



The SMARTER pilot study: Testing feasibility of real-time feedback for dietary self-monitoring

Lora E. Burke^{a,b,c,*}, Yaguang Zheng^d, Qianheng Ma^{a,b}, Juliet Mancino^e, India Loar^e, Edvin Music^e, Mindi Styn^e, Linda Ewing^e, Brian French^f, Dan Sieworek^f, Asim Smailagic^f, Susan M. Sereika^{a,b,c}

^a University of Pittsburgh School of Nursing, Pittsburgh, PA, USA

^b University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, USA

^c Clinical and Translational Science Institute, Pittsburgh, PA, USA

^d Connell School of Nursing, Boston College, Boston, MA, USA

^e University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

^f Carnegie Mellon University, School of Computer Science, Pittsburgh, PA, USA

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ABSTRACT

Self-monitoring (SM) of food intake is central to weight loss treatment. Technology makes it possible to reinforce this behavior change strategy by providing real-time feedback (FB) tailored to the diary entry. To test the feasibility of providing 1–4 daily FB messages tailored to dietary recordings via a smartphone, we conducted a 12-week pilot randomized clinical trial in Pittsburgh, PA in US in 2015. We compared 3 groups: SM using the Lose It! smartphone app (Group 1); SM + FB (Group 2); and SM + FB + attending three in-person group sessions (Group 3). The sample (N = 39) was mostly white and female with a mean body mass index of 33.76 kg/m². Adherence to dietary SM was recorded daily, weight was assessed at baseline and 12 weeks. The mean percentage of days adherent to dietary SM was similar among Groups 1, 2, and 3 (p = 0.66) at 53.50% vs. 55.86% vs. 65.33%, respectively. At 12 weeks, all groups had a significant percent weight loss (p < 0.05), with no differences among groups (−2.85% vs. −3.14% vs. −3.37%) (p = 0.95); 26% of the participants lost ≥ 5% of their baseline weight. Mean retention was 74% with no differences among groups (p = 0.37). All groups adhered to SM at levels comparable to or better than other weight loss studies and lost acceptable amounts of weight, with minimal intervention contact over 12 weeks. These preliminary findings suggest this 3-group approach testing SM alone vs. SM with real-time FB messages alone or supplemented with limited in-person group sessions warrants further testing in a larger, more diverse sample and for a longer intervention period.

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1. Introduction

The evidence supporting the central role of self-monitoring (SM) in weight management has been accumulating for nearly three decades (Acharya et al., 2009; Burke et al., 2008; Burke et al., 2011a; Butryn et al., 2007; Carels et al., 2005; Peterson et al., 2014). A recent review of the weight loss SM literature demonstrated consistent support for a significant association between participant SM and weight loss (Burke et al., 2011b). More recently, consistency and timing of SM in relation to eating were shown to be significantly related to weight outcomes (Sereika et al., 2011).

There is strong theoretical and empirical support for providing feedback (FB) on SM recordings to guide the individual towards better food

choices and reinforce behavior changes that lead to weight loss. The technology available today can facilitate personalized FB that can be delivered remotely and in real-time, which translates into the person receiving FB the same day as the recording. Theoretical underpinnings for optimizing the timing of the FB messages are drawn from behavioral theory that provides a wealth of empirical evidence demonstrating that positive reinforcement for an emitted, desired behavior provided immediately following the behavior leads to increases in the occurrences of the desired behavior; the more proximal the reinforcer to the desired behavior, the more likely the desired behavior will be increase (Kanfer and Grimm, 1980). Earlier studies using personal digital assistants (PDA) showed promising results (Burke et al., 2011a; Spring et al., 2012; Burke et al., 2012a). More recently, studies have used mobile phones to deliver messages via text or short message service to participants to promote healthful behaviors (Shapiro et al., 2012; Gerber et al., 2009; Haapala et al., 2009a; Patrick et al., 2009; Carter et al., 2013; Napolitano et al., 2013; Siopis et al., 2014; Martin et al., 2015; Turner-McGrievy and Tate, 2011; Turner-McGrievy et al., 2013).

* Corresponding author at: School of Nursing, Graduate School of Public Health, Clinical and Translational Science Institute, Hub for Excellence in eHealth Research, University of Pittsburgh, 415 Victoria Building, Pittsburgh, PA 15261, USA.

E-mail address: lb100@pitt.edu (L.E. Burke).

However, these studies did not directly incorporate SM of diet. Thus, the messages were generic in content, rather than focused on the SM data (Gerber et al., 2009; Patrick et al., 2009).

Our SMART Trial provided evidence that FB messages delivered via a PDA are most effective when tailored specifically to the individual's current behaviors (Burke et al., 2012a; Ambeba et al., 2012). The aim of the current study was to test the feasibility of providing 1 to 4 daily FB messages tailored to dietary recordings via a smartphone and compare the effect of SM alone to SM with tailored FB and SM plus tailored FB and face-to-face group sessions. The primary outcomes of the 12-week, pilot, randomized clinical trial (RCT) were recruitment, retention and adherence to SM as well as percent weight loss from baseline to 12 weeks. The secondary outcomes were changes in blood pressure and self-efficacy from baseline to 12 weeks.

2. Subjects and methods

2.1. Study design

The SMARTER pilot study was a 12-week RCT of behavioral treatment for weight loss with 39 adults randomized to one of 3 groups: Group 1 used the Lose It! app (LoseIt! FitNow, Inc., Boston, MA) on the smartphone for SM of dietary intake; Group 2 used the app for SM and received 1 to 4 tailored FB messages daily; and Group 3 used the app for SM, received 1 to 4 FB messages daily and attended 3 group behavioral weight loss sessions at weeks 2, 4, and 8. Participants were assessed at baseline and 12 weeks and compensated for the final assessment. Written informed consent was obtained from all participants; the study was approved by the University of Pittsburgh Institutional Review Board. The study flow is shown in Fig. 1.

2.2. Setting and participants

Individuals were eligible if they were ≥ 18 years of age with a body mass index ≥ 27 and ≤ 43 , using an Android smartphone, currently not SM their food intake daily, and no recent intentional 10-pound weight loss. Exclusion criteria included pregnancy; conditions requiring medical supervision of diet or exercise.

2.3. Recruitment, screening, and baseline assessment

Participants were recruited from the community using the University Mailing Services batch email system and screened using a Qualtrics survey (Qualtrics, n.d.). Eligible individuals were notified via a second email message with a link to another survey and consent for providing more in-depth health history, including diagnoses of major medical conditions.

2.4. Randomization

The 39 eligible individuals provided consent and were randomized with equal allocation to 1 of the 3 groups. Randomization was conducted using the minimization method considering the pre-randomization factors of gender and race (White vs. non-White) to ensure group balance with respect to these characteristics.

2.5. Intervention

2.5.1. Training on the use of the Lose It! app for dietary SM

All participants were provided the Lose It! app for dietary SM, a commercially available app for mobile and desktop platforms. Prior to training, they were sent an email with directions on installing the app on their smartphone, creating an account, and responding to an email invitation to join the University of Pittsburgh Lose It! portal. After participants "accepted" the invitation, their account was accessible via the portal to the study interventionist. Participants randomized to Groups

2 and 3 were also sent instructions for downloading and installing the FB message software. Each of the three groups had separate training sessions; each was observed by the research staff to perform several SM tasks, e.g., search and enter foods consumed, find an ethnic food, enter physical activity minutes.

Dietary goals. Participants in all three groups were given a daily calorie and daily fat gram goal using the following as a guideline: < 250 lb, 1200–1800 cal and 40–50 g of fat; ≥ 250 lb, 1800–2200 cal and 50–60 g of fat, with the lower numbers being for females. The interventionist discussed with each participant their recommended calorie and fat goal ranges and emphasized timely recording of dietary intake. The groups were instructed how to distribute the calorie and fat allowance across the full day; and about the different types of fat and limiting the saturated fat to no more than 10%. Limiting added sugar drinks was also addressed as a source of calories that did not add nutrients.

For Groups 2 and 3, the interventionist explained that as they completed dietary SM on the app, the FB app would generate responsive "pop-up" messages related to calories, fat, or total sugar they had consumed; if data suggested the absence of SM, a message on the importance of SM may be sent. These three dietary components, calories, fat and sugar, that are tracked in the Lose It! app are important in the management of energy consumption and thus were the focus of the feedback messages. All participants were given a daily goal for total calories and fat consumption.

2.5.2. Weight loss intervention

Participants were asked to self-monitor their dietary intake as soon as possible after eating as well as to weigh daily and enter the weight on the app. Participants were provided one if they had no home scale. One week after the initiation of the SM period, the interventionist sent a generic reminder email regarding continuing self-monitoring and contacting the interventionist if they had questions or technical issues. All participants received an individualized, generic email message at the start of Week 3, providing encouragement and asking if there were any technology issues that needed troubleshooting. For Group 2 and 3 participants who reported not receiving FB messages, troubleshooting with the software installation followed. Ongoing generic email messages were sent to all participants every two weeks to encourage continued SM or to offer technical support. Sending the message to all participants prevented the creation of bias.

2.5.3. FB messages

SM data were downloaded hourly between 9 AM and 10 PM from the Lose It! portal to the Oracle database maintained by the School of Nursing housed at the University of Pittsburgh Network Operating Center via the network server (see Fig. 2). The FB message algorithm was programmed to read the most recently recorded calories, fat, and sugar data 1 to 4 times per day from the download and randomly select an appropriate message. Conditions were created using percentages of calories, fat and sugar that approximated various combinations of 1) under-eating, 2) meeting goals, or 3) exceeding goals. See Table 1 for examples of conditions at breakfast. At each time point that a participant was randomly assigned to receive a message, the algorithm performed the following sequential tasks: calculated percentages, matched percentages to a condition, randomly chose a message from the library that was applicable to the condition and delivered the message to the participant's smartphone as a pop-up message. If the participant consumed amounts of calories, fat and sugar for which no condition "matched," no message would be delivered. The algorithm randomly selected the message from a library of messages. The library contained hundreds of messages, which we continued to develop over the course of the study to keep the messages fresh and prevent desensitization, an issue we experienced in the first study in which we tested an earlier version of the algorithm (Ambeba et al., 2015).

The FB message library contained approximately 6 to 9 messages for each condition; messages were refreshed with additional or alternative

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