Maternal-Fetal Disease Information as a Source of Exercise Motivation During Pregnancy

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Objective: A Protection Motivation Theory (PMT) framework was used to examine whether information about the role of exercise in preventing maternal-fetal disease served as a meaningful source of exercise motivation. Design: Pregnant women (n = 208) were randomly assigned into one of three conditions: PMT, attention control, and noncontact control. Women in the PMT group read a brochure about the benefits of exercise during pregnancy incorporating the major components of PMT; perceived vulnerability (PV), perceived severity (PS), response efficacy (RE), and self-efficacy (SE). Participants in the attention-control condition read a brochure about diet. Following treatment, all participants completed measures of their beliefs toward maternal-fetal disease and exercise, goal intention (GI), and implementation intention (IMI). One week later, a measure of self-reported exercise behavior was collected. Main Outcome Measures: Main outcome measures were PMT variables (PV, PS, RE, and SE), GI, IMI, and follow-up physical activity. Results: Participants assigned to the PMT-present group reported significantly higher PS, RE, SE, GI and increased exercise behavior. PS, RE, and SE predicted GI, GI predicted IMI, and IMI predicted exercise behavior. Conclusion: Information grounded in PMT is effective in influencing pregnant women’s beliefs and intentions as well as changing their initial behavior.

Keywords: pregnancy, exercise, maternal-fetal disease, Protective Motivation Theory, health psychology

While numerous studies have confirmed the benefits of exercise in the general population (Ehrman, Gordon, Visich, & Ketyeian, 2008), research has also established that physical exercise is as beneficial during pregnancy as it is at other times in a woman’s life (cf. Wang & Appar, 1998). In addition to helping manage pregnancy-related musculoskeletal issues, positively impacting mood and mental health, and shortening labor and reducing the need for obstetric interventions, exercise during pregnancy reduces the risk of two serious and potentially fatal maternal-fetal conditions: preeclampsia and gestational diabetes (American College of Sports Medicine, 2007; Wang & Appar, 1998). Preeclampsia is characterized by high blood pressure and elevated levels of protein in the mother’s urine, and evidence exists that leisure time exercise reduces the risk for preeclampsia by up to 66% (Weissgerber, Wolfe, Davies, & Mottola, 2006). Gestational diabetes mellitus (GDM) is a condition characterized by high blood sugar levels during pregnancy in women who have never had diabetes. Evidence exists that recreational exercise during pregnancy can reduce the risk for GDM up to 56%, although the link is less consistent relative to preeclampsia (Lewis et al., 2008). In the absence of serious complications, the Society of Obstetricians and Gynecologists of Canada (SOGC) recommends that all pregnant women participate in at least four 30-min sessions of moderate to vigorous aerobic exercise per week (Davies, Wolfe, Mottola, & MacKinnon, 2003). Despite these recommendations, approximately 60% of pregnant women are inactive (Poudveigne & O’Connor, 2006).

Protection Motivation Theory (PMT; Maddux & Rogers, 1983; Rogers, 1975) is a theoretical framework that aims to explain health behavior motivation from a disease prevention perspective (Courneya & Hellsten, 2001). Given the role that exercise can play in preventing maternal-fetal disease, PMT is likely to be an excellent model for understanding and predicting pregnant women’s exercise behavior. The theory’s four main constructs are perceived severity of the threat (PS), perceived vulnerability of the threat (PV), perceived efficacy of the preventive behavior (response efficacy; RE), and perceived self-efficacy (SE), an individual’s confidence in their ability to perform the recommended behavior. Together, these factors combine to predict an individual’s intention to engage in a particular behavior. In addition, it has been suggested that individuals who extend their goal intention by identifying when, where, and how to act are more likely to initiate and perform the intended behavior (Gollwitzer & Oettingen, 1998; Orbell & Sheeran, 2000). This postintentional process has been referred to as implementation intention (Gollwitzer, 1999). Therefore, according to theory, the four PMT constructs predict goal intention, which should predict implementation intention, which should then predict behavior.

PMT has been used to understand and promote exercise behavior. The majority of studies, however, lack a measure of follow-up...
behavior and focus primarily on presenting a student population with a persuasive message that experimentally manipulates PMT constructs into high and low conditions (Courneya & Hellsten, 2001; Fruin, Pratt, & Owen, 1991; Stanley & Maddux, 1986). In a study designed to address some of the limitations of earlier work, Graham, Prapavessis, and Cameron (2006) presented adults with factual information about the role of exercise in reducing the risk of colon cancer. Baseline as well as two follow-up measures of self-report exercise behavior were collected (e.g., 2 and 4 weeks’ postintervention). Results showed that the PMT-present group scored significantly higher on RE and intention and showed a trend effect for exercise behavior when measured at 2 weeks’ postintervention. Taken together, these studies indicate that PMT can be a useful model for understanding and predicting exercise behavior. However, PMT has yet to be used to address the topic of exercise during pregnancy.

The purpose of the present study was to examine the effectiveness of a persuasive message grounded in PMT on pregnant women’s beliefs toward exercise, their goal intention and implementation intention toward exercise, and their follow-up exercise behavior. It was hypothesized that: (a) women who received the PMT-present message would report higher PV, PS, RE, and SE, goal intention, implementation intention, and exercise behavior compared with those not receiving the message; and (b) consistent with theory, it is expected that PV, PS, RE, and SE will predict goal intention, which will in turn predict implementation intention, which should then predict exercise.

Method

Participants

Two hundred eight pregnant women were recruited from an obstetrician’s office in Southwestern Ontario. Women were eligible to participate provided they did not have any contraindications to exercise and were in their second or third trimester of pregnancy. The rationale underlying the decision to exclude women during their first trimester was twofold. First, with the exception of rare cases, prenatal care remains the responsibility of a woman’s general practitioner throughout the first trimester. Second, some women may be hesitant to begin an exercise program during the first trimester when miscarriage is more likely to occur. To ensure eligibility, women were told by the lead investigator that in order to participate they must meet the above criteria.

Only women who were under 31 weeks pregnant were used in subsequent analyses (n = 105) to test the study’s four hypotheses. This subgroup was chosen for the following reasons: (1) the protective benefits of exercise during pregnancy are minimal if a woman is nearing the end of her pregnancy, and (2) the physiological changes associated with late pregnancy may make exercise more difficult (Poudevigne & O’Connor, 2006). Participants in the subsample ranged in age from 15 to 40 (M = 27.26 years, SD = 5.69) and were between 14 and 30 weeks pregnant (M = 23.93 weeks, SD = 4.85). All relevant demographic characteristics are presented by group in Table 1.

Previous research examining the effects of a PMT-based message on exercise attitudes and follow-up behavior (Courneya & Hellsten, 2001; Graham et al., 2006) revealed medium to large effect sizes. An a priori sample size calculation estimated that for a between-groups design with an alpha level of .05 and a power of .80, a sample of 35 participants per group was needed (Cohen, 1992). Therefore, the sample size for the present study was adequate.

Development of PMT and Attention Control Brochure

Two separate brochures were produced for this study. The first, entitled Exercise During Pregnancy: Reducing Your Risk of Disease, incorporated the four major PMT constructs (PV, PS, RE, and SE). All information was factual and supported by academic references (Dawes, 2006; Weissgerber et al., 2006). PV was addressed by providing incidence rates for each condition, while PS involved a description of the possible consequences of each disease (e.g., “Potentially fatal, preeclampsia affects up to 10% of pregnant women . . .”). RE was targeted by providing information regarding the role of exercise in reducing the risk of maternal-fetal disease (e.g., “decreases your risk of developing gestational diabetes by up to 55%”), and SE was addressed by providing practical exercise suggestions and suggesting setting exercise goals (e.g., “The following activities . . .” and “begin with 15 minutes of exercise and work yourself up . . .”). In addition, a section entitled Turn Your Goals Into Reality was intended to target implementation intention by getting women thinking about how, when, and where they are going to exercise.

The second brochure served as an attention control condition and was entitled Diet and Pregnancy: Giving Your Baby a Healthy Start in Life. Similar in style, appearance, literacy level, and length, it provided information from Canada’s Food Guide (Health Canada, 2007) in addition to information specific to diet during pregnancy. The importance of setting goals for healthy eating was highlighted with practical suggestions such as “instead of simply using white or brown bread for your next sandwich, try a multigrain bagel.”

Measures

PMT Questionnaire. Sixteen items were adapted from Graham et al. (2006) to test the PMT constructs of PV, PS, RE, and SE. All questions were written with reference to “developing health problems during pregnancy,” and were rated on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree). Examples include the following: “Personally, I feel vulnerable to developing health problems at some point during my pregnancy” (PV); “The thought of developing health problems during my pregnancy scares me” (PS); and “I think physical exercise is one of the most important risk factors for health problems during my pregnancy that I could change” (RE). Given the similarities between SE and perceived behavioral control, SE was assessed by four 7-point items (Ajzen, 2007). A sample question is “If I wanted to I could easily do the types and amount of physical exercise necessary to reduce my risk of developing health problems during my pregnancy.”

A principal factor analysis with an oblique rotation produced a 4-factor solution, with all 16 of the items grouped into 4 coherent

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1 Please contact the corresponding (principal) author to obtain an electronic copy of the brochures.
2 Please contact the corresponding (principal) author for a copy of the complete questionnaire.
and interpretable factors: PS (4 items), PV (4 items), RE (4 items), and SE (4 items). Selection criteria was as follows: (a) an eigenvalue greater than one, (b) factor item loadings greater than 0.425 on the primary factor, and (c) factor item loadings less that 0.265 on the other factors. The four factors accounted for 69.1% of the total response variance. The subscales all demonstrated acceptable levels of internal consistencies that ranged from .79 to .90 (Tabachnik & Fidell, 2007).

Exercise goal intention. Goal intention for exercise was assessed using 3 items adapted from Graham et al. (2006). All were rated on a 7-point scale from 1 (definitely not) to 7 (definitely). A sample item is: “Do you plan to start an exercise program to reduce your risk of health problems during your pregnancy?” Reliability was adequate (α = .81).

Implementation intention. Implementation intention was assessed by four questions based on the items used by Norman and Conner (2005). Participants were asked whether they knew what type of exercise they would perform as well as whether they knew when, where, and how they might participate in exercise over the next week. Responses were rated on a 5-point scale from 1 (I have no idea . . .) to 5 (I know exactly . . .). Reliability was poor (α = .60), and further inspection revealed a rogue item. Once this item was removed, the reliability was substantially improved (α = .88).

Exercise. The Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985), which yields a total activity score in terms of the metabolic equivalent of task (METS), was used to assess baseline (preintervention) and follow-up exercise 1-week postintervention. Subjects were asked to indicate how many times they engaged in strenuous, moderate, and mild exercise over the course of the last 7 days for at least 30 min continuously. Thirty minutes was chosen as the minimum exercise session length based on clinical practice guidelines from SOGC (Davies et al., 2003).

Procedure

Following ethics approval, consent to recruit participants was obtained from an obstetrician’s office in Southwestern Ontario

Table 1

Demographic Characteristics for the Three Treatment Conditions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental (n = 36)</th>
<th>Attention control (n = 33)</th>
<th>Noncontact control (n = 36)</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>28.00 (5.07)</td>
<td>26.39 (6.18)</td>
<td>27.31 (5.87)</td>
<td>F(2, 102) = .68</td>
</tr>
<tr>
<td>Range = 19–38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeks pregnant</td>
<td>24.94 (4.38)</td>
<td>24.27 (4.68)</td>
<td>22.61 (5.27)</td>
<td>F(2, 102) = 2.54</td>
</tr>
<tr>
<td>Range = 14–30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnancy status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First pregnancy</td>
<td>47.2%</td>
<td>54.5%</td>
<td>52.8%</td>
<td>χ²(2, N = 105) = .41</td>
</tr>
<tr>
<td>Second or subsequent</td>
<td>52.8%</td>
<td>45.5%</td>
<td>47.2%</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>77.8%</td>
<td>75.8%</td>
<td>77.8%</td>
<td>χ²(8, N = 105) = 7.66</td>
</tr>
<tr>
<td>Other</td>
<td>22.2%</td>
<td>24.2%</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Married/common-law</td>
<td>86.1%</td>
<td>84.8%</td>
<td>75.0%</td>
<td>χ²(2, N = 105) = 1.78</td>
</tr>
<tr>
<td>Single/separated</td>
<td>13.9%</td>
<td>15.2%</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>Annual household income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under $25,000</td>
<td>16.7%</td>
<td>27.3%</td>
<td>16.7%</td>
<td>χ²(14, N = 105) = 8.78</td>
</tr>
<tr>
<td>$25,000–$40,000</td>
<td>11.1%</td>
<td>9.1%</td>
<td>13.9%</td>
<td></td>
</tr>
<tr>
<td>$40,000–$60,000</td>
<td>13.9%</td>
<td>18.2%</td>
<td>16.7%</td>
<td></td>
</tr>
<tr>
<td>$60,000–$80,000</td>
<td>13.9%</td>
<td>24.2%</td>
<td>13.9%</td>
<td></td>
</tr>
<tr>
<td>$80,000–$100,000</td>
<td>16.7%</td>
<td>3.0%</td>
<td>11.1%</td>
<td></td>
</tr>
<tr>
<td>$100,000–$150,000</td>
<td>11.1%</td>
<td>3.0%</td>
<td>5.6%</td>
<td></td>
</tr>
<tr>
<td>Over $150,000</td>
<td>2.8%</td>
<td>3.0%</td>
<td>2.8%</td>
<td></td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>13.9%</td>
<td>12.1%</td>
<td>19.4%</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed full time</td>
<td>38.9%</td>
<td>36.4%</td>
<td>52.2%</td>
<td>χ²(10, N = 105) = 7.24</td>
</tr>
<tr>
<td>Employed part time</td>
<td>25.0%</td>
<td>24.2%</td>
<td>11.1%</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>8.3%</td>
<td>15.2%</td>
<td>13.9%</td>
<td></td>
</tr>
<tr>
<td>Stay-at home mother</td>
<td>16.7%</td>
<td>15.2%</td>
<td>13.9%</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>5.6%</td>
<td>3.0%</td>
<td>8.3%</td>
<td></td>
</tr>
<tr>
<td>Self-employed</td>
<td>5.6%</td>
<td>6.1%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Education level achieved</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate/professional degree</td>
<td>19.4%</td>
<td>6.1%</td>
<td>2.8%</td>
<td>χ²(8, N = 105) = 13.38</td>
</tr>
<tr>
<td>Bachelors</td>
<td>11.1%</td>
<td>3.0%</td>
<td>16.7%</td>
<td></td>
</tr>
<tr>
<td>College or technical training</td>
<td>27.8%</td>
<td>48.5%</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>Secondary school diploma</td>
<td>27.8%</td>
<td>30.3%</td>
<td>36.1%</td>
<td></td>
</tr>
<tr>
<td>Some secondary school</td>
<td>13.9%</td>
<td>12.1%</td>
<td>19.4%</td>
<td></td>
</tr>
<tr>
<td>Baseline physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(METS/wk)</td>
<td>22.89 (2.30)</td>
<td>22.61 (3.88)</td>
<td>21.81 (2.42)</td>
<td>F(2, 103) = .04</td>
</tr>
</tbody>
</table>

Note. METS = metabolic equivalent of task.
during the period of April–August 2008. Women were approached by the lead investigator while waiting for their appointment and asked whether they would be willing to participate in a study examining women’s attitudes toward health and exercise during pregnancy. After providing informed consent and collecting demographic data, participants were randomly assigned to one of three treatment conditions: PMT-present (experimental), PMT absent (attention control), or no information (noncontact control). Nine women declined participation, 7 agreed but were called in for their appointments before having a chance to begin filling out the questionnaire, and 8 were ineligible because of contraindications to exercise. There were no risks involved with participation in the study.

A computer-generated random numbers list was created by the lead investigator using an online research randomization program (Urbańiak & Plous, 2008). Materials were coded by group from the beginning and handed out in the generated sequence. Participants were unaware of group assignment and completed all initial measures while waiting for their appointment. One week later, they were contacted by telephone and asked to indicate their level of physical activity over the last 7 days. The overall design of the study can be seen in Figure 1.

**Results**

**Group Equivalency**

One-way analysis of variance (ANOVA) and χ² procedures were used to ensure that there were no systematic differences between treatment groups on demographic characteristics. The results were not significant, indicating that there were no systematic differences between groups (see Table 1). Because of these results, it was deemed unnecessary to use demographic variables as covariates in the subsequent analyses.

**Group Differences**

**Beliefs toward maternal-fetal disease and exercise.** Separate one-way ANOVAs showed that the three treatment groups differed significantly on PS, RE, and SE (see Table 2). Planned comparisons tests found that the PMT-present group scored significantly higher on all three constructs when compared with their control counterparts.

**Exercise goal intention and implementation intention.** Separate one-way ANOVAs showed significant treatment group differences for goal intention but not for implementation intention (see Table 2). A planned comparisons test revealed that the PMT-present group reported significantly higher goal intention to engage in exercise compared with the other two control groups.

**Exercise behavior.** Exercise scores between treatment groups across time are illustrated in Figure 2 by METS and by average weekly minutes in Table 3. The analysis was by intention-to-treat and included all participants. Missing values were handled using last-observation-carried-forward methodology. A 3(group) × 2(time) repeated measures ANOVA for METS revealed a significant interaction effect, F(2, 105) = 21.48, p = .000, η² = .30. As recommended by Thomas, Nelson, and Silverman (2005), visual inspection of the interaction indicates that only participants in the PMT-present group reported increases in follow-up exercise behavior (see Figure 2).

**Correlations Between PMT Variables, Exercise Goal Intention, Implementation Intention, and Follow-Up Exercise Behavior**

Correlations between PMT variables, goal intention, implementation intention, baseline exercise, and follow-up exercise are presented in Table 4. If bivariate relations were found between the predictor variables and the criterion variable of interest, they were then entered into a regression analysis to determine their uncorrelated contribution.

**Predicting goal intention.** According to PMT, PV, PS, RE, and SE are expected to predict goal intention (Floyd, Prentice-Dunn, & Rogers, 2000; Milne, Sheeran, & Orrell, 2000). In the present study goal intention was related to PS, RE, and SE but not to PV. When these three constructs were entered together into a standard multiple regression, they accounted for 51% of the variance in goal intention, F(3, 101) = 37.57, p = .000. An examination of the beta coefficients showed that only RE and SE made significant and unique contributions: RE (β = .48, t(4, 100) = 5.86, p = .000); SE (β = .34, t(4, 100) = 4.45, p = .000).

**Predicting implementation intention.** Implementation intention was related to SE, RE, and goal intention. Given that implementation intention occurs after a goal intention has been formed (Gollwitzer, 1999), a hierarchical regression was conducted where goal intention was entered in the first block, followed by RE and SE in the second. Results indicated that goal intention was a significant predictor, accounting for 18.6% of the variance in implementation intention, F(1, 101) = 23.08, p < .000. The addition of RE and SE significantly increased the predictive utility of the model, explaining an additional 7.0% of the variance in
implementation intention, $R^2$ change = .07, $F$ change (2, 99) = 4.66, $p = .01$. An examination of beta coefficients revealed that only SE made significant and unique contributions to implementation intention, ($\beta = .27$, $t(3, 99) = 2.65, p = .009$).

**Predicting exercise behavior.** Follow-up exercise was significantly correlated with RE, SE, goal intention, and implementation intention. Consistent with theory, a hierarchical regression was conducted in which implementation intention was entered in the first block, goal intention in the second, and RE and SE in the third. Results showed that implementation intention alone accounted for 8.9% of the variance in follow-up exercise, $F(1, 66) = 7.52, p = .008$, and the addition of goal intention did not significantly increase the predictive utility of the model, $R^2$ change = .001, $F$ change (1, 65) = .06, $p = .81$. Although the addition of RE and SE explained an additional 7.0% of the variance in follow-up exercise, the change showed only a trend effect, $R^2$ change = .07, $F$ change (2, 63) = 2.68, $p = .08$. An examination of beta coefficients revealed that only SE made a significant and unique contribution to follow-up exercise, $\beta = .31$, $t(4, 63) = 2.17, p = .03$, and implementation intention showed a trend effect, $\beta = .23$, $t(4, 63) = 1.77, p = .08$.

**Discussion**

The results of the present study support the view that factual information about maternal-fetal disease grounded in PMT is an effective source of exercise motivation. Beyond this generalized conclusion, a number of specific issues warrant discussion.

First with the exception of PV, the present intervention successfully manipulated all three remaining PMT constructs. Cohen (1988) recommended using the following values to interpret the strength of the effect: .10 small, .25 medium, and .40 large. Effect sizes using this criteria indicate that RE was most strongly influenced, followed by SE and PS. This is in line with the majority of PMT research (Floyd et al., 2000). The failure to manipulate participants’ perception of vulnerability (PV) is consistent with previous research indicating that changing perceptions of vulnerability remains a challenge for health promoters (Milne et al., 2000). Several possible explanations exist. First, while studies using bogus information have generally been more successful in changing threat beliefs (Courneya & Hellsten, 2001; Milne et al.), the present study presented only factual information. Given the relatively low prevalence of maternal-fetal disease, it is possible that women perceived their risk of developing one of these conditions as small. Second, PV has been criticized for asking participants to indicate their personal vulnerability without giving them the option to state that they are unaware of the threat (Weinstein, 1988). Third, most of the women completing the questionnaires were healthy and young, and an optimistic bias toward serious disease is common among healthy young individuals (Weinstein, 1982). Furthermore, an independent samples $t$ test revealed that irrespective of treatment condition, women who had experienced complications during a previous pregnancy scored significantly higher on PV as compared with women in their second or subsequent pregnancy who had not previously experienced complications, $t(1, 98) = 4.21, p = .000$.

Second, with respect to intentions, goal intention was successfully manipulated, whereas implementation intention was not. The failure to manipulate implementation intention was unfortunate because it was the only intention construct to be significantly related to follow-up exercise behavior. Perhaps we might have found an implementation effect if RE had shown an association with implementation intention. The large effect observed for RE suggests that this variable had the greatest potential to produce an implementation intention effect. There is little doubt that the goal intention effect found was a direct result of effectively conveying the protective benefits of exercise during pregnancy (i.e., RE). Alternatively, had the intervention succeeded in manipulating SE to the same extent as RE, it is likely that an effect would also have been observed for implementation intention because the two constructs were related.

It is also possible that targeting SE in a different way would have led to a greater observed effect. Pregnant women face several unique barriers to exercise, which include physiological changes that make exercise more difficult, increased fatigue, and looking after other children (Symons Downs & Hausenblas, 2004). The intervention targeted SE by providing a list of structured activities that are safe and effective during pregnancy (i.e., brisk walking, stationary cycling, etc.), as well as setting basic exercise goals.

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3 Supporting our decision to exclude women who were 31 weeks or more pregnant, several differences were found when the data was reanalyzed using the full sample ($N = 208$). In particular, the effects found for PS ($\eta^2 = .03$), RE ($\eta^2 = .17$), SE ($\eta^2 = .03$), goal intention ($\eta^2 = .03$), and exercise behavior ($\eta^2 = .14$) were substantially smaller; and goal intention and SE explained much less variance in implementation intention scores (19%).
Perhaps the message would have been more effective had it also provided practical suggestions on incorporating more free-living physical activity into one’s lifestyle (i.e., park your car further away from the store, take the stairs rather than the elevator, etc.). A final plausible reason for why there was no implementation effect is that the PMT-present brochure failed to provide an opportunity for participants to form their own implementation intention plans, which likely diluted the importance of this information. Formulating such plans is a highly individualized process and a key component of any implementation intention intervention (Koestner, Lekes, Powers, & Chicoine, 2002).

Third, a very large treatment group by time interaction effect was found for exercise behavior. An examination of the interaction shows that while both control groups slightly decreased their exercise levels between baseline and follow-up, the PMT group was the only one to increase their exercise behavior (see Figure 2). The increase is consistent with other PMT and exercise research (Graham et al., 2006) while the decrease exhibited by both control groups is consistent with previous research examining women’s exercise patterns during pregnancy (Clissold, Hopkins, & Seddon, 1991; Poudevigne & O’Conner, 2006).

Fourth, three of the four PMT constructs (PS, RE, SE) were significantly related with goal intention (see Table 4). A regression analysis showed that only the two coping appraisal variables (RE, SE) made unique contributions to goal intention scores, explaining 51% of the response variance. In accordance with meta-analytic findings on PMT, RE showed the strongest relationship with goal intention (Milne et al., 2000). RE also was the most strongly manipulated in the present study, which points to the real world applicability of the present intervention.

Fifth, SE was the only construct in our model to significantly predict implementation intention and follow-up exercise behavior. These findings highlight the importance of this social–cognitive construct (McAuley & Blissmer, 2000). The exercise behavior findings are not in accordance with the Milne et al. (2000) PMT meta-analysis. They found that goal intention had the strongest, most robust, and most consistent association to concurrent health behavior.

Sixth, although goal intention accounted for 12% of the variance in implementation intention, it did not account for significant variance in follow-up exercise behavior. One possible reason for this is the potential lack of scale correspondence between the two measures. Perhaps if goal intentions had been worded to capture the dose of the exercise (i.e., intensity, frequency, and duration), they may have correlated more strongly with our measure of exercise behavior. Implementation intention, however, accounted for 12% of the variance in follow-up behavior, indicating that goal intention likely influenced behavior indirectly through its effect on implementation intention. According to a meta-analysis of studies dealing with implementation intention, Koestner et al. (2002) state that one of the main reasons for ineffective goal pursuit is the failure to develop specific action plans that specify how goals will be accomplished. The failure of goal intention to act as a significant predictor of follow-up behavior in the present study indicates that only participants who formed concrete implementation intentions actually followed through with behavior. Our findings underscore Gollwitzer’s (1999) notion that implementation intention helps bridge the goal intention—behavior (i.e., exercise) gap.

Although the present study is the first to examine the effectiveness of a persuasive message grounded in PMT on pregnant

Table 3

<table>
<thead>
<tr>
<th>Variables</th>
<th>Experimental (n = 36)</th>
<th>Attention control (n = 33)</th>
<th>Noncontact control (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
</tr>
<tr>
<td>Mild exercise</td>
<td>96.67 (68.45)</td>
<td>103.32 (59.33)</td>
<td>77.45 (76.13)</td>
</tr>
<tr>
<td>Moderate exercise</td>
<td>58.33 (47.54)</td>
<td>75.90 (49.50)</td>
<td>66.37 (57.00)</td>
</tr>
<tr>
<td>Vigorous exercise</td>
<td>11.67 (25.13)</td>
<td>13.33 (26.30)</td>
<td>12.73 (40.41)</td>
</tr>
</tbody>
</table>

*Note. SD in parentheses.*
women's exercise behavior, there are several limitations that should be acknowledged. One limitation is our failure to successfully manipulate PS. This is problematic, because all components of the PMT framework need to be manipulated to adequately test the effectiveness of the model. In addition, the present results can only be generalized to white, middle class women who are between 14 and 30 weeks pregnant. In addition, the absence of a pretest belief assessment period prevented conclusions to be drawn about actual change in the PMT and intention constructs. Finally, the measures used to assess baseline and follow-up exercise behavior were all self-report and retrospective. Despite the widespread use of such measures, some have suggested (Wareham & Rennie, 1998) that researchers make more of an effort to use objective measures (e.g., accelerometers) to strengthen conclusions about the effectiveness of interventions in changing (improving) exercise behavior.

There are several avenues of research that stem from the present findings. For instance, according to Estabrooks and Gyurcsik (2003), maintaining an exercise program requires progression through three phases: (1) motivation and intention to exercise, (2) successful initiation, and (3) successful maintenance. By assessing only beliefs, intentions, and exercise behavior 1-week postintervention, the present study only addressed the first two steps. Although previous work suggests that it is unlikely the increased exercise behavior would have continued much beyond 1 to 2 weeks’ posttreatment (Graham et al., 2006), there is evidence that supplementing a PMT intervention with implementation intentions strengthens the behavioral outcome significantly (Milne, Orbell, & Sheeran, 2002). As mentioned earlier, the present study highlighted the importance of forming implementation intentions (or action plans), but was not designed to deliver an engaging action planning intervention (Ziegelmann, Lippke, & Schwarzer, 2006). Future studies should, therefore, explore how such an intervention might augment a PMT-only intervention to maintain exercise in pregnant women. Another recommendation is to tailor the messages so that they correspond with the individual's style of processing health-relevant information (Salovey & Williams-Piehota, 2004). The premise here is that matched messages will be more effective in promoting behavior change (i.e., exercise and physical activity) than mismatched messages.

The current findings have implications for both research and practice. First, it should be mentioned that the majority of successful PMT interventions have used nonfactual information, which was manipulated into high and low conditions. The limited real-world applicability of these studies has fostered criticism of PMT as a potentially unsuccessful method of bringing about cognitive change through health education (Milne et al., 2000). For this reason, it is important to highlight the need for more ecologically valid studies using PMT as a theoretical framework. The results of the present study are encouraging in this regard and lend support to the idea that PMT may, despite past criticism, be a successful method of bringing about positive cognitive and behavioral change through the use of balanced and factual health information. Second, the present study suggests that brochures are an effective medium for conveying information about health and exercise to pregnant women. Compared with other mediums such as DVDs, brochures possess several advantages; they are cost-effective, easily reproduced, can be read while one is waiting for an appointment, and can be made readily available in a variety of settings including doctor’s offices.

Conclusions

In conclusion, this is the first study to support the view that presenting pregnant women with factual information about the role of exercise in the prevention of maternal-fetal disease may be an effective source of exercise motivation. However, more studies are needed to confirm whether such an intervention can lead to long-lasting behavior change.

References


Courneya, S., & Hellsten, K. (2001). Cancer prevention as a source of...


