

# Influence of Maternal Stress on Successful Participation in a Physical Activity Intervention: The IMPACT Project

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**ABSTRACT.** Few studies have examined the impact of motherhood on successful participation in physical activity (PA) interventions. The current study focused on mothers in the *Increasing Motivation for Physical Activity* or IMPACT study, which aimed to promote PA in sedentary, low-income, ethnically diverse women (74% Latina). The aim of this study was to determine whether certain maternal variables (e.g., number of children, number and intensity of maternal stressors) influenced successful participation in an 8-week, class-based, PA intervention. PA consisted of accumulating 30 minutes or more of moderate-intensity activities (e.g., walking) five or more days a week. Sixty-eight mothers (average age = 32 years) were assessed at baseline and 10 weeks. Paired comparison t-tests demonstrated a significant increase in PA-related energy expenditure from baseline to 10 weeks ( $p < 0.05$ ). Furthermore, this increase in PA was significantly associated with a decrease in the number of maternal stressors reported over this time period ( $p < 0.01$ ). Simultaneous regression analyses indicated that (1) having a higher number of maternal stressors at baseline was associated with lower class attendance ( $p \leq 0.05$ ) and (2) rating these maternal stressors (e.g., unable to control children's behavior) as being more stressful at baseline was associated with lower levels of PA at 10 weeks ( $p \leq 0.01$ ), independent of the number of children at home. These results suggest that the number and intensity of perceived maternal stressors may negatively impact attempts to become more physically active. Interventions should address such stressors. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2005 by The Haworth Press, Inc. All rights reserved.]

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## INTRODUCTION

The benefits of regular physical activity (PA) have been well established among women. Several large-scale epidemiological and prospective studies have demonstrated beneficial effects of PA in terms of reducing all-cause mortality and disability (Blair et al., 1996; Kushi et al., 1997), and helping to prevent and control several chronic diseases, such as coronary heart disease, obesity, Type 2 Diabetes, and certain cancers (Ball, Brown, & Crawford, 2002; Hu et al., 2001, 1999; Rockhill et al.,

1999; USDHHS, 1996). Despite these health benefits, increasing regular PA levels among women continues to be a significant challenge.

Although current health guidelines recommend that all U.S. adults accumulate at least 30 minutes of moderate PA per day (e.g., brisk walking; Pate et al., 1995; USDHHS, 1996), fewer than 45% of U.S. women meet these public health recommendations (Macera et al., 2005). Women of all ages engage in less regular moderate PA than men (Eyler et al., 1997; Romans, 1997; USDHHS, 1996), with approximately 43% of U.S. women reporting being physically inactive, while another 24% report being only sporadically active (USDHHS, 2000). Low-income and ethnic minority (i.e., Latino and African American) women, in particular, are less likely to engage in PA compared to women of higher income status and non-Hispanic white women, respectively (Crespo et al., 2000; Randell & Wells, 1998; USDHHS, 1996). A third group of women that is less active are women with children. Despite mothers reporting less moderate PA than non-mothers (Brown et al., 2000; Sternfeld, Ainsworth, & Quesenberry, 1999; Verhoef, Love, & Rose, 1992), they do tend to report more household and caregiving activity, which may account for a substantial proportion of their daily energy expenditure (Sallis et al., 2001; Sternfeld et al., 1999).

Several barriers have been reported in relation to adopting PA among low-income and ethnic minority women, particularly those with children. These barriers have included lack of time and motivation due to family obligations and childcare responsibilities, feeling too tired, safety concerns, having a lack of resources to exercise, and having little or no support to exercise (Brown et al., 2001; King et al., 2000; Pinto, Marcus, & Clark, 1996). It has been speculated that the lack of time for exercise may account for the relationship found between number of children living at home and the increased risk of obesity observed in mothers and fathers alike (Weng et al., 2004). Therefore, it is important to investigate the social and functional aspects of motherhood that might impede a woman's ability to engage in health behaviors such as PA.

To date, few studies have examined maternal factors in relation to PA participation. Sociodemographic factors, such as maternal age (younger mothers), number and age of children living at home (mothers with younger children), and marital status (mothers who are married) have been associated with decreased PA levels. However, these results have not been consistently found across studies (Miller, Trost, & Brown, 2002; Verhoef & Love, 1994; Verhoef et al., 1992), and few have examined these factors among low-income and ethnic minority women

(Sallis et al., 2001; Sternfeld et al., 1999). Furthermore, no study to our knowledge has examined what impact motherhood and its related stressors might have on PA patterns in this population. Increased maternal stress, in particular, has been associated with poorer physical and emotional well-being (Stephens, Franks, & Townsend, 1994) and might disenable mothers from becoming more physically active due to competing childcare demands and responsibilities.

In light of the physical and emotional challenges of motherhood, women with children may benefit from the health-promoting effects of PA. The few studies that have tested behavioral interventions aimed at increasing PA in mothers have tailored their interventions after well-studied theoretical approaches to behavior change (i.e., Bandura's Social Cognitive Theory, 1977; Prochaska & DiClemente's Transtheoretical Model of Behavior Change, 1983) (Cody & Lee, 1999; Fahrenwald et al., 2004; Ransdell et al., 2001) and community-based approaches (Miller et al., 2002). Preliminary evidence from these studies suggests that these interventions are potentially effective in increasing motivation to exercise, increasing daily energy expenditure, and mobilizing mothers towards meeting current guidelines for moderate-intensity PA (Fahrenwald et al., 2004; Miller et al., 2002). Although these studies demonstrate that mothers are in fact interested in programs that promote PA and can successfully adopt more physically active lifestyles, family-related constraints and maternal stressors continue to be factors that disrupt their level of exercise (Cody & Lee, 1999). Therefore, it is important to examine systematically which aspects of motherhood might influence successful adoption of moderate PA, particularly among low-income and ethnically diverse mothers, given that previous studies have focused on primarily non-Hispanic white populations (Miller et al., 2002; Verhoef & Love, 1994; Verhoef et al., 1992).

The current study focuses on a subset of participants from the *Increasing Motivation for Physical Activity* or IMPACT study that was designed to promote PA in sedentary, low-income, ethnically diverse women (Collins et al., 2002). Mothers were identified to determine whether certain maternal variables (e.g., number of children, number and intensity of maternal stressors) influenced successful participation in a class-based PA intervention. It was hypothesized that having a higher number and intensity of maternal stressors at baseline would lead to lower class attendance and influence mothers' ability to engage in recommended levels of PA.

## **MATERIALS AND METHODS**

### ***Procedure and Participants***

The objective of the IMPACT study was to promote adoption and maintenance of PA in sedentary, low-income women participating in federally funded job-training programs (Albright et al., 2005; Collins et al., 2002). The sponsoring institution's committee on human subjects approved all study procedures. Of the 83 women that participated in the class-based intervention phase of the IMPACT study (described in the following paragraphs), the current results focus on the 68 mothers (82%) that had children living at home with them.

From 1998 to 2000, participants were recruited from vocational training courses at seven San Francisco Bay Area adult education sites, a multiethnic population consisting primarily of low-income or unemployed adults, many of whom were the head of a single parent household. Women were eligible to join the study if they were 18-65 years of age, free of diagnosed coronary heart disease and insulin-dependent diabetes mellitus (IDDM), and did not have a medical condition or disorder that would limit participation in light- to moderate-intensity exercise. In addition, participants were excluded if they were pregnant, had plans to become pregnant during the course of the study, or had plans to move out of the area during the study period. Participants in the study had to have a command of English sufficient to participate in study assessments and in class activities, both of which had written and verbal components. Recruitment efforts focused on sedentary women who were not exercising at the nationally recommended levels (i.e., 30 minutes a day of moderate or higher intensity exercise on five or more days of the week). No women were excluded based on their self-reported level of PA at baseline.

### ***Research Design***

The present study focuses on the first phase of the IMPACT study in which participants took part in a baseline assessment and 8-week class-based intervention designed to prepare sedentary, low-income women to adopt and maintain PA in their home or community setting. This phase of the IMPACT study (i.e., class-based intervention) was conducted during participants' regular vocational training hours; for example, during laboratory periods, lunch, or independent study times. For the majority of the women attending these adult education sites, the

federally funded Welfare-to-Work program supported their vocational training. The class-based intervention consisted of eight one-hour, weekly behavioral skills-building lessons designed to inform and motivate women to become more physically active. Further details about the IMPACT lessons and their immediate effect on participants can be found elsewhere (Collins et al., 2002). In brief, the IMPACT sessions were adapted from the successful class-based interventions developed for Project Active and the Activity Counseling Trial (Dunn et al., 1998, 1999; King et al., 1998). Based on the current national recommendation for PA established by the American College of Sports Medicine and the Centers for Disease Control and Prevention (Pate et al., 1995), participants were told that their ultimate goal (i.e., at the end of 12 months) was to accumulate 30 minutes of moderate-intensity activities (e.g., brisk walking) at least five days a week.

The IMPACT classes taught behavior skills related to overcoming potential barriers to PA, setting short-term goals, and developing an appropriate and safe PA program (Marcus, Rakowski, & Rossi, 1992; Marcus, Banspach et al., 1992; Marcus & Owen, 1992). The curriculum was designed to be culturally sensitive for the primarily Latina population that attended the adult education sites (Resnicow et al., 1999). Bilingual, ethnically matched health educators guided the participants in small and large group activities, interactive discussions, problem-solving, and skill building tasks. Following the completion of the class-based intervention, participants returned for a 10-week follow-up assessment.

### *Measures*

Participants completed surveys and physiological assessments at baseline and after the IMPACT preparatory classes ended (10 weeks later). As described below, participants underwent interviews and completed questionnaires at the adult education sites that assessed sociodemographic factors (e.g., age, marital status, smoking status, ethnicity), maternal factors (number and age of children, maternal stress), and PA levels. Participants also underwent physiological assessments of cardiovascular risk (i.e., body mass index).

*Sociodemographic Questionnaire.* The sociodemographic questionnaire assessed age (in years), ethnicity (Latina/non-Latina), marital status (married or living with partner/not married), total years of formal education, household income, current smoking status (yes/no), language

spoken at home (Spanish/English/other), country of birth, number of children living at home, and children's age (defined as the number of children between the ages of 0-5, 6-11, or 12-18 years). For number of children living at home, we were unable to distinguish between biological and other children (adopted, foster, step, extended family members, etc.). The health educator that led each class documented the number of classes attended by each participant.

*Maternal and General Stress.* Participants completed the Mother Role Questionnaire (Stephens, Franks, & Townsend, 1994), a 13-item measure assessing the frequency and intensity of maternal stressors (e.g., "children having problems in school," "unable to control the children's behavior"). Participants were asked to endorse which of the 13 maternal stressors they had experienced in the last two months (frequency score) and to indicate how stressful those events were (intensity score) on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*very much*). Participants could indicate that items did not apply to their situation. Therefore, the frequency score consisted of the number of maternal stressors endorsed, and the intensity score was calculated as the average stress rating for those maternal stressors identified by participants. Women with more than one child living at home could respond to these items with regard to any or all of their children. The items were based on previous studies examining the mother role (Baruch & Barnett, 1986; Stephens, Franks, & Townsend, 1994). Cronbach's alpha for the current study was 0.86 (frequency score) and 0.87 (intensity score), respectively. Participants also completed the Cohen Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), a 14-item measure of general stress, to examine the roles of maternal stress and general stress on exercise participation (Cronbach's alpha = 0.69).

*Physical Activity.* The amount of PA undertaken in the previous week was assessed via the interviewer-administered Stanford Seven-Day Physical Activity Recall (PAR). This semi-structured interview has been used successfully in a number of studies, and its validity and reliability has been documented (Sallis et al., 1985; Blair et al., 1985). The interviewer asked the participant to recall the hours spent sleeping and the time spent doing physical activities in three activity categories (moderate, hard, and very hard) over the past seven days. The interviewer guided the participant through a day-by-day recall process and used probing questions to determine the intensity and duration of activities. The PAR interview captures activities of moderate intensity or higher. Energy expenditure ( $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{day}^{-1}$ ) is estimated from hours spent sleeping and time spent in moderate, hard, and very hard activities.

Time spent in light activity (hours or minutes per day) is calculated by subtracting the sum of moderate, hard, and very hard activities, and sleep time from 24 hours (or 1440 minutes). Cards that listed examples of moderate, hard, and very hard activities were used during the interview to help participants with the classification of their activities and included examples of home, occupational, and sports/recreational activities at each intensity level. These examples are consistent with the materials utilized in the original PAR interview and have good reliability and validity in Latino adults (Rauh et al., 1992).

*Body Mass Index.* To determine body mass index (BMI), body weight was measured in light indoor clothing, without shoes, using the Seca Model 770 digital electronic scale (Irwin Shorr Productions, Olney, MD). Height was measured without shoes using the Shorr height measuring board (Irwin Shorr Productions, Olney, MD). BMI was calculated as the weight in kilograms divided by height in meters squared.

### *Statistical Analyses*

The primary aim of the IMPACT study was to detect a significant increase in PA following participation in a class-based PA intervention (Albright et al., 2005; Collins et al., 2002). Sample size calculations demonstrated that with 80 participants, the statistical power to detect a moderate effect size of 0.54 for an increase in minutes/week of PA with  $\alpha = 0.05$  is 80%. The current results focus on post-hoc analyses of the subset of mothers who reported having at least one child living at home with them ( $n = 68$ ; 82%) and thus had 77% power to detect moderate effects when controlling for multiple covariates. Descriptive information on maternal stressors was examined. Pearson product-moment correlations were performed to examine baseline relationships between sociodemographic factors (age, marital status, ethnicity), health-related factors (smoking status, BMI, PA), and maternal factors (total number and age of children, number and intensity of maternal stressors). Paired comparison t-tests were conducted to assess changes in PA (PAR) and maternal stress from baseline to 10 weeks as a function of participation in the 8-week, class-based PA intervention.

Simultaneous regression analyses were performed to identify which sociodemographic, health-related, and maternal factors were most strongly associated with class attendance and 10-week PA levels. Number of classes attended and 10-week PA levels (PAR total score) were used as separate dependent variables. Based on associations found in past studies and preferences for independent variables that were not collinear

( $r \geq 0.40$ ), the following seven demographic and maternal factors were considered independent variables: maternal age, marital status, smoking status, ethnicity, number of children living at home, and baseline maternal stress (frequency and intensity scores). Baseline PA (PAR) and BMI were also included in the regression equation for 10-week PA to assess whether initial PA levels and body mass index were associated with 10-week PA levels. Secondary regression analyses were performed to examine whether children's age (i.e., number of children between the ages of 0-5, 6-11, or 12-18) and general stress (PSS) attenuated any relationships found in the primary regression analyses for class attendance and 10-week PA. Given that the total number of children and children's age were highly collinear ( $p < 0.001$ ), children's age replaced total number of children in the secondary regression models for number of classes attended and 10-week PA levels. In contrast, general stress was not collinear with maternal stress frequency or intensity; therefore, both measurements of stress were included in the secondary regression models for number of classes attended and 10-week PA levels. Case-wise deletion of missing data was used in all analyses, such that cases were deleted if they were missing data on any covariate.

## **RESULTS**

### ***Participant Characteristics***

Table 1 describes sociodemographic, maternal, and health-related characteristics for the current sample. Of the 68 mothers in the IMPACT study, a large proportion were low-income, Latina women who were born in the U.S. and spoke English at home. Participants were approximately 32 years of age and had less than 12 years of education on average. Most participants were not married (i.e., never married, separated, or divorced), had one to two children living at home with them (56%), and had at least one child under the age of five.

### ***Maternal Stressors***

The maternal stressors participants reported experiencing most often were examined at baseline (Table 2). These included their children not getting along with one another, feeling heavy demands in raising their children, and having financial strain related to childcare. Participants reported experiencing five of these maternal stressors on average (out of

TABLE 1. Sociodemographic, Health-Related, and Maternal Characteristics of Low-Income Mothers Attending a Physical Activity Preparatory Course

Characteristic	Mothers ( <i>n</i> = 68)
<b>Sociodemographic Characteristics</b>	
Mean age ( $\bar{x} \pm \text{sd}$ )	31.7 ( $\pm 8.8$ )
Mean education ( $\bar{x} \pm \text{sd}$ )	11.0 ( $\pm 2.0$ )
Annual family income < \$20,000 (%)	78
Race/Ethnicity (%)	
Latina	74
Caucasian	16
Other	10
Country of Birth (%)	
United States	57
Mexico/Central or South America	31
Other	12
Marital Status (%)	
Not Married	63
Married/Living as Married	37
<b>Health-Related Characteristics</b>	
Current Smokers (%)	35
Mean baseline Body Mass Index ( $\bar{x} \pm \text{sd}$ )	30.2 ( $\pm 6.8$ )
Mean baseline PAR ( $\bar{x} \pm \text{sd}$ )	32.9 ( $\pm 1.3$ )
<b>Maternal Characteristics</b>	
Total number of children ( $\bar{x} \pm \text{sd}$ )	2.6 ( $\pm 1.3$ )
Age group of children living at home (%)	
Child 0-5 years of age	91
Child 6-11 years of age	72
Child 12-18 years of age	54
Mean number of maternal stressors ( $\bar{x} \pm \text{sd}$ )	5.2 ( $\pm 3.9$ )
Mean maternal stress intensity score ( $\bar{x} \pm \text{sd}$ )	2.6 ( $\pm 0.8$ )

Note: PAR = Physical Activity Recall (values represent total energy expenditure; kcal·kg<sup>-1</sup>·day<sup>-1</sup>).

a possible 13) and rated them as being slightly to somewhat stressful (Table 1). Pearson correlations among baseline study variables revealed that the number of maternal stressors reported was significantly higher ( $p < 0.05$ ) among older mothers ( $r = 0.28$ ), current smokers ( $r = 0.36$ ),

TABLE 2. Rank Order of Maternal Stressors by Low-Income Mothers at Baseline

Stressor	Percentage endorsing <sup>1</sup>
Children did not get along with each other	52.8
Heavy demands or responsibilities for the children	51.9
Financial strain in rearing the children	50.9
Not sure if doing the right thing in rearing the children	45.3
Arguments or conflicts between respondent and children	45.3
Children not turning out as hoped	43.4
Too much time spent alone with children	41.5
Children did not show appreciation or love	41.5
Unable to control children's behavior	41.5
Children had school or education problems	32.1
Teenage problems	28.3
Children need you less as they get older	28.3
Children had physical health problems	20.8

<sup>1</sup> $n = 53$ .

and mothers that had children between the ages of 6 to 11 years ( $r = 0.39$ ). In contrast, mothers tended to perceive these maternal stressors as being less intense if they had children between the ages of 12 to 18 years ( $r = -0.36$ ,  $p < 0.05$ ).

### ***Change in Physical Activity from Baseline to 10 Weeks***

Paired comparison t-test analyses demonstrated a significant increase in energy expenditure, as measured by the PAR, from baseline to 10 weeks ( $t(57) = 2.36$ ,  $p < 0.05$ ). This observed increase translates to mothers improving their PA level by an average of 214 kcal or approximately two miles of brisk walking per week over the 10-week period. Interestingly, the number of maternal stressors reported during this time period decreased and approached significance (baseline:  $M = 5.2$ ,  $SD = 3.9$ ; 10 weeks:  $M = 4.1$ ,  $SD = 3.3$ ;  $p = 0.06$ ); however, maternal stress intensity did not significantly change. Increased PA from baseline to 10 weeks was significantly associated with a decrease in the number of maternal stressors reported over this time period ( $r = -0.42$ ,  $p < 0.01$ ). No significant reductions in general stress levels were observed, as measured by

the PSS. Furthermore, number of classes attended was not significantly associated with the observed decrease in the number of maternal stressors reported over the 10-week period ( $r = -0.01$ ,  $p = 0.97$ ).

### *Effect of Maternal Factors on Number of Classes Attended*

On average, participants attended six out of eight classes ( $M = 5.6$ ,  $SD = 1.8$ ), with 75% attending five or more classes. Class attendance was positively associated with increases in PA from baseline to 10 weeks ( $r = 0.26$ ,  $p < 0.05$ ). Simultaneous regression analyses revealed that the number of maternal stressors reported at baseline was the only significant predictor of class attendance, with mothers who reported experiencing a higher number of maternal stressors at baseline attending fewer classes ( $p = 0.05$ ; see Table 3). Age ( $p = 0.08$ ) and smoking status ( $p = 0.07$ ) approached significance such that older mothers and those who currently smoked were more likely to attend the classes. The overall model of baseline sociodemographic and maternal variables accounted for 25% of the variance in class attendance  $F(7, 38) = 1.50$ ,

TABLE 3. Summary of Simultaneous Regression Analyses for Sociodemographic, Health-Related, and Maternal Variables Associated with Number of Classes Attended, and 10-Week Physical Activity

Variable	Number of classes attended ( $n = 39$ )			10-week physical activity ( $n = 43$ )		
	$\beta$	$SE$	$p$	$\beta$	$SE$	$p$
Age	0.06	0.03	0.08	-0.02	0.03	0.45
Marital status	0.25	0.57	0.66	0.78	0.45	0.09
Smoking status	1.11	0.60	0.07	-0.03	0.46	0.95
Ethnicity	0.94	0.60	0.16	0.17	0.51	0.74
Baseline physical activity				0.57	0.19	0.004 <sup>b</sup>
Body mass index				0.03	0.03	0.31
Number of children	0.31	0.21	0.14	-0.07	0.15	0.62
Maternal stress frequency	-0.18	0.09	0.05 <sup>a</sup>	0.02	0.07	0.82
Maternal stress intensity	0.14	0.41	0.73	-0.76	0.30	0.01 <sup>b</sup>
$R^2$	0.25 ( $p = 0.20$ )			0.44 ( $p = 0.01$ )		

<sup>a</sup> Significant predictor of number of classes attended.

<sup>b</sup> Significant predictor of physical activity at 10-weeks.

but was not significant ( $p = 0.20$ ); therefore, these results should be interpreted with caution.

Secondary regression analyses were performed to examine whether children's age (i.e., number of children between the ages of 0-5, 6-11, or 12-18) or general stress attenuated the relationship found between number of maternal stressors reported at baseline and number of classes attended. When number of children between the ages of 0-5 or 6-11 was entered into the regression equation, replacing total number of children, frequency of maternal stressors was no longer significantly associated with number of classes attended ( $p > 0.10$ ). However, when number of children aged 12-18 years was entered into the regression equation, frequency of maternal stressors reported at baseline remained significantly associated with number of classes attended ( $p = 0.05$ ). General stress did not diminish the effect of frequency of maternal stressors reported at baseline and number of classes attended.

### ***Effect of Maternal Factors on Physical Activity at 10 Weeks***

Simultaneous regression analyses revealed that baseline PA levels and maternal stress intensity were the only significant predictors of 10-week PA levels, with mothers who had lower initial levels of PA and those that rated maternal life events as being more stressful at baseline having lower levels of PA following the class-based PA intervention ( $p < 0.01$ ; see Table 3). The overall model of baseline sociodemographic, health-related, and maternal variables accounted for 44% of the variance in 10-week PA levels  $F(9, 42) = 2.88, p = 0.01$ .

Secondary regression analyses were performed to examine whether children's age or general stress attenuated the relationship found between baseline maternal stress intensity and 10-week PA levels. When number of children between the ages of 0-5 or 6-11 was entered into the regression equation, replacing total number of children, baseline maternal stress intensity remained significantly associated with 10-week PA levels ( $p < 0.05$ ). However, when number of children aged 12 to 18 years was entered into the regression equation, baseline maternal stress intensity was no longer significantly associated with 10-week PA levels ( $p > 0.10$ ). In its place, marital status became a significant predictor of 10-week PA, along with baseline PA, such that mothers who were not married/living with a partner had lower levels of PA following the class-based program compared to those who were married/living with a partner ( $p < 0.01$ ). General stress was not found to attenuate the relationship between baseline maternal stress intensity and 10-week PA.

### *DISCUSSION*

Few studies have examined the impact of motherhood on successful participation in PA interventions. Results from the current study are the first, to our knowledge, to systematically examine what aspects of motherhood and its related stressors might influence successful adoption of moderate PA among sedentary, low-income, ethnically diverse women. Mothers participating in a class-based PA intervention, as part of the IMPACT study, demonstrated significant increases in PA-related energy expenditure over a 10-week period, averaging an increase of 214 kcal or approximately two miles of brisk walking per week. These results add to the small body of literature demonstrating significant improvements in energy expenditure among mothers with the introduction of a moderate-intensity PA program (Fahrenwald et al., 2004). The amount of PA achieved is impressive given the social, situational, economic, and familial constraints often experienced by low-income mothers.

Maternal stress has been identified as a factor that might disrupt mothers' level of exercise involvement; however, it has not been systematically examined with respect to its effect on adopting PA (Cody & Lee, 1999). Mothers in the current study identified several stressors related to motherhood (e.g., their children not getting along with one another) that are similar to those reported in previous studies of primarily non-Hispanic white and non-Hispanic black mothers and have been associated with poor physical and emotional health outcomes (Stephens, Franks, & Townsend, 1994).

Results from the current study demonstrated that increased participation in moderate PA was significantly associated with reductions in the number of maternal stressors reported from baseline to 10-weeks, although it is difficult to determine whether increased PA resulted in the reduction of maternal stress or vice-versa. One possible explanation for this finding is that it was the consistent contact and additional social support that mothers received from health educators, rather than engaging in moderate PA, that may have provided sufficient stress reduction for mothers in the study. However, only increased PA-related energy expenditure, not number of classes attended, was associated with the observed decrease in number of maternal stressors reported. These results are consistent with previous studies that have demonstrated that regular PA can result in improvements in emotional well-being (DiLorenzo et al., 1999; Martinsen, 1993). Moderate levels of PA, such as brisk walking, might be more adaptable for mothers with competing

childcare demands and responsibilities. Therefore, improvements in maternal stress may be one of the motivations and benefits for mothers wanting to become more physically active. Future studies are needed to determine what factors might motivate mothers in adopting PA.

Although the majority of mothers in this study (75%) attended five or more classes (out of a possible eight) in the PA intervention, mothers who reported a higher number of maternal stressors at baseline were found to attend fewer classes. In addition, mothers who attended fewer classes made fewer gains in PA-related energy expenditure at 10 weeks. Notably, these findings only persisted for mothers who had children between the ages of 12-18, suggesting that mothers with children in this age group might experience unique barriers and stressors that might inhibit their ability to attend class-based PA programs.

Consistent with our hypothesis, mothers who reported maternal life events to be more stressful at baseline were found to have lower levels of PA at 10 weeks. Baseline levels of PA were the only other predictor of 10-week PA. In contrast to the secondary analyses performed for class attendance, these findings only persisted for mothers who had children between the ages of 0-11. These results suggest that mothers of young children may perceive maternal life events as being more stressful than mothers of teenage children, and consequently, engage in less moderate PA. For mothers of teenage children, marital status appears to be a more important predictor of PA adoption than the intensity of maternal stressors experienced, with unmarried women being less likely to engage in moderate PA than those who are married or living with a partner. This last finding is somewhat consistent with prior studies demonstrating the importance of partner emotional and instrumental support in helping to encourage mothers to become more physically active (Brown et al., 2001; Janisse et al., 2004; Miller et al., 2002).

The findings presented should be regarded with some degree of caution because of several limitations. First, although our sample was largely representative of women at the adult education sites, our results may not represent the experiences of mothers from other settings or regions of the United States. A second limitation is the lack of an assessment-only or wait-list control group. We did not include a control group in the first phase of the IMPACT study for reasons related to logistical constraints at the adult education centers. Previous studies that have included control groups typically find that women not receiving a direct PA intervention do not significantly change their behaviors around PA (King et al., 1995; Dunn et al., 1999). A third limitation was the recruitment of Latinas who could speak and read English. This was necessary

largely due to the adult education's requirement that adult students, enrolled in the courses from which we recruited, were required to read and speak English. We could not recruit from the English-as-a-second-language or ESL courses at the adult education sites because these courses included individuals with a wide range of primary languages (e.g., Spanish, Vietnamese, Laotian, Russian, etc.). Nevertheless, our results are generalizable to low-income Latinas who were born in the U.S., or have lived in the U.S. more than 6 years, and speak English. Finally, the number of variables included in the regression models for number of classes attended and 10-week PA, as well as our limited sample size, may have resulted in reduced statistical power to detect a moderate effect among sociodemographic and health-related factors and our outcome measures (77% power;  $n = 68$ ). However, when the number of variables in these regression models was reduced, our findings remained consistent. Additional studies examining the role of maternal stress on successful participation in PA programs are needed to help elucidate these findings.

In summary, our results suggest that theoretically grounded PA interventions, such as the one delivered in the IMPACT study, may be effective in supporting mothers' attempts to meeting PA recommendations. PA interventions structured within existing community resources for mothers, such as the Welfare to Work and WIC (Women, Infants, and Children) programs (Collins et al., 2002; Fahrenwald et al., 2004), have been effective in mobilizing mothers towards becoming more physically active. However, the presence of maternal stressors may negatively impact attempts by mothers to become more active. Future PA interventions should explicitly address family-related constraints and responsibilities that may contribute to an increase in maternal stress and override personal goals such as PA adoption so as to incorporate specific coping strategies that address these constraints. Such strategies may include increasing available supports (e.g., familial, peer, community) for exercise, as well as problem-solving and reframing one's cognitions around balancing the practical demands of motherhood with the need to take care of oneself so as to better manage those demands.

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