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Mediators of a physical activity intervention among women with a family history of breast cancer

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Abstract

The current study examined mediators of an efficacious physical activity intervention. Women with a mean age of 42.6 (range 23–61) years and a family history of breast cancer were randomized to either an Internet-based physical activity intervention ($n = 28$) or an active control condition ($n = 27$) for three months. Data were collected between November 2010 and August 2011. Hypothesized mediators were examined using a product of coefficients model with bootstrapped standard errors. Significant mediation was observed for both self-efficacy and behavioral processes. Specifically, the regression coefficients of the indirect effects (“ab path”: unstandardized effect of the intervention on physical activity that occurred through the mediator) were $ab = 38.58$ (95% confidence interval [CI]: 8.66–92.76) for self-efficacy, and $ab = 42.02$ (95% CI: 6.76–104.84) for behavioral processes. Other factors examined in this study, including cognitive processes, decisional balance, and perceived risk of breast cancer, were not statistically significant mediators. Findings suggest that self-efficacy and behavioral processes may be key constructs to use in targeting future physical activity interventions among women with a family history of breast cancer.

Keywords

Behavioral science; exercise; intervention study; mediation analyses

Introduction

Breast cancer is a significant public health concern. An estimated 12% of women will develop invasive breast cancer at some point in their life times, and this percentage is roughly twofold higher among women with a mother, sister, and/or daughter who have been diagnosed with breast cancer (Nelson et al. 2012). While this additional risk for breast cancer attributed to family history cannot be altered, some factors that may modulate risk, such as physical activity levels, can be modified: findings from over 70 observational studies support an approximately 25% lower risk of breast cancer among physically active women, relative to those who are inactive (Friedenreich 2010). Despite what is known about the benefits of physical activity for cancer prevention, only 46% of U.S. women meet the recommended levels of physical activity (Ward et al. 2015). Furthermore, data from the 2014 Health Information National Trends Survey suggested that physical activity behaviors may be similarly low for women with a family history of breast cancer (Amuta and Barry 2015). These low rates of physical activity engagement, coupled with the public health burden of breast cancer, highlight the need for research assessing methods to motivate physical activity behavior change effectively among women with a family history of breast cancer.

Intervention efforts to increase physical activity that tailor to familial risk or specifically target women with a family history of breast cancer are rare, but the few conducted to date have been moderately efficacious in increasing physical activity levels (Hartman, Dunsiger, and Marcus 2013; Ruffin et al. 2011). For example, one 12-week physical activity intervention significantly increased moderate-to-vigorous intensity physical activity (MVPA) (Hartman, Dunsiger, and Marcus 2013). However, only 41% of participants met the American College of Sports Medicine criteria of engaging in 150 minutes or more of moderate intensity activity at 12-weeks, suggesting that more could be done to promote behavior change. Among the general population, intervention efforts to increase physical activity have also yielded modest to moderate success (Conn, Hafdahl, and Mehr 2011; Hillsdon, Foster, and Thorogood 2005). A meta-analysis of 358 reports (99,011 participants) of physical activity intervention studies found that the overall mean effect size for treatment vs. control was 0.19 (Conn, Hafdahl, and Mehr 2011), a small effect size for behavioral trials.

One way to enhance the efficacy of physical activity behavior change interventions is through the application of behavioral science theories (Glanz and Bishop 2010). These theories help researchers identify intervention targets, as well as the approaches needed to achieve behavior change. Theory-based interventions are postulated to influence behavior through changes in one or more theoretical “constructs,” such as decisional balance or self-efficacy (Glanz and Bishop 2010; Rhodes and Pfaeffli 2010). Measuring and analyzing these constructs in the context of the intervention can help researchers understand which components of an intervention worked. This information can also assist in the design of more efficacious interventions and can support resource and cost savings. If the intervention is efficacious due to changes in the theoretical constructs, these constructs are considered mediators of behavior change.

The present study examined the mediators through which a minimal contact, theoretically-grounded, Internet-based physical activity intervention successfully increased physical activity levels among women with a family history of breast cancer (Hartman et al. 2015). The intervention was based on principles of the Transtheoretical Model (TTM) and the Social Cognitive Theory (SCT); therefore, the current study examined SCT and TTM constructs as possible mediators of physical activity behavior change. The SCT postulates that behaviors are determined by a dynamic and reciprocal interaction of personal factors, environmental influences, and behavioral characteristics (Bandura 1986). According to the SCT, one's self-efficacy, or confidence in his/her ability to change behavior is vital to (and thus a key construct of) behavior change (Bandura 1977). The TTM posits that individuals progress through a series of stages as they adopt and maintain a new behavior (Prochaska and DiClemente 1983). The TTM constructs include strategies people use as they advance through these stages (known as processes of change), as well as a construct characterized by weighing the pros and cons of behavior change (known as decisional balance).

This study was exploratory, given the limited sample size. Nevertheless, it offers a unique contribution to the literature because it provides insight into the mediators of physical activity behavior change in a sample of women who are at an elevated risk of developing breast cancer, which may be different than other previously studied populations of adults. In addition to investigating whether SCT and TTM constructs may have mediated behavior change, the current study examined whether breast cancer-related motivations and contextual factors (e.g., perceived risk of breast cancer) also mediated behavior change. It was hypothesized that SCT and TTM constructs, in addition to perceived risk of breast cancer, would mediate the effect of a physical activity intervention among women with a family history of breast cancer.

Methods

Study design and sample

This study used data from a three-month, theoretically-grounded, Internet-based physical activity pilot intervention that targeted women at an increased risk for breast cancer.

Details of the study's eligibility criteria and data collection processes and procedures have been described elsewhere (Hartman et al. 2015). To summarize briefly, the study enrolled 56 women who: were currently sedentary (engaged in less than 60 minutes per week of moderate intensity physical activity); were between 21 and 65 years of age; had a mother or sister who had previously been diagnosed with breast cancer; and self-reported eating three or fewer servings of fruits and vegetables per day. Women were excluded if they: had a personal history of cancer, except basal cell carcinoma; were pregnant or intended to become pregnant within three months of study enrollment; had a history of severe psychiatric illness; or had a condition that would make exercise difficult or dangerous.

Recruitment was conducted by posting advertisements on a variety of Websites, including [craigslist.org](https://www.craigslist.org), in 10 cities throughout the eastern and central time zones. Eligibility was evaluated with a telephone interview. Eligible women were sent an informed consent form, in which they were required to sign and mail, fax, or scan back to the study team.

After signed informed consent was received, study participants completed a series of initial assessments, including online study questionnaires and a telephone-based assessment of physical activity, and were thereafter randomized to either a three-month physical activity intervention or an active control arm. Follow-up study assessments, which were conducted at months three and five, included online psychosocial questionnaires, and a telephone-administered seven-day Physical Activity Recall (PAR)(Blair et al. 1985). All procedures performed involving human participants were in accordance with the ethical standards of the institutional review board of The Miriam Hospital, RI, which approved the study protocol, and all participants provided written, signed informed consent.

Participation

Study staff received 314 calls from women who were interested in the study, of whom 246 were assessed for eligibility (68 could not be contacted). One hundred and twenty-six women did not meet the eligibility requirements, and 21 declined before eligibility could be assessed. The reasons for being ineligible were being too active ($N = 34$), not having a first-degree relative diagnosed with breast cancer ($N = 20$), eating too many fruits and vegetables per day ($N = 20$), having a medical condition that restricted mobility ($N = 19$), having a medical condition that may have made exercise dangerous ($n = 17$), history of other cancer ($n = 4$), participation in another exercise or weight loss program ($n = 5$), and other reasons ($n = 7$). Of the 99 women deemed eligible for study participation, 56 women were randomized into the intervention ($N = 28$) and control arms ($N = 28$). Reasons for not being randomized included not providing informed consent ($N = 30$) or not completing pre-randomization activities ($N = 13$).

One participant was diagnosed with breast cancer and was withdrawn from participation two weeks after being randomized. At the three-month follow-up, four participants in the intervention and two participants in the control group were lost to follow-up; no additional participants were lost to follow-up at five months.

Interventions

Physical activity intervention—The physical activity intervention was a three-month Internet-based program with brief telephone counseling and was designed to motivate participants to increase their MVPA with the goal of reaching 45–60 minutes of MVPA most days of the week. Although this physical activity goal is higher than public health recommendations for cancer prevention, it was selected because of the evidence suggesting that higher amounts of physical activity may provide even greater reductions in cancer risk (Kushi et al. 2012). The intervention used formative research (specifically, focus groups) when developing the intervention to ensure that it targeted the interests and needs of women at an increased risk for breast cancer (Hartman and Rosen 2017). A total of seven focus groups were conducted among 20 women (mean age = 40 years) who had a first-degree female relative who had been diagnosed with breast cancer and who were participants in a different physical activity intervention.

Participants in the physical activity intervention arm were given access to an interactive study website that was designed to help them reach their physical activity goals. The

information provided on the website drew from topics obtained from focus groups, as well as established behavior change strategies (Kok et al. 2015) to influence skills and capability, foster social support, and build self-efficacy. Specifically, the intervention included: (1) tools to self-monitor physical activity; (2) a message board to interact with other participants and study staff; (3) graphs depicting the participant's progress in relation to other women in the study; (4) details of personalized physical activity goals; and (5) information and resources about physical activity and breast cancer. The breast cancer-related topics included evidence-based information on modifiable and non-modifiable risk factors for breast cancer, as well as general information about breast cancer (e.g., the importance of breast cancer screening, and myths and facts about breast cancer). The website also detailed the advantages of physical activity for reducing breast cancer risk.

In addition to the website, participants received a call at week 2 from the study psychologist, which included a review of progress and barriers to physical activity adoption and maintenance. The week 2 call was also used to teach participants how to set new goals as needed so they could work up to the study's physical activity goal. Furthermore, participants received 2–3 emails per week for three months. These emails included brief tips and facts about physical activity and breast cancer, motivational materials about physical activity, and individually-tailored feedback reports. The reports provided information consisting of preplanned counseling messages that were tailored to each participant's barriers to, and expected benefits from physical activity. A doctoral-level psychologist with experience in health behavior change techniques oversaw all intervention procedures and content. Participants were followed for an additional two months after the intervention period, during which time they continued to have access to the study website.

Active control arm—Participants randomized to the active control arm received a nutrition intervention designed to encourage increased intake of fruits and vegetables, which was a modified version of an existing, non-tailored intervention (Gans et al. 2015). Participants in the active control arm had access to a study website containing nutrition-related information and materials.

Measures

Assessment of physical activity—Physical activity was self-reported using the 7-day Physical Activity Recall (PAR) (Blair et al. 1985). The 7-day PAR is an interviewer-administered measurement tool that has been well-validated (Hayden-Wade et al. 2003; Johnson-Kozlow et al. 2006) and shown to be sensitive to change over time (Dunn et al. 1999). Number of minutes per week of MVPA was calculated for each participant in the study.

Psychosocial measures—Self-efficacy was evaluated using a 5-item instrument that assesses the following: confidence in resisting relapse, making time for physical activity, and overcoming negative affect (Marcus et al. 1992b). Processes of behavior change were assessed with the 40-item Processes of Change for Physical Activity instrument, which includes both behavioral and cognitive process of change (Marcus et al. 1992a). Examples of behavioral processes of change include substituting alternatives, enlisting social support, as

well as rewarding and reminding oneself. Examples of cognitive processes of change include increasing knowledge, warning of risks, caring about consequences to others, comprehending benefits, and increasing healthy opportunities. The Processes of Change instruments have been shown to be reliable and accurately differentiate participants across stages of motivational readiness for physical activity adoption (Marcus et al. 1992a). Each of the five cognitive and five behavioral processes of change was examined by four items assessing a number of events during the past month using a 5-point Likert scale ranging from 1 = never to 5 = repeatedly. A total cognitive process score and a total behavioral process score were calculated for the current study. Decisional balance for physical activity was assessed using a 16-item instrument with two sub-scales: one indicative of the benefits (or “pros”) of increased physical activity, and the other of negative consequences (or “cons”) of physical activity engagement (Marcus, Rakowski, and Rossi 1992). Perceived risk of developing breast cancer was evaluated using two questions modeled from previous research assessing absolute and relative risk of breast cancer (Brain et al. 1999; Rowe et al. 2005).

Other measures—Demographic information was obtained at baseline through a self-report questionnaire. Height and weight were also self-reported.

Statistical analysis

All analyses were conducted using an intent-to-treat approach, such that all eligible randomized participants were included in the analysis ($N = 55$). Baseline demographics and physical activity level were summarized using descriptive statistics. Unadjusted values of the hypothesized mediating variables were summarized at baseline and three months separately by treatment arm. Potential mediators of the intervention effect on minutes/week of MVPA at five months were explored using a series of mediation models based on the product of coefficients approach with bootstrapped standard errors (Preacher and Hayes 2008). Mediators were considered to be the absolute scores at three months, with baseline MVPA and baseline value of the hypothesized mediator treated as covariates. This method allows for estimation of “a path” coefficients (effect of intervention on the proposed mediators), “b path” (effect of mediator on the outcome), and indirect effects (“ab path”: effect of intervention on MVPA that occurs through the mediator). Given a total sample size of $N = 55$ and two-sided $\alpha = 0.05$, we would be able to detect an indirect effect size of $f^2 = 0.15$ with 80% power.

Mediators were chosen a priori because they were constructs that were targeted by the intervention and included self-efficacy, decisional balance, cognitive processes, and behavioral processes. Perceived risk of developing breast cancer was also evaluated as a possible mediator. As no additional baseline variables (besides physical activity level) differed between the intervention and control groups, only baseline MVPA and baseline value of the hypothesized mediators were included as covariates in the mediation models. Due to the small sample size and limited statistical power of this pilot trial, these mediating variables were examined in separate models instead of together in a multiple mediation model. A variable was considered a mediator if the regression coefficient for the indirect effect (i.e., unstandardized effect of the intervention on physical activity that occurred through the mediator) was significantly different than zero.

Results

Participants were a mean age of 42.6 years ($SD = 11.4$), were predominantly white (93%), and had a mean body mass index (BMI) of 27.3 kg/m² ($SD = 4.8$) (Table 1). Participants in the intervention group did not differ significantly from the control group at baseline on any of the demographic characteristics measured, although the active control arm reported significantly more minutes per week of MVPA at baseline than the intervention group ($F = 6.177$, $p = .016$). This difference in physical activity between groups was controlled in subsequent mediation analyses by including baseline physical activity as a covariate in models, as mentioned previously.

The overall effects of the intervention on physical activity and psychosocial outcomes have been published elsewhere (Hartman et al. 2015). In brief, the intervention arm had significantly greater increases in minutes of MVPA compared to the active control arm at three months (intervention group increasing from a mean of 14.11 minutes/week to 213.13 minutes/week, compared to the increase in the active control arm from 30.22 minutes/week to 129.04 minutes/week ($B = 100.39$; $SE = 30.25$, $p = .0013$). This significant between-group difference in physical activity was maintained at the five-month follow-up (207.92 minutes/week vs. 118.70 minutes/week; $B = 105.86$; $SE = 29.89$; $p = .0006$). As previously published, in adjusted models, participants in the physical activity intervention also had an estimated 0.72-point higher self-efficacy score for physical activity at three months ($p < .01$) and 0.51 higher self-efficacy at 5 months ($p = .05$). However, no statistically significant differences were observed between groups at either time point for the other psychosocial outcomes that were evaluated.

The active control arm had a higher mean cognitive process score, compared to the intervention arm at baseline (Table 2). No other significant cross-sectional differences were observed between the intervention and control groups at baseline.

Mediation analyses suggested significant mediating effects for self-efficacy and behavioral processes (Table 3). Specifically, intervention participants reported higher mean self-efficacy scores at three months, controlling for baseline MVPA and self-efficacy (Parameter Estimate [PE] representing the unstandardized regression coefficient of the a path = 0.52, $se = 0.3$, $p = .05$). Higher mean self-efficacy scores at three months were associated with higher minutes/week of MVPA at five months, controlling for baseline covariates (PE of b path = 73.63, $se = 20.3$, $p < .01$). In terms of indirect effects (e.g., unstandardized effect of the intervention on physical activity that occurred through the mediator), the regression coefficient of the ab path was 38.58, 95% CI: 8.66–92.76. These results suggest that differences between intervention and control groups in mean MVPA at five months were due in part to greater mean self-efficacy at three months among intervention participants compared to those in the control group, after adjusting for baseline MVPA and self-efficacy scores.

With respect to behavioral processes, significant a, b and ab paths were observed such that the intervention was associated with higher mean behavioral processes at three months, controlling for baseline MVPA and behavioral process scores (PE of a path = 0.42, $se = 0.2$,

$p = .03$); higher mean behavioral processes at three months were associated with higher mean MVPA at 5 months, controlling for baseline covariates scores (PE of b path = 101.06, $se = 29.9$, $p = .002$) and significant indirect effects of the intervention through behavioral processes (PE of ab Path = 42.02, 95% CI:6.76–104.84). Thus, differences between intervention and control arms with respect to mean MVPA at five months were due in part to greater mean behavioral processes at three months among intervention participants compared to those in the control group, after adjusting for baseline MVPA and behavioral process scores. No statistically significant mediation effects were observed for cognitive process, decisional balance, or perceived risk of developing breast cancer.

Discussion

This study examined possible mediators of physical activity behavior change in response to an Internet-based physical activity intervention among women with a family history of breast cancer. Specifically, several constructs from the TTM and SCT were evaluated that may have contributed to participants in the intervention group increasing their physical activity level more than those in the active control arm. Results indicated that self-efficacy and behavioral processes of change mediated the effects of the intervention on physical activity engagement, but no evidence of mediation was observed for any of the other hypothesized mediating variables.

These findings add to the accumulating body of research illustrating the importance of targeting behavioral processes (e.g., enlisting social support, rewarding and reminding yourself) in physical activity behavior change interventions. For example, a 2002 review of theory-based physical activity interventions by Lewis and colleagues identified behavioral processes of change as the most consistent construct mediating the relationship between theory-based physical activity interventions and physical activity engagement (Lewis et al. 2002). More recently, Papandonatos and colleagues showed that changes in behavioral process mediated the relationship between a 12-month, individually tailored, physical activity intervention and changes in activity levels among 239 healthy under-active adults (Papandonatos et al. 2012); and in an updated review, Rhodes et al. recommend targeting self-regulatory constructs such as behavioral processes in physical activity interventions (Rhodes and Pfaeffli 2010). Taken together, the consistency of these findings across a variety of studies and study populations suggests that interventions designed to target behavioral processes are likely to be effective in promoting physical activity behavior change.

Our finding that self-efficacy mediated the relationship between the intervention and physical activity outcomes is a divergence from results of previous studies, which have found limited or weak evidence that self-efficacy is a mediator of physical activity behavior change (Lewis et al. 2002; Papandonatos et al. 2012; Rhodes and Pfaeffli 2010). For example, a 2010 review of the literature by Rhodes and colleagues reported that a mediator effect for self-efficacy was not supported by four of the five studies the authors identified that used formal mediation tests (Rhodes and Pfaeffli 2010). It is possible that differences in either the intervention delivery channels or the behavior change strategies used account for discordant findings for self-efficacy as a mediator between our study and previous ones. For example, self-efficacy may be a more important construct to target when using non face-to-

face delivery channels, such as the current study's Internet-based intervention. Additionally, the intervention used in the current study heavily emphasized strategies to self-monitor behavior, set goals, as well as incorporated elements of verbal persuasion (via messages and emails); therefore, the intervention was well positioned to influence self-efficacy with the goal of promoting behavior change (Kok et al. 2015).

Consistent with previous studies (Napolitano et al. 2008; Papandonatos et al. 2012), decisional balance was not a mediator of physical activity behavior change; nor did the intervention significantly influence decisional balance at three months (a-path). However, it is notable that scores on the decisional balance "pros" subscale were statistically significantly associated with physical activity behavior (b-path), suggesting that decisional balance pros could be a mediator in studies that effectively enhance it. Forthcoming physical activity interventions may consider specifically emphasizing (targeting) the benefits of physical activity adoption (e.g., improved health, stress reduction) to see whether it promotes behavior change.

Perceived risk of developing breast cancer was not a mediator of physical activity behavior change in this sample of women with a family history of breast cancer; nor did the intervention influence this breast cancer construct. This was a surprising finding, given that women in this study were provided with a wealth of information and resources regarding physical activity and breast cancer, including details on the benefits of physical activity for reducing breast cancer risk. It is possible that simply providing information and resources about breast cancer topics are not sufficient to affect risk perception. Rather, other behavioral strategies (e.g., self-reevaluation, self-affirmation, framing) may also be necessary to influence this construct with the goal of promoting behavior change (Kok et al. 2015). It is also notable that our sample did not perceive their risk of cancer to be much higher than that of other women their age. Therefore, it is plausible that breast cancer-related psychosocial variables are only effective intervention targets among women who perceive that they are at a high risk of developing cancer.

Findings from this study may be limited by the relatively homogeneous sample, which reduced the generalizability of the finding, as well as the small sample size of this pilot trial, which restricted our statistical power to detect modest but potentially meaningful associations as statistically significant. The low participation rate in the trial was another limitation, as it could have reduced the accuracy of our results due to potential participation bias. Also, although physical activity was assessed using a well-validated self-report measure (7-day PAR), the physical activity estimates may be biased by factors such as social desirability (Adams et al. 2005). The physical activity measure used in this study also does not account for activities of less than 10 minutes in duration. Thus, this measurement tool has the potential to underestimate physical activity among women who accumulate it in short episodic bouts throughout the day. Also, given the relatively small sample size, each mediator was assessed separately in multivariable models instead of together in multiple mediation models. Therefore, we did not account for possible interrelationships between the mediators evaluated in this study. Larger trials among women with a family history of breast cancer should consider examining mediators of physical activity behavior change using multiple mediation analyses.

Strengths of this study are notable and include the experimental study design, with the intervention group assignment, the assessment of possible mediating variables, and the follow-up assessments of physical activity conducted at different time points—minimizing potential issues of temporality in mediation analyses (Lockhart, MacKinnon, and Ohlrich 2011). Furthermore, bootstrap methods to assess mediation were used, which is recommended in small to moderate samples (Shrout and Bolger 2002).

In summary, the results of this study provide preliminary evidence that self-efficacy and behavioral processes are important targets for Internet-based physical activity interventions among women with a family history of breast cancer. To our knowledge, this is the first study to examine the mediators of physical activity behavior change in this population subgroup. If supported by larger studies, findings may help improve the efficacy of future physical activity interventions among women with a family history of breast cancer.

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Table 1

Baseline characteristics by study group in a sample of women with a first degree relative diagnosed with breast cancer.

	Intervention (<i>n</i> = 28)	Active Control (<i>n</i> = 27)	All (<i>n</i> = 55)
Mean (SD) age, years	42.4 (11.0)	42.7 (12.0)	42.6 (11.4)
Attended College	86%	100%	93%
Married	50%	37%	44%
White	96%	82%	91%
Non-Hispanic Latino	89%	93%	91%
Mean (SD) BMI, kg/m ²	27.6 (5.1)	26.9 (4.5)	27.3 (4.8)
Number of Children in Home	1.0 (1.1)	1.6 (3.8)	1.3 (2.8)
MVPA ^{<i>I</i>} (minutes/week) [*]	14.1 (22.5)	30.2 (25.5)	22.0 (25.2)

^{*} Significant between-group difference, $p < .05$;

^{*I*} Moderate-to-vigorous intensity physical activity.

Table 2

Baseline, 3-month, and 5-month scores by study group for hypothesized mediating variables among women in an internet-based Physical Activity (PA) intervention.

	Baseline			3-month		5-month		
	PA Intervention <i>n</i> = 28	Active Control <i>n</i> = 21	PA Intervention <i>n</i> = 25	Active Control <i>n</i> = 24	PA Intervention <i>n</i> = 24	Active Control <i>n</i> = 24	PA Intervention <i>n</i> = 24	Active Control <i>n</i> = 25
Self-efficacy (range 1–5)	2.18 (0.9)	2.24 (0.9)	3.01 (1.0)	2.56 (0.9)	2.87 (1.06)	2.61 (1.03)		
Behavioral Processes (range 1–5)	2.47 (0.6)	2.71 (0.6)	3.29 (0.8)	3.04 (0.6)	3.11 (0.90)	3.10 (0.70)		
Cognitive Processes (range 1–5)	2.84 (0.7) *	3.23 (0.7)	3.23 (0.9)	3.31 (0.7)	3.13 (0.94)	3.34 (0.60)		
Decisional Balance Pros (range 2.5–5)	3.97 (0.6)	4.25 (0.6)	3.88 (0.9)	4.18 (0.6)	3.85 (0.75)	4.16 (0.56)		
Decisional Balance Cons (range 1–4.8)	2.65 (0.9)	2.71 (0.8)	2.49 (0.9)	2.55 (0.9)	2.33 (0.85)	2.54 (0.96)		
Perceived Risk (range 11–60)	38.93 (11.0)	39.25 (8.4)	42.29 (10.2)	39.19 (8.6)	39.08 (9.9)	39.24 (6.9)		

* Significant between-group difference at baseline, $p < .05$.

Table 3

Mediating effects of behavior change constructs on changes in MVPA¹ Among ($N = 55$) women in an Internet-based physical activity intervention.

Putative Mediator	a Path PE ² (SE)	b Path PE ² (SE)	ab Path PE ² (SE)	95% CI of ab Path
Self-efficacy	0.52 (0.3) ⁺	73.63 (20.3) ^{**}	38.58 (20.2)	8.66–92.76
Behavioral Processes	0.42 (0.2) [*]	101.06 (29.9) ^{**}	42.02 (24.5)	6.76–104.84
Cognitive Processes	0.29 (0.2)	50.57 (35.4)	14.69 (17.9)	–3.62–74.14
Decisional Balance Pros	–0.22 (0.2)	60.02 (29.4) [*]	–12.99 (17.0)	–69.23–8.59
Decisional Balance Cons	–0.05 (0.3)	–40.01 (23.5)	2.04 (10.4)	–14.69–28.34
Perceived Risk	2.08 (2.0)	–1.39 (2.9)	–2.89 (12.7)	–36.04–17.04

Note: PE = Parameter Estimate; SE = Standard Error. Mediators were examined in separate mediation models, with baseline values of the hypothesized mediator and baseline moderate-to-vigorous intensity physical activity treated as covariates.

¹Moderate-to-vigorous intensity physical activity

²Parameter estimates are unstandardized regression coefficients

⁺ $p = .05$

^{*} $p < .05$

^{**} $p < .001$.