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Short communication

Development and evaluation of a multimedia CD-ROM for exercise during pregnancy and postpartum

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Abstract

Objective: To meet the need for an interactive product on exercise during pregnancy and postpartum, we developed and evaluated a personally tailored multimedia CD-ROM.
Methods: Pregnant and postpartum women, who were randomly assigned to either the experimental group (*PregXercise*™ CD-ROM) or the control group (CD-ROM with neutral content), navigated through the CD-ROM for 1 h. Main outcomes were exercise self-efficacy and knowledge.
Results: In analyses of covariance, compared with the control group, the experimental group had significant increases in self-efficacy and knowledge.
Conclusion: The multimedia CD-ROM delivering information about exercise motivation, guidelines, and prescription was effective in improving exercise self-efficacy and knowledge.
Practice implications: Our preliminary results illustrate that healthcare professionals and researchers may use interactive multimedia for improving exercise behavior and related outcomes with pregnant and postpartum women.
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Keywords: Physical activity; Women; Health; Transtheoretical model; Theory of planned behavior

1. Introduction

1.1. Significance and purpose

Pregnant and postpartum women are at high-risk for sedentary lifestyles, and consequently, for developing diseases such as obesity and diabetes [1–4]. Multimedia can be used to present exercise interventions economically, engagingly, effectively, and efficiently [5,6]. This is important for pregnant and postpartum women, who have significant exercise barriers such as fatigue, limited time, child care, and lack of exercise knowledge [7]. The purpose of our study was to develop and evaluate a multimedia CD-ROM for exercise during pregnancy and postpartum. Because brief exposure to the CD-ROM is intended to increase exercise knowledge and self-efficacy [8], we hypothesized that a 1 h session using the *PregXercise*™ CD-ROM would produce increases in women's exercise knowledge and self-efficacy compared to a control group.

1.2. CD-ROM development

Content for *PregXercise*™ was developed using the social cognitive theories of the transtheoretical model (TTM) and the theory of planned behavior which have been shown to positively influence self-efficacy and subsequent exercise intentions and behaviors (see Table 1) [2,8–13]. Individually tailored multimedia CD-ROMs are successful in modifying health behaviors and key mediators of health behaviors, including physical

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Table 1
Theoretical applications within the CD-ROM

Information included in CD-ROM	Theoretical construct	
	Transtheoretical model	Theory of planned behavior
Individualized PA motivational/behavioral stage	Stages of change	Intention, behavior
Benefits of PA	Decisional balance: pros	Attitude
Common barriers to PA and strategies to overcome barriers	Decisional balance: cons	Attitude
Self-efficacy building messages using interactive activities with immediate feedback regarding PA knowledge and individualized PA program. Vicarious experiences through videos/pictures of pregnant and postpartum women. Verbal persuasion through videos from pregnant and postpartum women to stick with realistic PA goals. Setting performance mastery accomplishments (e.g., individualized PA programs; PA logs, and PA contracts)	Self-efficacy	Perceived behavioral control
Setting realistic goals	POC: self-liberation	
Identify new self-image as an exerciser	POC: self-reevaluation	Attitude
Identify supportive others and where to obtain social support.	POC: helping relationships	Subjective norm
Identify sedentary habits that can be replaced with PA (taking a walk instead of watching TV)	POC: counterconditioning	
How to be a positive role model to children and family by being PA	POC: environmental reevaluation	
Videos describing the health risks of a sedentary lifestyle	POC: dramatic relief	Attitude
Presenting PA knowledge in a variety of interactive formats	POC: counsciousness raising	
Awareness of programs/environments that encourage PA (bike paths, walking programs)	POC: environmental reevaluation	
Rewarding oneself or being rewarded by others for PA participation	POC: reinforcement management	
Structuring the environment to make PA easier (e.g., infant carrier, baby jogger)	POC: stimulus control	Perceived behavioral control

POC = processes of change

activity (PA) in inactive women [14,15]. Multimedia has been used effectively with pregnant and postpartum women for other health issues, illustrating the efficacy of a multimedia CD-ROM with this special population [16]. Of significance to our study, multimedia PA interventions based on the TTM result in increased PA [5], and they are acceptable and feasible for promoting PA for adults with different stages of change, ages, education levels, and computer use levels [6].

The content was developed by degree-qualified health professionals with expertise in exercise and behavior change. Consistent with other health multimedia programs [17], our content, mainly bulleted points and short paragraphs, corresponds to a reading level equivalent to the eighth/ninth grade. Because of the content-specific motherhood and exercise stage information, the CD-ROM is designed for both single use (i.e., one-time viewing of relevant sections) and multiple uses (i.e., longitudinally viewing relevant motherhood and exercise stage sections and/or reviewing sections of interest). Single and multiple viewings are intended to increase exercise self-efficacy and knowledge, with multiple viewings establishing, reinforcing, and improving exercise knowledge, behaviors, and psychological skills. The interactive components help the user acquire cognitive and behavioral skills necessary to exercise and provide direct and vicarious experiences needed to foster exercise self-efficacy [8]. Examples of the interactive components include true/false quizzes; video, photographic, and audio clips of first, second, and third trimester pregnant and postpartum women; and personal accounts from women regarding the physical, psychological, and social benefits of exercise. The CD-ROM contains a blend of theory, practical content, and detailed information in four separate yet interrelated sections (see Fig. 1).

First, the *Introduction* is tailored to the user's exercise and motherhood status. This section begins with a video regarding the benefits of exercising during pregnancy and postpartum. The introductory video is followed by two sets of videos in which a narrator and pregnant/postpartum women discuss the

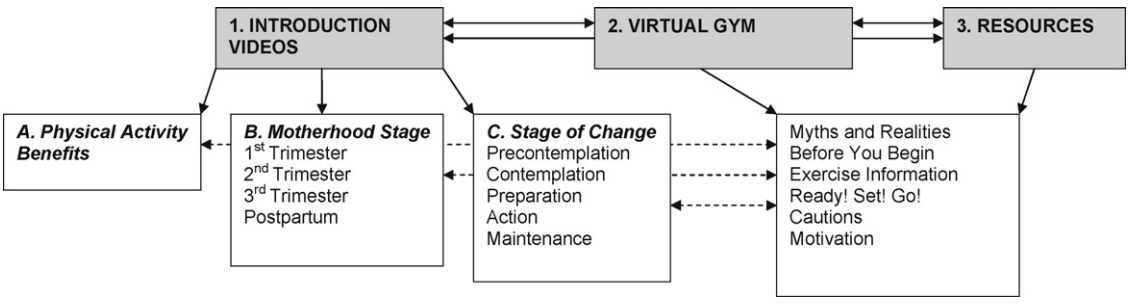


Fig. 1. PregXercise™: a multimedia CD-ROM for exercise during pregnancy and postpartum guided by the theory of planned behavior and the transtheoretical model.

Table 2
Overview of virtual gym

Content
Myths and realities Myths and realities of exercise for pregnant and postpartum women
Before you begin Safety information before starting an exercise program specific to pregnancy and postpartum. Determine a high-risk pregnancy for exercise. Users complete the PARmed-X for pregnancy, which is a preliminary screen for exercise testing and prescription
Exercise information Overview of national physical activity guidelines and explanation of sufficient activity and common exercise terms defined. Present exercises done by pregnant and postpartum women. Identify psychological, social, and physiological effects of exercise in general and specific to pregnant and postpartum women. Topics include main fitness components and methods to monitor exercise intensity such as target heart rate, ratings of perceived exertion, and talk test
Ready! Set! Go! Individualized exercise programs focusing on the fitness and skill components of a well-rounded exercise program for pregnant and postpartum women based on their stage of change, physical level, and health-status
Cautions Information on when to stop exercising and cautions on when to visit a healthcare professional before continuing with an exercise program
Motivation Motivational information for exercise including goal setting (using the SMART principle where users set and record exercise goals), exercise contracts, exercise journals, and theory-based information on exercise attitudes, self-efficacy, pros, cons, and barriers. Other motivational information includes using vocabulary that avoids turning potential users off to physical activity, offering encouragement through peer-support video clips, and turning exercise sessions into social occasions

cognitive and behavioral aspects of exercising during the user's corresponding motherhood stage (i.e., first, second, or third trimester, or postpartum). Based on their response to Reed et al's [18] staging algorithm (i.e., precontemplation, contemplation, preparation, action, or maintenance), the women then view videos containing information personally tailored to the user's TTM stage of exercise change. Second, the *Virtual Gym* contains six stations whereby users self-select which station(s) to view (see Table 2). Third, on every screen, there is a link to a *Resources* section that includes links to online resources and lists of relevant books, magazines, websites, organizations, and references. The *Resources* section helps users apply and acquire further exercise information. Finally, the *Exit* contains a video providing exercise motivation and highlighting the importance of returning to the CD-ROM to obtain further information during each motherhood stage.

2. Methods

2.1. Participants

Participants were 25 pregnant and 25 postpartum women (*M* age = 30.77, S.D. = 4.15 years; age range = 22–40 years; 86% White; 84% had college degree; 72% had a family income between $40,000 and $100,000, 52% had other children to care for, 94% were married) who were randomly assigned to the experimental group (*PregXercise*™ CD-ROM) or the control group (CD-ROM with neutral content). The control CD-ROM was a multimedia CD-ROM designed to enhance preoperative, postoperative, and rehabilitative outcomes associated with surgical reconstruction of the anterior cruciate ligament of the knee. Because our emphasis was on obtaining feedback on the *PregXercise*™ CD-ROM, the control group was smaller ($n = 10$) than the experimental group ($n = 40$). Nevertheless, the control group was of sufficient size to test for a Hawthorne effect and demand characteristics [19].

2.2. Procedures and measures

The participants were recruited from two OBGYN offices and pregnancy and postpartum exercise/support groups in Gainesville, FL, USA, from January 2006 to May 2006. Institutional Review Board approval for our study was obtained from the University of Florida. A total of 57 women agreed to participate in the study with 7 women who did not attend the focus group session, representing a response rate of 87.7%. Common reasons for not participating were lack of time and going into labor. Volunteer women attended a group session at a computer lab where they completed an informed consent document and received answers to their questions about the study. As is customary in small-group testing [20], a pretest–posttest design was used for variables on which change was expected following a 1 h exposure to the CD-ROM (i.e., exercise knowledge and self-efficacy).

We developed the Exercise Knowledge Questionnaire to assess knowledge of exercise-related content featured on the *PregXercise*™ CD-ROM. To ensure content validity, a panel of doctoral-level researchers with expertise in scale construction in exercise and health domains reviewed the pool of items that were written for the test. A total of 32 items, with four-foil response options was selected by a panel. The Questionnaire has a reading level equivalent to the sixth grade. Scores on the Exercise Knowledge Questionnaire corresponded to the number of correct answers on the 32 items. A correct answer

Table 3
Mean and standard deviation (S.D.) responses to the Treatment Acceptability Questionnaire

Items	Mean (S.D.)
Overall, how acceptable do you find this CD-ROM to be?	5.54 (0.66)
How ethical do you think this CD-ROM is?	6.36 (1.01)
How effective do you think this CD-ROM is?	5.29 (1.20)
How likely do you think it is that this CD-ROM may have negative side effects?[a]	5.29 (1.07)
How accurate do you think the information is on this CD-ROM?	6.00 (1.04)
How trustworthy do you think the information is on this CD-ROM?	6.14 (1.09)

Scoring on 7-point Likert scale ranging from *not at all* [1] to *extremely* [7], with lower scores indicating lower acceptability.
[a] Reversed scored.

Table 4
Technology and content revisions to the CD-ROM

	Technology revisions	Content revisions
1	Adding navigation bar indicating where user is and which pages have been examined	More information on health benefits (e.g., lower depression) and overcoming barriers (e.g., returning to work) to postpartum PA
2	Improving consistency and location of navigation buttons	More information on advanced exercises (already exercisers) and creative exercises to do with baby
3	Increasing font size	More information for second and third time mothers
4	Adding more audio	Content on nutrition and PA in pregnancy/postpartum
5	Program internet login/logout process to track users' frequency/duration of CD-ROM interaction	Techniques on reducing amount of time in sedentary activities (e.g., watching TV)
6	Reduce wording, text, and video segments to maintain user attention	Addressing specific recommendations for modifying PA within a culturally diverse framework
7	Ensure graphics have parallel levels of richness, character, and theme	Updating website content on PA in pregnancy and postpartum
8	Program internet login/logout process to objectively determine the duration and frequency of CD-ROM use	Adding content on stretching/pilates

was assigned a score of ''1'' and an incorrect answer was scored ''0''. Split-half reliability and 7-day test retest coefficients of .73 and .92, respectively, were obtained for the Exercise Knowledge Questionnaire. For the 12-item *Self-efficacy Questionnaire* [21], the participants rated the degree of confidence that they could exercise when barriers were to occur on a 0–100% scale (0% = no confidence at all; 100% = completely confident; pre-assessment alpha = .92; post-assessment alpha = .92). After the participants completed the pretest, they explored the CD-ROM to learn about the content and provide feedback on its utility. Upon completing the posttest after the 1 h exploration, the experimental group completed the *Treatment Acceptability Questionnaire* (TAQ) [22], which assessed whether the CD-ROM was acceptable with respect to its intended function. This scale contains 6 items with a 7-point Likert scale ranging from 1 (*not at all*) to 7 (*extremely*), with lower scores indicating lower acceptability. Finally, a focus group (*M* group size = 4) was held in which participants responded to questions about the content, feasibility, and applicability of the CD-ROM for pregnant and postpartum women. Participants were compensated with $60.

3. Results

The *M* change (posttest–pretest) scores for self-efficacy for the experimental and control groups were 2.85 and 0.29, respectively. The *M* change scores for exercise knowledge for the experimental and control groups were 3.52% and 1.56%, respectively. An analysis of covariance (ANCOVA) revealed that the experimental group reported significantly higher self-efficacy [$F(1, 46) = 25.93$, $p < .001$] and exercise knowledge [$F(1, 47) = 57.33$, $p < .001$] scores at posttest compared to the control group while statistically controlling for pretest scores. For treatment acceptability of the *PregXercise*™ CD-ROM, the mean score was above 5.00 on a 7-point scale for all TAQ items, indicating that the CD-ROM was rated as highly acceptable (see Table 3). Follow-up analyses revealed that scores on the scales used to evaluate the CD-ROM did not differ by motherhood status, $ps > .05$.

A note-based analysis [23] of the responses to the focus group questions was conducted to summarize themes and provide suggestions for modifications to improve the CD-ROM. Consistent with their responses to the quantitative instruments, the participants reported satisfaction with the *PregXercise*™ CD-ROM, and they noted its applicability to exercising during pregnancy and postpartum. Participants used terms such as ''informative'', ''simple to use'', ''clear and easy to understand'', ''good resource'', and ''helpful'' to describe the CD-ROM. Participants expressed appreciation for the variety of presentation modes, and they indicated that the CD-ROM enabled them to receive more information and better reflect on that information than they did at their OBGYN's office. However, some participants reported that the CD-ROM was ''too long'' and ''better for pregnant than for postpartum women.'' Participants also offered suggestions of how the CD-ROM could be enhanced with respect to its navigation and content. Novice computer users commented that they had no difficulty using the CD-ROM. Several participants suggested the addition of navigational features (such as navigation bar or progress menu) and either more audio or an option to have the text read aloud. The content-related themes of participants' focus group responses referred to the need for greater culturally diverse models and emphasis on postpartum exercise. Based on the focus group responses, both content and technology revisions will be made to the CD-ROM (see Table 4 for a description of the proposed modifications). Modifications to the content will also be made based on recent research findings on PA during pregnancy and postpartum [3,4].

4. Discussion and conclusion

4.1. Discussion

Consistent with our hypotheses, a 1 h session using the CD-ROM resulted in women's increased exercise knowledge and self-efficacy during pregnancy and postpartum compared to a control group. Our findings are similar to other researchers who found that a CD-ROM intervention increased nutrition [24] and exercise [25] self-efficacy. Our results constitute the first steps toward developing and evaluating an empirically validated

multimedia CD-ROM designed to improve pregnant and postpartum women's exercise intentions and behaviors.

4.2. Conclusion

Our study demonstrated the feasibility of and laid the foundation for producing and empirically evaluating a final prototype of the *PregXercise*™ CD-ROM. Once modifications to the prototype are made based on the focus group findings further validation of the CD-ROM is needed. Randomized controlled field trials with large samples to compare the CD-ROM with other forms of intervention will permit examining determinants/predictors of exercise (e.g., age, ethnicity, parity) [4]; and causal inferences to be drawn regarding the impact of the CD-ROM on women's exercise knowledge, intentions, and behaviors during pregnancy and postpartum. Examining the acceptability of the CD-ROM across demographic groups with varying computer competency levels is required to determine the reach of this type of intervention with pregnant and postpartum women of varying demographic backgrounds.

4.3. Practice implications

The Institute of Medicine has recently identified pregnancy as a critical risk period for sedentary behavior and overweight development among women; thereby placing these women at increased risk for several chronic diseases and premature mortality [1–4]. Most women are unaware of the benefits of regular exercise and they have little knowledge of the exercise guidelines during pregnancy and postpartum. Our multimedia CD-ROM is a cost-effective intervention to increase exercise knowledge and self-efficacy for pregnant and postpartum women for whom it is often impractical to recommend group and community-based exercise. The revision and completion of the *PregXercise*™ CD-ROM provides a disseminable intervention promoting exercise among pregnant and postpartum women.

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