

Feasibility and Effectiveness of a Web-Based Physical Activity Intervention for Working Mothers

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Background: The purpose of this study was to examine the feasibility and effectiveness of a web-based intervention to promote physical activity and self-worth among working mothers. **Methods:** Participants ($N = 69$) were randomly assigned to receive a standard web-based intervention or an enhanced intervention that included group dynamics strategies to promote engagement. The 8-week intervention was guided by self-determination theory. Each week, participants were instructed to complete 3 tasks: listen to a podcast related to well-being, complete a workbook assignment, and communicate with other participants on a discussion board. Participants in the enhanced condition received an additional weekly task to enhance group cohesion. Data were collected at baseline, week 8, and week 16. **Results:** Physical activity ($P < .001$, $\eta^2 = 0.35$) and self-worth ($P < .001$, $\eta^2 = 0.39$) increased significantly in both groups following the intervention, and introjected ($P < .001$, $\eta^2 = 0.30$) and external motivation ($P = .04$, $\eta^2 = 0.10$) decreased. Website use declined across the 8-week intervention in both groups ($P < .001$, $\eta^2 = 0.48$); however, discussion board use was higher in the enhanced condition ($P = .04$, $\eta^2 = 0.21$). **Conclusions:** These findings suggest web-based interventions can improve physical activity and self-worth among working mothers. Group dynamics strategies only minimally enhanced user engagement, and future studies are needed to optimize web-based intervention designs.

Keywords: group dynamics, Internet, self-determination theory, self-worth

Although the physical and mental health benefits of physical activity are well documented, a majority of adults in the United States are not engaging in enough activity to reap these benefits.¹ Recently, working mothers have been identified as a segment of the population that exhibits high levels of inactivity as a group.^{2,3} Working mothers report numerous barriers to engaging in regular physical activity, including lack of time, guilt, and lack of social support.⁴ Time constraints make it difficult to fit physical activity into schedules already packed with work, childcare, and household responsibilities.^{5,6} Furthermore, working mothers are especially susceptible to feelings of guilt associated with taking time for themselves because their time with their children is already limited, and, therefore, they may forgo their own health and participation in physical activity.^{7,8} Interventions are needed that help working mothers overcome physical activity barriers such as time and guilt by fostering feelings of self-worth, promoting self-care, and teaching self-regulatory strategies for prioritizing physical activity participation.

Fit Minded is an evidence-based intervention that uses book clubs to bring women together to improve self-worth and physical activity.⁹⁻¹¹ Intervention content emphasizes meaningful benefits of physical activity related to daily well-being and teaches participants to set realistic and achievable goals. The intervention is guided by self-determination theory (SDT), which suggests self-motivation and health are enhanced when the 3 basic psychological needs (autonomy, competence, and relatedness) are met.¹² SDT-based interventions aim to satisfy the 3 basic needs to foster internalization, the process by which a behavior becomes more autonomous and less controlled over time.^{13,14}

Although Fit Minded was originally developed as a face-to-face intervention, a recent study explored the feasibility and effectiveness of delivering the intervention via tablet.¹⁵ Participants reported the program helped them become more physically active, but also attended fewer meetings and felt less support/connection than those who attended meetings in person. These findings are consistent with previous research that highlights lack of engagement as a significant challenge of technology-delivered interventions.¹⁶ Web-based interventions have been shown to lead to improvements in physical activity,¹⁷ but typically see steep, rapid declines in program usage over time.^{16,18,19} Given the potential for web-based interventions to reach large groups in a cost-effective manner,²⁰ more research is needed to identify effective strategies for improving engagement and, in turn, improving intervention outcomes.

One strategy to improve engagement may be to incorporate group dynamics-based (GDB) strategies designed to strengthen social ties among participants. GDB interventions, which incorporate strategies such as group goal setting to facilitate group cohesion, have demonstrated robust positive effects on physical activity and program adherence (ie, engagement) in face-to-face settings,^{21,22} but the extent to which these strategies can be implemented in web-delivered interventions has not been explored. Further, engagement with the program content reasonably relies on the quality, relevance, and accessibility of content.²³ Publicly available podcasts are one type of media that delivers content in a way that may satisfy all of these criteria. Podcasts, however, have not been widely used in physical activity promotion programs. Testing the use of such media for physical activity promotion, particularly for working mothers, is warranted.

The purpose of this pilot study was to explore the feasibility and effectiveness of delivering an entirely web-based version of the Fit Minded intervention to working mothers. Because working mothers face significant time constraints, we substituted podcasts for books to make the weekly time commitment more manageable. To determine whether the use of GDB strategies would enhance

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participant engagement, participants were randomly assigned to receive a standard web-based intervention or an enhanced intervention that included GDB strategies. We hypothesized that participants in the enhanced group would use the website more consistently and exhibit greater increases in physical activity after participating in the intervention.

Methods

Participants

Participants were recruited nationally by contacting schools, childcare centers, newspapers, bloggers, and moms groups and asking if they would consider posting a blurb about the study in a newsletter, on their Facebook page, or on their website. A majority of participants heard about the study from social media posts by various groups targeting mothers. To be included in the study, participants had to be mothers working at least 30 hours/week, have a child under the age of 12 years living at home, and engage in less than 150 minutes/week of moderate-to-vigorous physical activity. Individuals who were currently pregnant or considered high risk for engaging in unsupervised physical activity (based on a "yes" response on the Physical Activity Readiness Questionnaire) were excluded.

Procedures

All procedures were approved by the institutional review boards at Arizona State University and Kansas State University. Recruitment began in March 2014 and ceased in March 2015. Individuals who responded to advertisements were directed to a brief online screening questionnaire to assess eligibility. Participants who met all inclusion criteria were invited to complete the baseline questionnaires online. The questionnaires were preceded by an informed consent document, and participants acknowledged that by completing the questionnaires they were consenting to participate in the study.

The intervention was delivered to 3 cohorts of participants. Once responses to a round of advertisements abated, we contacted all participants who had completed the baseline questionnaires with the intervention start date. Individuals who confirmed that they were still interested in participating were mailed an Omron HJ-112 pedometer (Omron Healthcare; www.omronhealthcare.com) to use during the intervention. All confirmed participants were randomized to either the standard or enhanced intervention condition using a random digit generator. Participants received an introductory e-mail with login instructions for the Fit Minded website, a link to a brief welcome video describing the project, and an overview of the weekly tasks they would be asked to complete starting the following week.

Follow-up data collection occurred during week 8 and week 16. Participants received an emailed link to complete the questionnaires online. Participants did not have any contact with the Fit Minded staff during the 8-week follow-up period, but maintained access to the Fit Minded website.

Intervention

Fit Minded Working Moms was an 8-week intervention delivered entirely online. Participants received an e-mail every Monday morning outlining the tasks for the week. The intervention content was guided by SDT and aimed to improve autonomy, competence, and relatedness among participants. Each week participants were instructed to complete 3 tasks: (1) listen to a podcast, (2) complete

an assignment in the Fit Minded workbook, and (3) communicate with other participants on the Fit Minded website discussion board. Autonomy was targeted through the use of podcasts that emphasized reasons for physical activity that would likely be highly valued by working mothers, thus enhancing their motivation to prioritize the behavior. Specifically, the intervention content highlighted intrinsic physical activity motives related to daily well-being (eg, reduced stress and increased energy) and encouraged participants to focus on these immediate positive benefits instead of long-term external benefits (eg, weight loss and reduced risk of disease). Sample podcast topics included self-renewal, stress reduction, work-life balance, and mindfulness; each podcast was 20 to 30 minutes long. Competence was targeted through weekly workbook assignments that provided tangible resources for prioritizing physical activity, such as goal setting worksheets, a pedometer log, time management tips, and home-based resistance training exercises. The workbook assignments were designed to take 10 to 15 minutes and to build participants' confidence in their capabilities to engage in physical activity by teaching self-regulatory skills. For example, the website included a pedometer log, and participants could set daily or weekly step goals and use the log to track their progress. Relatedness was targeted through discussion boards that provided a space for participants to connect with and support each other throughout the intervention. The discussion topics corresponded with the podcast topics and aimed to build a sense of community by reminding participants that they are not alone in their struggles to prioritize their own health and well-being.

Participants in the enhanced intervention group received additional group dynamics content on the discussion boards each week. Specifically, they were placed in small discussion groups of 4 to 5 participants at the beginning of the intervention. Each week, they received a task designed to enhance group cohesion among the members (eg, introductions, creating a group name, setting group goals, etc.). For example, starting in week 4, small groups were encouraged to set a group goal (eg, 750 total minutes of physical activity), and each group member would report her individual minutes of activity to contribute to the group total. In addition, they received several specific discussion questions designed to prompt reflection on the podcasts. Participants in the standard intervention group were all together in 1 large discussion group and received 1 generic discussion question each week (ie, "What did you think about this week's podcast and workbook assignment?").

Measures

Demographics. Participants provided demographic information, including age, race, employment status, marital status, education, and income. In addition, they indicated the number and age(s) of their child(ren).

Physical Activity. Physical activity was measured using the Godin Leisure Time Exercise Questionnaire (GLTEQ)²⁴ and the Modifiable Activity Questionnaire (MAQ).²⁵ The GLTEQ asks participants to report the current frequency of engaging in strenuous (eg, running), moderate (eg, easy bicycling or swimming), and light (eg, bowling or golf) exercise for at least 15 minutes per session during a typical week. A total weekly leisure activity score was calculated by multiplying the frequencies of strenuous, moderate, and light activities by 9, 5, and 3, respectively, and then summing the products. This measure is widely used and has previously demonstrated adequate test-retest reliability and concurrent validity with objective measures of physical activity and energy expenditure.^{26,27}

The MAQ asks participants to report the frequency and duration of any activities in which they engaged during the past 7 days. The MAQ provides a list of 38 activities, each of which has a corresponding metabolic equivalent (MET) value, which is multiplied by duration in hours to calculate MET-hours per week. A total MAQ score is computed by summing MET-hours per week across all activities. Previous research has demonstrated the past-week MAQ is a valid and reliable measure of leisure physical activity among women.²⁸

Self-Worth. The 6-item Physical Self-Worth subscale of the Physical Self-Perception Profile²⁹ was used to assess self-worth. Physical self-worth is considered 1 domain of global self-esteem that is highly relevant in studies of physical activity.³⁰ For each item (eg, "I am extremely proud of who I am and what I can do physically"), participants respond on a scale from 1 (not at all true) to 4 (completely true). Item scores were summed to yield a total score (range: 6–24; $\alpha = 0.80$ – 0.88).

Exercise Motivation. The Behavioral Regulation in Exercise Questionnaire 2³¹ is a multidimensional measure of exercise motivation comprising 5 subscales: amotivation (not included in the current study), external regulation, introjected regulation, identified regulation, and intrinsic regulation. The measure is derived from SDT, which outlines a continuum of behavioral regulation in exercise contexts, where external and introjected are viewed as controlled regulations, and identified and intrinsic are viewed as self-determined (autonomous) regulations.¹² Specifically, external regulation refers to behaviors that are performed to comply with an external demand (eg, "I feel under pressure from my friends/family to exercise"). Introjected regulation suggests internal control, where behaviors are performed to avoid guilt/shame or maintain feelings of worth (eg, "I feel guilty when I don't exercise"). Identified regulation is extrinsic, but autonomous, because the individual is performing the behavior because he/she values it and believes it is important (eg, "It's important to me to exercise regularly"). Finally, behaviors that are intrinsically motivated are performed for the inherent enjoyment and satisfaction they provide (eg, "I get pleasure and satisfaction from participating in exercise"). Participants rated each item on a scale from 0 (not true for me) to 4 (very true for me). For each subscale, responses were averaged to yield a total score (range: 0–4; external $\alpha = 0.59$ – 0.84 ; introjected $\alpha = 0.75$ – 0.84 ; identified $\alpha = 0.65$ – 0.69 ; intrinsic $\alpha = 0.89$ – 0.91).

Self-Efficacy. The Barriers Self-Efficacy Scale³² assesses participants' perceived capabilities to exercise regularly in the face of commonly identified barriers to participation (eg, bad weather and schedule conflicts). For each of the 13 items, participants responded by indicating their confidence to execute the given behavior on a 100-point percentage scale range from 0% (not at all confident) to 100% (highly confident). Total strength of self-efficacy was determined by calculating the mean of all items, resulting in a maximum possible efficacy score of 100, with higher scores reflecting greater self-efficacy to overcome common barriers (range: 0–100). Internal consistency of this scale was acceptable ($\alpha = 0.74$ – 0.92).

Program Evaluation. At week 8, participants completed a detailed program evaluation. They were asked to indicate the extent to which they agreed or disagreed with a variety of statements about the program. They also answered open-ended questions about aspects of the program they liked best and least.

Data Analysis

All data were analyzed using SPSS version 20 (IBM Corporation, Armonk, NY). First, we examined intervention completion rates and used *t* tests (for continuous variables) or χ^2 tests (for categorical variables) to determine whether participants who completed the study differed from those who dropped out on any demographic or baseline measures.

Next, to test the hypothesis that engagement would be higher in the enhanced group, we conducted two 2 (group) $\times$ 8 (time) repeated measures analyses of variance (ANOVAs) to examine differences in the number of weekly website logins and number of weekly discussion board posts between groups. All randomized participants were included in these analyses.

For physical activity and physical self-worth, we conducted a series of 2 (group) $\times$ 3 (time) repeated-measures ANOVAs to examine changes from baseline to postintervention to follow-up between groups. For exercise motivation and self-efficacy, we conducted 2 (group) $\times$ 2 (time) ANOVAs because we only collected these data at baseline and postintervention. A small number of participants were not lost to follow-up, but completed only the week 8 ($n = 5$) or week 16 ($n = 5$) measures. For all repeated measures analyses, we replaced their missing scores with the score from the previous time point to retain these participants in the analyses. Participants who did not provide any follow-up data were excluded from these analyses.

Results

Participant Characteristics and Retention

Participant flow through the study is depicted in the CONSORT diagram (Figure 1). Briefly, of 160 participants who completed the initial screening questionnaire, 131 were eligible to participate in the study, and 69 completed all baseline measures and were randomized. Baseline demographic characteristics are displayed in Table 1. The standard and enhanced groups did not differ significantly on any demographic or baseline variables.

Of the 33 participants randomized to the enhanced group, 22 completed at least 1 of the follow-up measures (66.7% retention). Of the 36 participants randomized to the standard group, 20 completed at least 1 of the follow-up measures (55.6% retention). The *t* tests showed those who completed the study differed from those who dropped out on 2 variables: introjected regulation and self-efficacy. Specifically, participants who completed the study reported higher introjected regulation (2.39 vs 1.88; $P = .03$) and lower self-efficacy (29.3 vs 40.8; $P = .02$) at baseline than those who dropped out. Completers and dropouts did not differ on any demographic variables at baseline.

Website Usage

Both website use ($F_{7,61} = 8.06$, $P < .001$, $\eta^2 = 0.48$) and discussion board posts ($F_{7,61} = 3.51$, $P = .003$, $\eta^2 = 0.29$) declined significantly across the 8-week intervention (Figure 2). Of the 69 participants randomized, 57 logged onto the website during week 1, but only 22 logged on during week 8. The number of logins did not differ between the standard and enhanced groups ($F_{7,61} = 0.82$, $P = .58$, $\eta^2 = 0.09$); however, there was a significant interaction effect for discussion board posts ($F_{7,61} = 2.26$, $P = .04$, $\eta^2 = 0.21$). Discussion board use was higher in the enhanced group throughout the 8-week intervention (Figure 2).

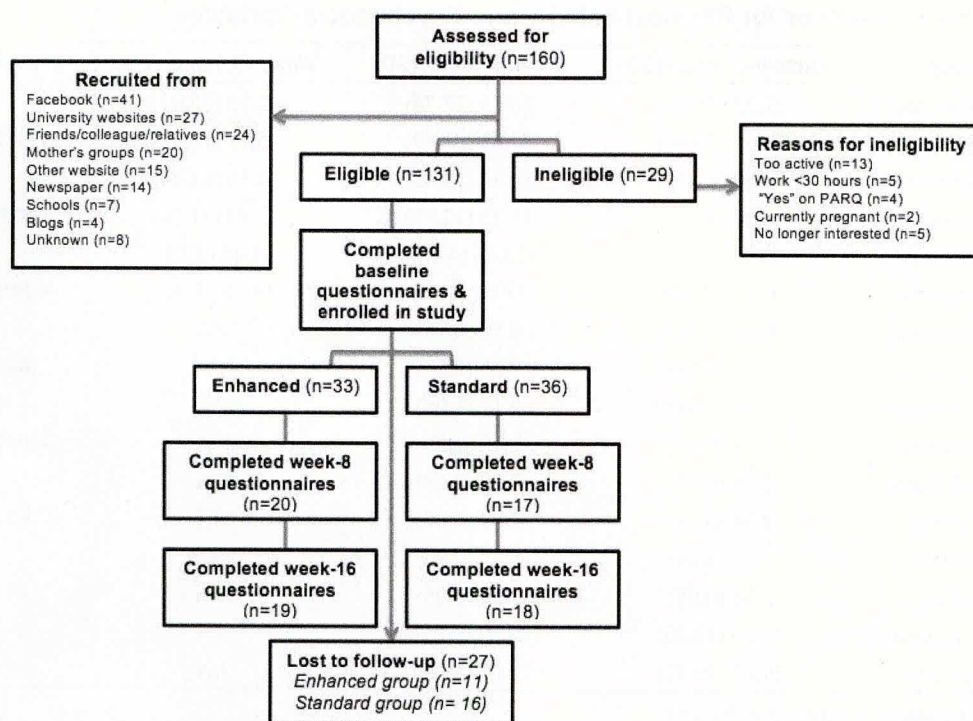


Figure 1 — CONSORT diagram depicting participant flow through the study.

Table 1 Demographic Characteristics of the Full Sample (N = 69)

Variable	Mean (SD)/freq (%)
Age	35.88 (5.14)
Age of youngest child	3.16 (3.09)
Number of children	
1 child	31 (45%)
≥2 children	38 (55%)
Employment hours/week	41.44 (6.11)
Marital Status	
Married/partnered	63 (91%)
Race	
White	60 (87%)
Asian	7 (10%)
Black	2 (3%)
Education	
College graduate	65 (94%)
Annual household income	
>\$60,000	58 (84%)

Abbreviations: freq, frequency; SD, standard deviation.

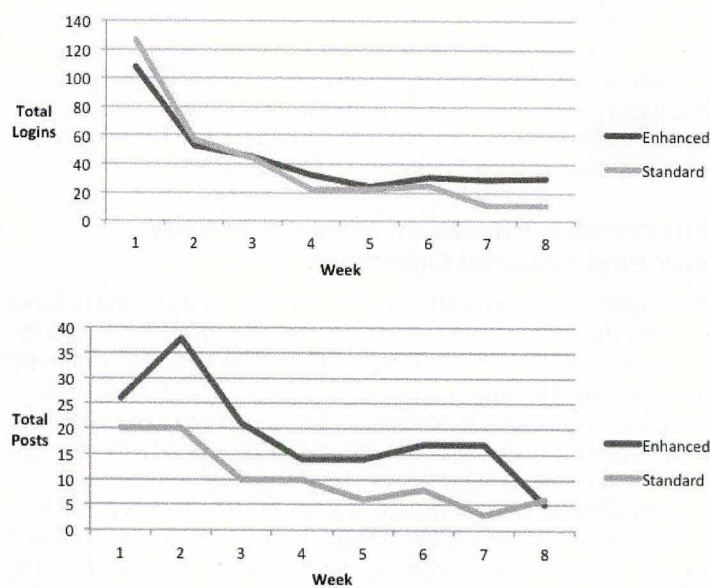


Figure 2 — Total logins (top) and discussion board posts (bottom) across the 8-week intervention by group.

Table 2 Descriptive Statistics for Physical Activity and Psychosocial Variables

Variable	Group	Baseline, mean (SD)	Week 8, mean (SD)	Week 16, mean (SD)	<i>P</i> (time)	<i>P</i> (int)
GLTEQ	Enhanced ^a	12.32 (14.93)	33.55 (27.74)	32.59 (25.03)		
	Standard ^b	17.10 (20.46)	25.65 (21.89)	25.70 (18.94)	<.001	.18
MAQ	Enhanced	8.00 (9.87)	14.46 (12.42)	14.35 (11.64)		
	Standard	8.06 (9.47)	15.95 (12.95)	12.94 (12.50)	.002	.65
PSW	Enhanced	11.77 (3.21)	13.45 (4.18)	13.45 (3.33)		
	Standard	11.85 (3.63)	13.60 (3.57)	14.75 (3.91)	<.001	.28
BREQ-Ext	Enhanced	0.66 (0.66)	0.59 (0.75)	N/A		
	Standard	0.80 (0.55)	0.55 (0.59)	N/A	.04	.24
BREQ-Intro	Enhanced	2.58 (1.04)	2.17 (1.05)	N/A		
	Standard	2.18 (0.80)	1.70 (0.85)	N/A	<.001	.73
BREQ-Ident	Enhanced	2.76 (0.85)	2.76 (0.68)	N/A		
	Standard	2.74 (0.53)	2.84 (0.67)	N/A	.65	.65
BREQ-Intri	Enhanced	2.32 (1.09)	2.41 (0.97)	N/A		
	Standard	2.34 (0.95)	2.59 (0.95)	N/A	.19	.53
BARSE	Enhanced	29.29 (13.23)	37.20 (20.51)	N/A		
	Standard	29.23 (10.22)	32.31 (15.57)	N/A	.08	.43

Note. Bold values indicate statistical significance ($P < .05$).

^a $n = 22$.

^b $n = 20$.

Abbreviations: Modifiable Activity Questionnaire; Physical Self-Worth; BARSE, Barriers Self-Efficacy Scale; BREQ, Behavioral Regulation in Exercise Questionnaire; Ext, external; GLTEQ, Godin Leisure Time Exercise Questionnaire; Ident, identified; Intri, intrinsic; Intro, introjected; MAQ, Modifiable Activity Questionnaire; N/A, not applicable; PSW, Physical Self-Worth; SD, standard deviation.

More than 85% of participants who completed the program evaluation at week 8 ($n = 37$) reported listening to the podcasts during weeks 1 and 2, whereas only 55% reported listening to the podcasts during weeks 7 and 8.

Intervention Effects on Physical Activity and Psychosocial Outcomes

Descriptive statistics for all outcome variables are presented in Table 2. Both the GLTEQ ($F_{2,39} = 10.29$, $P < .001$, $\eta^2 = 0.35$) and the MAQ ($F_{2,39} = 7.52$, $P = .002$, $\eta^2 = 0.28$) showed physical activity increased significantly from baseline to week 8, and these changes were maintained at the 16-week follow-up. The changes did not differ between groups for either the GLTEQ ($F_{2,39} = 1.83$, $P = .18$, $\eta^2 = 0.09$) or the MAQ ($F_{2,39} = 0.43$, $P = .65$, $\eta^2 = 0.02$).

Physical self-worth increased from baseline to week 16 ($F_{2,39} = 12.62$, $P < .001$, $\eta^2 = 0.39$) in both groups. Participants exhibited significant decreases in external regulation ($F_{1,40} = 4.34$, $P = .04$, $\eta^2 = 0.10$) and introjected regulation ($F_{1,40} = 16.99$, $P < .001$, $\eta^2 = 0.30$) from baseline to week 8. Identified regulation ($F_{1,40} = 0.20$, $P = .65$, $\eta^2 = 0.01$) and intrinsic regulation ($F_{1,40} = 1.82$, $P = .19$, $\eta^2 = 0.04$) did not change significantly. Participants reported increases in self-efficacy to overcome barriers that approached significance ($F_{1,40} = 3.32$, $P = .08$, $\eta^2 = 0.08$). There were no significant interaction effects for any of the psychosocial variables.

Program Evaluation

Participant responses to the open-ended questions about what they liked most/least about the intervention were compiled for

descriptive purposes. Participants reported the BEST aspects of the intervention were (in descending order): the podcasts ($n = 19$), the pedometer ($n = 7$), the overall concept/message of the intervention ($n = 7$), the discussion boards/social connection ($n = 5$), the workbook ($n = 2$), and the flexibility of the web-based design ($n = 2$). One participant said, "I really enjoyed the podcasts and felt that they gave me some new ideas as I think about health, physical activity, wellness, and the example I was setting for my daughter." Another commented: "The pedometer was an easy eye opening way to see how little I move during a typical day." Participants said their LEAST favorite aspects of the program were (in descending order): low participation on the discussion boards ($n = 22$), program took too much time/effort ($n = 8$), the podcasts ($n = 7$), the workbook ($n = 4$), website issues ($n = 3$), lack of support from the research team ($n = 2$), and the pedometer ($n = 1$). One participant commented, "I was assigned to a discussion group and for three weeks I was the only one answering questions, so I stopped participating." Another said, "It was too time consuming for me to use the discussion boards effectively."

The percent of participants who indicated "agree" or "strongly agree" to specific questions on the program evaluation are included in Table 3. Overall, participants' evaluation of the intervention was fairly neutral. Consistent with the qualitative feedback, participants rated the pedometers and the impact of the program on their perceptions of physical activity highly, but did not believe the discussion boards provided sufficient interaction and support. Participants liked the short, succinct podcasts (ie, TED talk format) best.

Table 3 Participant Responses on Program Evaluation

Question	% agree or strongly agree
General	
1. Fit Minded Working Moms has helped me think more positively about physical activity.	76
2. Fit Minded working Moms has helped me to be more physically active.	43
3. Fit Minded Working Moms has helped me to feel supported to participate in physical activity.	38
4. Fit Minded Working Moms has helped me to set goals related to physical activity.	57
5. The online format of Fit Minded Working Moms was effective for increasing physical activity.	27
6. The support I received from my discussion board group contributed to my participation in physical activity.	12
7. The discussion boards stimulated conversation beneficial to my understanding of the messages presented in the podcasts.	21
8. I would recommend Fit Minded Working Moms to other women interested in increasing their physical activity participation.	49
Workbook	
1. The activities included in the Fit Minded workbook were informative to me.	51
2. The activities included in the Fit Minded workbook helped me to learn about ways to increase my current physical activity level.	41
3. The benefits and barriers to physical activity exercises in the workbook helped me to overcome barriers related to physical activity.	27
4. The goal-setting exercises in the workbook helped me to learn to set my own goals.	30
5. The information provided in the workbook about strength training was easy for me to understand and apply.	50
Website	
1. The design of the webpage was appealing.	32
2. I found the website easy to navigate.	19
3. Tracking my pedometer steps was easy with the online tracking tool.	67
4. I liked the discussion board feature of the website.	33
5. I liked the support (fitness, food and recipes, motivation) section of the website.	28
6. The Fit Minded team responded to my questions/comments in a timely manner.	97

Discussion

The purpose of this study was to explore the feasibility and effectiveness of delivering a web-based version of the Fit Minded intervention to working mothers, using podcasts to deliver autonomy supportive intervention content. Results showed the intervention elicited increases in physical activity and self-worth. In addition, participants reported decreases in the 2 types of controlled motivation (external and introjected regulation) that have been linked to low physical activity maintenance over time.³³ These results are encouraging and suggest it is possible to change physical activity behavior and key psychosocial outcomes by providing a self-directed web-based intervention to busy working mothers. However, it is important to note that nearly 40% of the sample dropped out of the study, so these results should be interpreted with caution based on the poor retention rate.

Previous research has highlighted rapid declines in participant engagement as a notable limitation of web-based interventions.^{16,18,19} Thus, a core objective of this study was to determine whether using GDB strategies would enhance engagement and physical activity outcomes. Our hypothesis was not supported. Participants in the

enhanced group used the discussion boards more than participants in the standard group (likely because they received more weekly discussion prompts), but exhibited similar declines in website use across the intervention. Both groups reported similar increases in physical activity. Participant feedback on the program evaluation suggested that the discussion boards were sparsely used, and the GDB strategies were not sufficient for generating increased interaction and engagement in the intervention.

There are a number of explanations for the low website use, even within the enhanced group. Participants did not know each other when they enrolled in the study, so may have been less trustworthy of or inclined to participate in group activities with strangers, regardless of their commonalities (eg, being a working mother).³⁴ Nonetheless, a number of individuals participated actively on the discussion boards in the early weeks of the intervention, but reported becoming discouraged by the lack of response from their group members. Participants also reported issues related to the Fit Minded website discouraged them from participating on the discussion boards. For example, the website did not send any notifications when group members posted or responded on the discussion board, so participants simply forgot to log on and continue

the discussion throughout the week. Future studies should include formative research to determine the type and frequency of notifications participants prefer. Some other participants reported it took too much time to keep up with the discussion boards. This issue may be especially salient for working mothers, and future studies might consider alternatives, such as a brief weekly live group video chat, which would allow for more efficient group interaction for this busy population. Finally, although limiting group size has been identified as an effective GDB strategy in previous research,^{22,35} in the current study the small group size in the enhanced group tended to reduce engagement because, with low participation rates due to the reasons cited above, many groups lacked a critical mass for meaningful discussion.

A number of participants also reported that the intervention took too much time and effort to complete or expressed frustrations with the lack of direct support/mediation by the research team during the intervention. Although we anticipated these concerns, we intentionally limited our participation on the discussion boards to determine whether the inclusion of GDB strategies to generate meaningful group discussions would enhance the self-sufficiency of a web-based intervention. A self-directed intervention would lend itself well to broad translation; however, it appears that some degree of interaction and support from research staff may be necessary for improving retention and participation.²⁰ In particular, participants may have benefitted from an orientation meeting that outlined all of the weekly tasks that they would be expected to complete during the 8-week intervention. Future research will need to explore the optimal amount of support (eg, facilitating group dynamics-based activities, answering participant questions) to keep both expectations of participants and burden on the research team manageable.³⁶

An interesting finding of the study was that participants who completed the study had lower self-efficacy and higher introjected regulation at baseline than those who dropped out. Identifying factors that predict attrition from interventions is important for informing future studies and targeting at-risk individuals.^{20,37} Previous research has shown individuals with lower self-efficacy are more likely to drop out of physical activity interventions,³⁸ so our findings were unexpected. One possible explanation is that participants with lower confidence and lower quality motivation had more to gain from the information and resources provided by the intervention (ie, podcasts and workbook), whereas individuals who were already moderately confident and autonomously motivated did not find the content novel enough to stay engaged. This is encouraging, as it suggests the individuals who needed the intervention most were more likely to sustain their participation and, in turn, increase their physical activity. However, future studies should consider offering content that is tailored to participants' initial confidence/readiness to change (ie, based on initial self-efficacy and behavioral regulation scores) to benefit all participants.³⁹

This study has a number of strengths and limitations to be acknowledged. To our knowledge, this was one of the first studies to incorporate novel approaches such as podcasts and GDB strategies to promote engagement in a web-based intervention. Although these strategies were only moderately effective, the extensive process data collected during this intervention will help inform the development of future web-based interventions. The intervention was guided by SDT, and participants appreciated the efforts to promote autonomy, competence, and relatedness. They praised the nonjudgmental nature of the intervention content, the focus on autonomous motives related to their well-being, and the ability to connect with other working mothers "in the same boat." There is some evidence that participants internalized messages about letting go of controlling

motives, as they reported significant decreases in external and introjected regulation. In addition, they reported increases in self-worth, which may translate to greater investment in self-care behaviors such as physical activity.⁴⁰ Thus, using SDT to promote physical activity appears to be warranted for future studies. Using podcasts to deliver intervention content was an innovative approach that was generally well received by the participants. More than one-half of the participants who completed the program evaluation identified the podcasts as their favorite aspect of the intervention; however, some individuals did express concerns about the length and/or content of some of the podcasts. Future studies should pursue the use of podcasts to deliver intervention content, but might consider pilot testing a variety of podcasts with members of the target population before making final selections.

There were several limitations to the study design. Physical activity was self-reported, so it is possible that participant estimates of their physical activity behavior were affected by biases. Future studies should include objective measures or stronger self-report measures. To reduce participant burden, we did not measure motivation or self-efficacy at week 16, so we cannot say whether changes in these variables were maintained beyond the initial intervention period. Despite extensive recruitment efforts, the final sample was primarily white, highly educated, and affluent. Thus, we cannot determine whether the intervention would be effective in more diverse samples of working mothers, or whether the intervention would be more or less effective in other populations (eg, nonworking mothers, fathers, blue collar workers, etc.). Future studies should explore strategies for recruiting more diverse samples, particularly for web-based interventions.

Working mothers are an inactive but understudied population, so physical activity interventions for this population are needed. This study represents a first step toward developing a web-based intervention that has the potential to have broad reach for working mothers. The inclusion of GDB activities did little to improve physical activity and engagement outcomes, so future studies should determine how to optimize GDB components in online settings and explore strategies for keeping participants engaged in web-based interventions.

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