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Feasibility of a lifestyle intervention for overweight/obese endometrial and breast cancer survivors using an interactive mobile application ☆

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HIGHLIGHTS

- The purpose of this study was to elicit weight-loss via mobile app lifestyle intervention.
- The lifestyle intervention delivered via an app showed significant reductions in body weight.
- Significant improvements were noted in the Weight Efficacy Life-Style Questionnaire.

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ABSTRACT

Objective. The study aimed to assess a one-month lifestyle intervention delivered via a web- and mobile-based weight-loss application (app) (*LoseIt!*) using a healthcare-provider interface.

Methods. Early-stage overweight/obese (body mass index [BMI] ≥ 25 kg/m^2) cancer survivors (CS) diagnosed in the past three years, and without recurrent disease were enrolled and received exercise and nutrition counseling using the *LoseIt!* app. Entry and exit quality of life (FACT-G) and Weight Efficacy Lifestyle Questionnaire (WEL) measuring self-efficacy were measured along with anthropometrics, daily food intake, and physical activity (PA) using the app.

Results. Mean participant age was 58.4 ± 10.3 years ($n = 50$). Significant reductions ($p < 0.0006$) in anthropometrics were noted between pre- and post-intervention weight (105.0 ± 21.8 kg versus 98.6 ± 22.5 kg); BMI (34.9 ± 8.7 kg/m^2 versus 33.9 ± 8.4 kg/m^2); and waist circumference (108.1 ± 14.9 cm versus 103.7 ± 15.1 cm). A significant improvement in pre- and post-intervention total WEL score was noted (99.38 ± 41.8 versus 120.19 ± 47.1, $p = 0.043$). No significant differences were noted in FACT-G, macronutrient consumption, and PA patterns.

Conclusion. These results indicate that a lifestyle intervention delivered via a web- and mobile-based weight-loss app is a feasible option by which to elicit short-term reductions in weight. Though these results parallel the recent survivors of uterine cancer empowered by exercise and healthy diet (SUCCEED) trial, it is notable that they were achieved without encumbering significant cost and barrier-access issues (i.e. time, transportation, weather, parking, etc.).

1. Introduction

Overweight/obese endometrial (EC) and breast cancer (BC) survivors face numerous co-morbidities that are the leading cause of death that supersedes cancer diagnosis [1,2]. The majority of women in the United States of America (USA) are overweight or obese; therefore, not surprising that the majority of EC and BC survivors are overweight or obese which can interfere with a survivor's recovery and subsequent quality of life (QOL) [2–4]. Correspondingly, the majority of overweight/obese cancer survivors are not meeting public health exercise and/or nutrition recommendations [2]. There is a critical need to determine what methods of weight-loss and risk factor reduction in this population are most effective. As a result, the strategic plan for the National Institutes of Health (NIH) Obesity Research calls for innovations to

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improve health outcomes in populations affected by obesity using theory based approaches such as Social Cognitive Theory (SCT) and Theory of Planned Behavior (TPB) [5–7].

Recent studies have demonstrated that increased obesity or body mass index (BMI) is associated with decreased survival [8,9]. The National Cancer Institute (NCI) emphasizes the need for interventions including weight, physical activity, nutrition counseling that contribute to survivorship, and methods to improve health outcomes and mortality for cancer survivors [10,11]. Improving body weight in EC and BC survivors may decrease morbidity and have the potential to improve overall survival since relative risk of death for obese EC women with a body mass index (BMI) 30–34 was 2.53, and BMI >40 was 6.25; the highest of all cancers [12,13]. Specifically, the risk of death from cardiovascular disease (CVD) related causes begin to exceed the risk from cancer-related causes 3.5 years after EC diagnosis [14]. Thus, interventions that address dietary change and increased exercise together are necessary to elicit weight-loss and improve cardiovascular disease risk factors. Lifestyle interventions have been shown to improve wellness, self-efficacy, and QOL in cancer survivors [15–18].

Mobile health (mHealth) applications (aka. "apps") using web- and/or a mobile-based app are tools that have the potential to improve effective patient-provider communication, adherence to treatment and self-management, especially in regards to weight-loss. In recent years, mobile phones have become a major conduit for communication and information. The uses of web- and mobile-based apps as a tool for health promotion and weight-loss have been successful in randomized trials [19,20].

The current study aimed to assess the feasibility of delivering a lifestyle intervention focusing on weight-loss using a multi-disciplinary team via popular mHealth app (*LoseIt!*) which offers both a website and mobile versions for users. The secondary objective was to assess characteristics of EC and BC survivors in regards to nutrient intake, physical activity (PA), self-efficacy, QOL, and correlation to patient-provider contact points. We hypothesized that EC and BC survivors would be willing to engage in a lifestyle program using mHealth technology and improve the principal co-morbidity of weight.

2. Methods

2.1. Study design and patient recruitment

This study was a prospective intervention in 50 overweight/obese women with a history of Stage I or II (early) EC and/or BC. The comprehensive lifestyle program with emphasis on nutrition quality, physical activity, and improving eating self-efficacy was delivered using a "beta" healthcare provider version of *LoseIt!* (Boston, MA), a popular web- and mobile-based app for logging food intake and volitional exercise. The multi-disciplinary team delivering the comprehensive lifestyle program included a gynecologic oncologist (GO), resident physician (RP), research coordinator (RC), registered dietician nutritionist (RDN), and a certified clinical exercise specialist (CES) by the American College of Sports Medicine (ACSM) to elicit weight-loss in patients at a rate of 1.0–2 lb per week. Participants were monitored over the course of 4-weeks through the "beta" healthcare provider version of *LoseIt!*. This allowed for real-time interface to provide personalized feedback via notifications. Weight change was the primary outcome. Secondary outcomes included the number of motivational patient-provider feedback notifications to the participant in relation to weight-loss, self-efficacy towards weight-loss, minutes spent in physical activity, and nutritional content.

Women included in the study were aged 18 to 75 years with histologically confirmed Stage I or II EC or BC within the previous three years and no evidence of recurrent disease. Participants needed access to a smartphone or Internet with unlimited data or Internet connection, body mass index (BMI) $\geq$25 kg/m^2, medical clearance from the patient's oncologist, a performance status of 0–2, surgical treatment greater than 6-months prior to start of the study, and an endorsed desire to lose weight. Exclusion criteria included: non-English speaking, inability to read the consent form, lack of smartphone or Internet connection, inability to use the *LoseIt!* app, patients with severe depression, physical or cognitive deficits, pregnancy, plan to become pregnant, breastfeeding, surgical treatment less than 6-months prior to start of the study, and women who participated in a structured weight-loss program in the last 6-months.

The cancer registry was used to identify eligible BC patients based upon time of diagnosis and stage of disease. Endometrial cancer patients were identified through the use of ICD-9 codes and eligibility was determined through subsequent chart review. All eligible women were contacted via telephone or in-person in the oncology office, screened using inclusion and exclusion criteria, and provided a baseline research appointment, if interested in participating (Fig. 1).

2.2. Intervention protocol

Participants individually met with a member of the research team (RP, RC, or CES) for two-visits, one at baseline and another at exit, four-weeks later. The baseline visit lasted between 30 and 60 min, time depending on patient familiarity with web- or mobile-based apps and time to answer questions. Each woman received log-on information and instructions on how to use *LoseIt!*. Each participant passed a *LoseIt!* competency test, which encompassed logging exercise as well as looking up and logging foods from different venues including supermarket items, restaurant items, and home cooked meals. Participants were then instructed to use *LoseIt!* in order to log daily food choices, daily exercise type and duration, and daily body weight in the morning over the course of the next four, consecutive weeks.

The nutritional component of our intervention focused on limiting the daily intake of carbohydrates to less than 70 g per day and increasing fiber intake to 30 g per day, and an approach that has been demonstrated as effective in other weight-loss programs [21]. Nutrition goals were conveyed to participants during the baseline visit. Here, participants were shown nutrition labels to aid their understanding of monitoring carbohydrate and fiber intake. No other restrictions in fat or calories were made. Participants were able to monitor their carbohydrate intake through the *LoseIt!* app. Women were encouraged to meet standard physical activity guidelines as indicated by the ACSM which emphasizes moderate-intensity cardiorespiratory exercise training for $\geq$150 min per week, vigorous exercise $\geq$40 min per week, and resistance exercises for each of the major muscle groups [22]. Weight-loss goals were established at the baseline visit and included the loss of approximately 1–2 lb/week.

The real-time feedback component provided by the multi-disciplinary team was based on the SCT whereas messaging focused on the patient to improve weight-loss self-efficacy by using verbal or typed persuasion, vicarious learning experiences, mastery, and social support [6,23,24]. Participants received motivational patient-provider feedback notifications in response to their individual input in the *LoseIt!* app for the four weeks study period. A patient-provider feedback notification is defined as a phone call, email message, and/or a push notification which was manually generated based on user input. Push notifications were automatically provided by *LoseIt!* technology to serve as motivation reminders to log meals at specified times throughout the day and reward compliance. User input regarding declining adherence to entering weight, dietary information, and exercise habits triggered the more frequent delivery of automatic push notifications.

Patients were encouraged to log nutrition and exercise in real-time or at least once a day. The daily exercise and nutrition logs were monitored by the multi-disciplinary team (GO, RP, RC, RD, and CES). Participants were also provided a Bluetooth scale (Withings©, Boston, MA) to assist in weight tracking during the intervention period; however, the final analyses were completed from the validated scale in the clinical office (499KL Health O Meter ® Professional Digital Column Scale, Neosho, MO).