months postpartum.¹⁵ Encouraging walking, with the baby in the stroller, may be one way to

TABLE 4. ENABLERS TO PHYSICAL ACTIVITY REPORTED BY WOMEN AT 3 AND 12 MONTHS POSTPARTUM, GROUPED BY THE SOCIOECOLOGICAL FRAMEWORK^a

Enabler	Cohort						p value ^b
	3 months postpartum		3 months postpartum		12 months postpartum		
	n = 667	%	n = 530	%	n = 530	%	
Domains							
Intrapersonal	393	58.9	308	58.1	354	66.8	0.001
Interpersonal	202	30.3	163	30.8	118	22.3	0.001
Neighborhood or environmental	37	5.6	26	4.9	43	8.1	0.04
Organizational or policy	16	2.4	14	2.6	7	1.3	0.13
Multiple domains	189	28.3	147	27.7	144	27.2	0.82
Intrapersonal							
To feel better, sleep better, to have more energy, resting more, increased energy, sleeps and feels better, having more energy, no longer being pregnant so less weight	87	13.0	76	14.3	50	9.4	0.01
Baby reasons: baby older/healthier, playing with baby, baby not breastfeeding, baby being more active, carrying baby around	73	10.9	55	10.4	171	32.3	<0.0001
To improve my health	70	10.5	53	10.0	52	9.8	0.91
Want to get back to my prepregnancy weight, weight loss	59	8.9	46	8.7	17	3.2	<0.0001
Get stronger or toned, back into shape, to look better	45	6.8	36	6.8	19	3.6	0.008
New responsibilities, busy, to accomplish something, must get things done	38	5.7	30	5.7	10	1.9	0.002
To relieve stress, get out of the house	28	4.2	22	4.2	14	2.6	0.14
More time, not working, decreased work time, schedule	25	3.8	19	3.6	35	6.6	0.02
Enjoyment (of outdoors, of being active)	20	3.0	15	2.8	17	3.2	0.71
Incentive, ambition, motivation—could be from the baby	12	1.8	9	1.7	5	0.9	0.29
Because of boredom	1	0.2	1	0.2	0	0.0	^c
Training for exercise event or test at work (i.e., in military)	1	0.2	1	0.2	1	0.2	^c
Recovering from injury, pain	0	0.0	0	0.0	3	0.6	^c
Interpersonal							
Having support of partner/husband, wants to do things with him	97	14.5	85	16.0	51	9.6	0.0009
Other children, kids want to go out	43	6.5	31	5.9	23	4.3	0.27
Having support of other friends or family, teams, having someone to be active with, family together	73	10.9	58	10.9	56	10.6	0.84
Dog(s) need to be walked	6	0.9	5	0.9	2	0.4	0.26
Neighborhood or environmental							
Weather	24	3.6	18	3.4	27	5.1	0.17
Home exercise equipment or access to equipment, exercise TV channel, baby equipment (stroller, backpack, harness, jogger); environmental, such as pool in yard, or gym access is convenient	13	2.0	8	1.5	15	2.8	0.14
	0	0.0	0	0.0	1	0.2	^c
Organizational or policy							
Working/school, work, garden, walk to work, active at work, such as at lunch	16	2.4	14	2.6	7	1.3	0.13
Multiple domains							
Child care (including other kids at school) at home or in gym	38	5.7	32	6.0	43	8.1	0.19
Get baby outside	7	1.1	6	1.1	3	0.6	0.32
Other	10	1.5	8	1.5	2	0.4	0.06
No reason, nothing has helped	7	1.1	6	1.1	3	0.6	0.32

^aAt 3 months postpartum, 564 women reported one enabler, 80 women reported two enablers, 15 women reported three enablers, and 6 women reported four enablers. At 12 months postpartum, 445 women reported one enabler, 76 women reported two enablers, 6 women reported three enablers, and 3 women reported four enablers.

^bp value from the generalized estimating equation models compares cohort between 3 and 12 months postpartum.

^cp value cannot be calculated from the generalized estimating equation models.

overcome this barrier and may be a promising transitional activity.^{44,45}

At 3 months postpartum, 13% reported being too tired or not having enough energy as a barrier to physical activity. Among the cohort, this percent did not change from 3 to 12 months postpartum. Fatigue is a reasonable concern, given sleep issues,⁴⁶ and physical activity may help return feelings of energy.^{12,43} Health issues were reported less often than expected. At 3 months postpartum, only 5% of women reported being physically ill or unable (including medical limitations or depression), and 3% reported nursing issues. Because of the study protocol requiring visits in the home, however, this likely already restricted the sample to women who were more healthy. This is in contrast to our findings during pregnancy, wherein this cohort of pregnant women reported health-related intrapersonal factors more than any other type of barrier to physical activity.⁴⁷ A similar finding was also reported in a retrospective study of 74 postpartum women, wherein physical limitations and restrictions were much more commonly mentioned during pregnancy than in the postpartum period.⁴¹ This indicates a change in women's perceptions of physical activity barriers and enablers over time and points to the need for tailored messages at different times from pregnancy through the postpartum period. Thus, physical activity counseling is challenging and needed throughout the pregnancy and postpartum period, as the motivation to be physically active is related to the individual and not to static perceptions of barriers or enablers.

The most common enablers at 3 months postpartum were partner support and the motivation to feel better. The need for support, particularly partner support, for physical activity has been demonstrated in other smaller studies.^{23,41,48,49} Social support was the most common enabler reported in a smaller study of mothers,⁴² and in a study of postpartum women who had gestational diabetes, higher social support was associated with reporting sufficient physical activity.⁵⁰ Other studies suggest practical support, through help with child care and other responsibilities, as well as confirmation of the importance of taking time out from their responsibilities to be active appear important.⁵⁰ Women also reported not breastfeeding and a more active baby (i.e., starting to walk and play) as enablers more often at 12 months than at 3 months postpartum. Interestingly, several factors were both barriers and enablers to different women, including having other children and work or school.

Environmental, neighborhood, policy, and organizational factors were reported less often than intrapersonal and interpersonal factors for either barriers or enablers. This is similar to what was found during pregnancy⁴⁷ and in a small study of postpartum women who had experienced gestational diabetes.⁴⁹ Although these factors were reported less often, several of the interpersonal and intrapersonal factors, such as lack of time and child care issues, may be influenced by upstream factors, such as not having nearby exercise facilities with child care onsite.

Strengths and limitations

Strengths of this study include the comprehensive measurement of physical activity and the large sample size, permitting the assessment of differences in beliefs by other

factors. By collecting the same information at two time points, we could explore whether barriers and enablers changed over time, covering the same time period in which breastfeeding is recommended.⁴⁰ Despite the strengths of this study, several limitations of this work should be acknowledged. Although our analysis on barriers and enablers to physical activity included a cohort of women, the analysis on beliefs was cross-sectional. The generalizability of this study may be limited, as the women were volunteers from central North Carolina carrying singleton babies, and there may have been some selection bias because of differences found in those participating in the study compared with those who did not.⁵¹ It is also not known how well the five items address beliefs about exercise for postpartum women and may instead indicate education levels or advice provided by others. In the multivariable modeling regarding beliefs, we included education level and advice given by health professionals and friends or family members. Education was not significant in any of the four belief models, but advice from health professionals was associated with agreeing that it was acceptable to increase physical activity or exercise.

In the United States, women typically end postpartum care with a 6-week follow-up appointment. It is not known how the barriers or enablers might have been reported differently during this time period, as we only assessed them at 3 and 12 months postpartum. It would be important to better understand barriers and enablers earlier in the postpartum period as well, when other health issues, such as vaginal bleeding, urinary stress incontinence, and diastasis recti, may be pertinent issues.¹² Finally, our questions on barriers and enablers to physical activity were open ended and should be interpreted as such. These results can be used to generate closed-ended questions to better estimate the prevalence of these factors among postpartum women.

Conclusions

This study found that beliefs about exercise and physical activity during the postpartum period were favorable for most women. Barriers and enablers to physical activity were reported at 3 and 12 months postpartum, and although many did not change during this time, there was a shift away from health-related intrapersonal factors reported during pregnancy.⁴⁷ Some barriers were similar to those in past studies of women,⁵² where as others were unique to women during the postpartum period. The postpartum period is often focused on the baby rather than the mother, but health professionals could consider assessment of women's health needs and counseling during this time regarding physical activity.⁵³ Furthermore, this study showed that individual women have differing perceptions of barriers and enablers to physical activity. Future research could examine if counseling that is tailored to the specific needs of women would be more beneficial than a one-size-fits-all approach. Additionally, future research could explore how policies and environments (e.g., child care policies, worksites, community centers, parks) may interact with women's perceptions of intrapersonal and interpersonal barriers or enablers. The postpartum period offers a window of opportunity to shape new health behaviors, such as physical activity.⁵⁴ This work can contribute to the development of physical activity interventions that are relevant to postpartum women and their families.

Acknowledgments

Funding for this study was provided by the National Institutes of Health (NIH)/National Cancer Institute (CA109804-01). Data collection was supported by NIH/National Institute of Child Health and Human Development (HD37584), NIH General Clinical Research Center (RR00046), and NIH/National Institute of Diabetes and Digestive and Kidney Diseases (DK 061981-02). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. The Pregnancy, Infection, and Nutrition 3 Study is a joint effort of many investigators and staff members, whose work is gratefully acknowledged. We thank Fang Wen for her assistance with the analysis and both Kathryn Carrier and Ginny Lee for reviewing an earlier draft of the article, as well as the anonymous reviewers.

Disclosure Statement

The authors have no conflicts of interest to report.

References

- Pate R, Pratt M, Blair S, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 1995;273:402–407.
- U.S. Department of Health and Human Services: Physical activity and health: A report of the Surgeon General. Atlanta, GA: U.S. DHHS, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
- Haskell W, Lee I, Pate R, et al. Physical activity and public health. Updating recommendations for adults from the American College of Sports Medicine and the American Heart Association. *Circulation* 2007;116:1081–1093.
- U.S. Department of Health and Human Services: 2008 Physical Activity Guidelines for Americans. Available at www.health.gov/paguidelines Washington, DC 2008:1–61. Accessed November 1, 2008.
- Linne Y, Barkeling B, Rossner S. Long-term weight development after pregnancy. *Obes Rev* 2002;3:75–83.
- Siega-Riz A, Evenson K, Dole N. Pregnancy related weight gain—A link to obesity? *Nutr Rev* 2004; (Suppl II):S105–111.
- Larson-Meyer DE. Effect of postpartum exercise on mothers and their offspring: A review of the literature. *Obes Res* 2002;10:841–853.
- Amorim A, Linne Y, Lourenco P. Diet or exercise, or both, for weight reduction in women after childbirth [Review]. *Cochrane Database of Systematic Reviews*. 2007;3 (Art. No. CD005627; DOI: 10.1002/14651858.CD005627.pub2):1–32.
- Pivarnik JM, Chambliss H, Clapp J III, et al. Impact of physical activity during pregnancy and postpartum on chronic disease risk. *Med Sci Sports Exerc* 2006;38:989–1006.
- Sampselle C, Seng J, Yeo S, Killion C, Oakley D. Physical activity and postpartum well-being. *J Obstet Gynecol Neonat Nurs* 1999;28:41–49.
- ACOG. Exercise during pregnancy and the postpartum period. ACOG Committee Opinion No. 267. *Obstet Gynecol* 2002;99:171–173.
- Mottola MF. Exercise in the postpartum period: Practical applications. *Curr Sports Med Rep* 2002;1:362–368.
- Chasan-Taber L, Schmidt MD, Pekow P, Sternfeld B, Manson J, Markenson G. Correlates of physical activity in pregnancy among Latina women. *Matern Child Health J* 2007; 11:353–363.
- Clarke P, Gross H. Women's behavior, beliefs, and information sources about physical exercise in pregnancy. *Midwifery* 2004;20:133–141.
- Pereira M, Rifas-Shiman S, Kleinman K, Rich-Edwards J, Peterson K, Gillman M. Predictors of change in physical activity during and after pregnancy: Project Viva Am *J Prev Med* 2007;32:312–319.
- Oken E, Ning Y, Rifas-Shiman SL, Radesky JS, Rich-Edwards JW, Gillman MW. Associations of physical activity and inactivity before and during pregnancy with glucose tolerance. *Obstet Gynecol* 2006;108:1200–1207.
- Borodulin K, Evenson K, Wen F, Herring A, Benson A. Physical activity patterns during pregnancy. *Med Sci Sports Exerc* 2008;40:1901–1908.
- Rousham E, Clarke P, Gross H. Significant changes in physical activity among pregnant women in the UK as assessed by accelerometry and self-reported activity. *Eur J Clin Nutr* 2005;60:393–400.
- Sternfeld B, Quesenberry C Jr., Eskenazi B, Newman L. Exercise during pregnancy and pregnancy outcome. *Med Sci Sports Exerc* 1995;27:634–640.
- Grace SL, Williams A, Stewart DE, Franche RL. Health-promoting behaviors through pregnancy, maternity leave, and return to work: Effects of role spillover and other correlates. *Women Health* 2006;43:51–72.
- Mottola M, Campbell M. Activity patterns during pregnancy. *Can J Appl Physiol* 2003;28:642–653.
- Treuth MS, Butte NF, Puyau M. Pregnancy-related changes in physical activity, fitness, and strength. *Med Sci Sports Exerc* 2005;37:832–837.
- Blum JW, Beaudoin CM, Caton-Lemos L. Physical activity patterns and maternal well-being in postpartum women. *Matern Child Health J* 2004;8:163–169.
- van Raaij J, Schonk C, Vermaat-Miedema S, Peek M, Hautvast J. Energy cost of physical activity throughout pregnancy and the first year postpartum in Dutch women with sedentary lifestyles *Am J Clin Nutr* 1990;52:234–239.
- Cramp A, Brawley L. Moms in motion: A group-mediated cognitive-behavioral physical activity intervention. *Intl J Behav Nutr Phys Activity* 2006. Available at www.ijbnpa.org/content/3/1/23
- Kinnunen TI, Pasanen M, Aittasalo M, Fogelholm M, Weiderpass E, Luoto R. Reducing postpartum weight retention—A pilot trial in primary health care. *Nutrition J* 2007;6:1–9. Available at www.nutritionj.com/content/6/1/21
- McLeroy K, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q* 1988;15:351–377.
- Sallis J, Owen N. Ecological models. In: Glanz K, Lewis FM, Rimer BK, eds. *Health behavior and health education: Theory, research, and practice*. San Francisco, CA: Jossey-Bass, 1997:403–424.
- Evenson K. The Pregnancy, Infection, and Nutrition Study. Documentation for PIN3 and PIN3plus. 2009. Available at www.cpc.unc.edu/projects/pin/design_pin3/docs_3 Accessed February 9, 2009.
- Borg G, Linderholm H. Perceived exertion and pulse rate during graded exercise in various age groups. *Acta Med Scand* 1974;472:194–206.
- Ainsworth B, Haskell W, Leon A, et al. Compendium of physical activities: Classification of energy costs of human physical activities. *Med Sci Sports Exerc* 1993;25:71–80.

32. Ainsworth B, Haskell W, Whitt M, et al. Compendium of physical activities: An update of activity codes and MET intensities. *Med Sci Sport Exerc* 2000;32:S498–S516.
33. National Institutes of Health, National Heart Lung and Blood Institute. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The evidence report. *Obes Res* 1998;6:S51–S209.
34. Evenson K. Towards an understanding of change in physical activity from pregnancy through postpartum. *Psych Sport Exerc* 2010, in press.
35. Zeger S, Liang K. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* 1986;42:121–130.
36. Hausenblas HA, Brewer BW, Van Raalte JL, et al. Development and evaluation of a multimedia CD-ROM for exercise during pregnancy and postpartum. *Patient Educ Counsel* 2008;70:215–219.
37. Moran C, Holt V, Martin D. What do women want to know after childbirth? *Birth* 1997;24:27–34.
38. Krans EE, Gearhart JG, Dubbert PM, Klar PM, Miller AL, Replogle WH. Pregnant women's beliefs and influences regarding exercise during pregnancy. *J Miss State Med Assoc* 2005;46:67–73.
39. U.S. Department of Health and Human Services, U.S. Department of Agriculture: Dietary guidelines for Americans 2005. Bethesda, MD. Available at www.healthierus.gov/dietaryguidelines Accessed September 12, 2006.
40. American Academy of Pediatrics. Breastfeeding and the use of human milk. *Pediatrics* 2005;115:496–506.
41. Symons Downs D, Hausenblas H. Women's exercise beliefs and behaviors during their pregnancy and postpartum. *J Midwifery Women Health* 2004;49:138–144.
42. Albright C, Maddock JE, Nigg CR. Physical activity before pregnancy and following childbirth in a multiethnic sample of healthy women in Hawaii. *Women Health* 2005;42:95–110.
43. Groth SW, David T. New mothers' views of weight and exercise. *Am J Matern Child Nurs* 2008;33:364–370.
44. Watson N, Milat A, Currie T, Currie J. The feasibility and effectiveness of pram walking groups for postpartum women in western Sydney. *Health Prom J Aust* 2005;16:93–99.
45. Currie J, Develin E. The Strollers Pramwalking Program: A community intervention aimed at increasing the physical activity level of mothers with young children. *Health Prom J Aust* 2000;10:57–59.
46. Lee K. Alterations in sleep during pregnancy and postpartum: A review of 30 years of research. *Sleep Med Rev* 1998;2:231–242.
47. Evenson K, Moos M, Carrier K, Siega-Riz A. Perceived barriers to physical activity among pregnant women. *Matern Child Health J* 2009;13:364–375.
48. Kanotra S, D'Angelo D, Phares TM, Morrow B, Barfield WD, Lansky A. Challenges faced by new mothers in the early postpartum period: An analysis of comment data from the 2000 Pregnancy Risk Assessment Monitoring System (PRAMS) survey. *Matern Child Health J* 2007;11:549–558.
49. Symons Downs D, Ulbrecht JS. Understanding exercise beliefs and behaviors in women with gestational diabetes mellitus. *Diabetes Care* 2006;29:236–240.
50. Smith BJ, Cheung NW, Bauman AE, Zehle K, McLean M. Postpartum physical activity and related psychosocial factors among women with recent gestational diabetes mellitus. *Diabetes Care* 2005;28:2650–2654.
51. Laraia B, Entwisle B. Study design in the study of adverse birth outcomes: Clinic-based versus representative samples poster presented at the Population Association of America, April 18, 2008. New Orleans, LA, 2008.
52. Eyler A, Wilcox S, Matson-Koffman D, et al. Correlates of physical activity among women from diverse racial/ethnic groups: A review. *J Womens Health Gend Based Med* 2002;11:239–253.
53. Sword W, Watt S. Learning needs of postpartum women: Does socioeconomic status matter? *Birth* 2005;32:86–92.
54. Peterson K, Sorensen G, Pearson M, Hebert J, Gottlieb B, McCormick M. Design of an intervention addressing multiple levels of influence on dietary and activity patterns of low-income, postpartum women. *Health Educ Res* 2002;17:531–540.

Address correspondence to:

Kelly R. Evenson, Ph.D.

Bank of America Center

UNC Department of Epidemiology

Gillings School of Global Public Health

137 East Franklin Street, Suite 306

Chapel Hill, NC 27514

E-mail: kelly_evenson@unc.edu