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Log Often, Lose More: Electronic Dietary Self-Monitoring for Weight Loss

Jean Harvey[1], **Rebecca Krukowski**[2], **Jeff Priest**[3], **Delia West**[4]

[1]Department of Nutrition and Food Sciences, University of Vermont, Burlington, Vermont, USA.

[2]Department of Preventive Medicine, University of Tennessee Health Sciences Center, Memphis, Tennessee, USA

[3]Medical Biostatistics Unit, University of Vermont, Burlington, Vermont, USA

[4]Department of Exercise Science, Arnold School of Public Health, University of South Carolina, Columbia, South Carolina, USA.

Abstract

Objective: Dietary self-monitoring is consistently related to both short- and long-term weight loss. The purpose of this study was to quantify the time spent and the daily frequency of self-monitoring necessary for weight-loss success.

Methods: Participants in a 24-week, online, behavioral weight-control intervention recorded daily dietary intake using a Web-based dietary analysis program. Time spent self-monitoring and frequency of dietary journal page access were captured. Weight loss (kilograms) and the proportion of participants losing ≥ 5% and ≥ 10% of baseline weight were assessed at 6 months.

Results: Participants (n = 142; BMI 35.8 kg/m^2; 90.8% female; 23.2% African American) spent an average of 23.2 minutes per day self-monitoring in month 1 and 14.6 minutes in month 6. For those still recording any minutes self-monitoring by month 6 (65.5%), there were no significant differences in time spent based on weight loss; however, those losing either ≥ 5% or ≥ 10% logged in to the journal Web page significantly more times per day (1.6 vs. 2.4, P < 0.001 for < 5% vs. ≥ 5%; 1.7 vs. 2.7, P < 0.001 for < 10% vs. ≥ 10%).

Conclusions: The frequency of self-monitoring is significantly related to weight loss, with the time needed to be successful diminishing during the intervention.

Introduction

Dietary self-monitoring is consistently related to successful short- and long-term weight loss (1–3). Daily dietary self-monitoring consists of recording all foods and beverages consumed as well as the portion size and preparation method. Weight-loss program participants are often instructed to record foods as soon as they are consumed, or to “write it when you bite

Correspondence: Jean Harvey (Jharvey@uvm.edu).

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it," although we are aware of very little research supporting this recommendation. The advent of nutrient analysis websites and smartphone applications allows for the easy tabulation of total calories and fat consumed, thus lowering the burden of numerical calculation. This is important, as an ongoing tabulation of calories consumed provides an awareness of whether goals are being achieved. Unfortunately, many people engaged in weight-loss interventions fail to record their food intake proximal to consumption, and self-monitoring overall has been shown to consistently decrease over time (4). This is despite repeated encouragement to continue the behavior to attain weight-loss success.

Evidence has suggested that the accuracy and completeness of self-monitoring diaries are not as important as the frequency with which they are completed (5). Daily diary completion for a typical 24-week weight-loss intervention is perceived by participants as onerous and can represent a significant time commitment. Little is known, however, about exactly how much time individuals successful at weight loss actually spend self-monitoring. Moreover, it is not clear whether individuals become more efficient with practice, thus becoming able to decrease the time they spend self-monitoring in order to get the same result. Previous methods of dietary self-monitoring (i.e., paper and pencil diaries) did not lend themselves to an analysis of time spent engaged in the behavior. Moreover, it was not generally possible to evaluate the timing and frequency of recording during a single day without relying on self-report, which is notoriously unreliable. Electronic self-monitoring options now provide opportunities to continue to evaluate the details of self-monitoring behavior without relying on self-report. Therefore, the purpose of this study was to quantify the time spent and the daily frequency of dietary self-monitoring for participants engaged in an online 24-week behavioral weight-control intervention. Given that adherence to self-monitoring predicts weight-loss success yet declines over time, it is important to understand the thresholds of engagement necessary to produce clinically significant weight loss in order to establish meaningful goals and expectations for program participants.

Methods

Participants

Participants enrolled in the final two cohorts of the Internet Obesity Treatment Enhanced with Motivational Interviewing (iReach^2) trial (6) were the focus of this substudy. To be eligible, participants had to be in generally good health, be at least 18 years old, and have a BMI (weight in kilograms divided by height in meters squared) between 25 and 50. Individuals were ineligible if they took medications that might affect weight loss, reported substantial recent weight loss, had a history of bariatric surgery or were enrolled in another weight-reduction program, or had a condition for which weight loss was contraindicated. All participants had to have access to a computer (at home or work) and the Internet. Additional details on inclusion and exclusion criteria, recruitment and screening procedures, weight-loss outcomes, and attrition have been published previously (6).

Lifestyle interventions

The iReach^2 study randomized participants to an 18-month, online, group-based lifestyle intervention for obesity with the following two conditions: Behavior Therapy alone or

Behavior Therapy plus Motivational Interviewing (MI). All group meetings, as well as MI sessions, were conducted via Internet chat. Participants met in closed groups once per week during the first 6 months and monthly for the remaining 12 months. Six individual MI sessions were conducted over the 18-month period for those in the Behavior Therapy plus MI condition. All participants were encouraged to adhere to a reduced-calorie lowfat diet and complete 200 minutes per week of moderate to vigorous exercise. Behavioral strategies offered to assist in making habit changes included self-monitoring, goal setting, problem solving, and relapse prevention (7–9). There were no weight-loss or adherence differences by condition (6); therefore, data have been combined for the purposes of this analysis. Because participants were not asked to self-monitor daily after the first 24 weeks, the present analysis is restricted to the first 6 months of the intervention. For additional details regarding the design and methods of iReach^2, see West et al. and Krukowski et al. (6,10). The trial was approved by the Institutional Review Boards of the University of Vermont and the University of Arkansas for Medical Sciences.

Measures

Height and weight.—Weight was measured in street clothes, without shoes, on a calibrated digital scale (Tanita, Tokyo, Japan). Height was measured using a wall-mounted stadiometer (Seca Corp., Hamburg, Germany). Both height and weight were measured in person by a trained research assistant. The dependent variable was weight change measured as a continuous variable and converted to BMI as well as percent of participants achieving a 5% or 10% weight loss (categorical variable). These cutoffs were chosen as they are related to improvements in prevalence and incidence of chronic disease (11).

Dietary self-monitoring.—Dietary self-monitoring was the independent variable expressed as frequency of log-in sessions to the journal page per day as well as minutes spent on the journal page per day. Participants were instructed to record dietary intake daily over the 24-week intervention using the iReach^2 study website. A self-monitoring journal tool, based on US Department of Agriculture dietary analysis data, with a personalized dietary monitoring feature was embedded on the website. Participants were provided a goal for a calorie-restricted diet and given a dietary fat goal corresponding to ≤ 25% of calories from fat. The website offered real-time feedback on total calories consumed in the day based on the foods and portion sizes recorded as well as calories remaining to reach the participant's personal daily goal. Participants were encouraged to monitor their intake throughout the day ("write when you bite") and check the balance of calories remaining to meet (and not exceed) their daily goal to help them plan their eating for the remainder of the day. Time spent daily on the website journal page, which included exercise minutes, weight reporting, and dietary entries, as well as number of log-ins each day to this particular page was captured electronically. The capacity to electronically record engagement with the journaling page of the iReach^2 website was operational only in the later part of the trial, which is why only the final two cohorts are included in these analyses.

Statistical analysis

Descriptive statistics were calculated for all study variables. Using a multiple imputation method, intent-to-treat analyses were conducted to evaluate change in weight from baseline

to 6 months. The fully conditional specification method was used in SAS PROC MI (SAS Institute Inc., Cary, North Carolina) to conduct six imputations of missing data. This method utilized regression of continuous variables and logistic regression of classification variables to estimate missing parameters. Predictors of missingness included baseline weight and weight at 6 months, site, treatment condition, cluster, sex, education, African American identity, age at baseline, depression score, and obesity status. Weight change was calculated as total kilograms lost as well as the proportion of participants losing ≥ 5% and 10% of baseline weight. Pearson correlation coefficients were used to explore the relationship between time spent self-monitoring and log-ins to the journal Web page and weight change. Because the purpose of the study was to assess whether frequency of self-monitoring and time spent self-monitoring were associated with successful weight loss, participants who had 0 minutes of self-monitoring each month were excluded from analysis. We examined sociodemographic factors that were potentially associated with not self-monitoring to explore whether certain groups may be more prone to struggle with self-monitoring and may need a tailored intervention. The total number of minutes spent self-monitoring as well as the total number of self-monitoring log-in sessions per month was calculated. These data were then converted to average daily minutes and log-ins each month. Differences between minutes and sessions by percent weight loss were assessed using the Wilcoxon rank sum test. All analyses were conducted using SAS version 9.4. Across all tests, statistical significance was defined as $P < 0.05$ (two-tailed).

Results

The 142 participants enrolled and randomized in the final two recruitment waves of the larger iReach[2] study were, on average, 48.9 ± 10.5 years old with an average BMI of 35.8 ± 5.9 kg/m^2. They were predominantly female (90.8%); 81.7% were classified as having obesity (BMI ≥ 30), and 23.2% identified as African American. The subset of participants in this substudy did not differ at baseline from the remaining participants in the overall study sample ($n = 256$; data not shown). They also did not differ in the amount of weight lost or overall retention at 6 months (data not shown). Clinic-obtained weight-change outcome data at 6 months were available for 88.7% ($n = 126$) of randomized participants in the substudy, and 65.5% ($n = 93$) were still self-monitoring in month 6. Total minutes spent self-monitoring were significantly correlated with total number of log-ins to the self-monitoring Web page ($r = 0.79$, $P < 0.0001$). Weight change (kilograms) was also significantly correlated with number of minutes spent self-monitoring ($r = 0.61$, $P < 0.0001$) and with total self-monitoring log-ins ($r = 0.64$, $P < 0.0001$). Those with no minutes of self-monitoring in month 6 were significantly younger than those with any minutes of self-monitoring ($P < 0.01$) (Table 1). Participants who identified as African American had significantly higher rates of not recording any minutes of self-monitoring (35% vs. 17%; $P < 0.001$) by month 6. Neither gender nor BMI was a significant predictor of lack of self-monitoring by month 6.

Participants spent an average of 23.2 ± 10 minutes per day self-monitoring during month 1 and 14.6 ± 9.6 minutes per day at month 6 (Table 2). Among those still self-monitoring, there were no significant differences in time spent monitoring based on weight loss, with those losing ≥ 5% or ≥ 10% spending as much time as those not losing a clinically

significant amount of weight. There were, however, significant differences at month 6 in weight loss among those who still monitored during the month compared with those who did not monitor at all, such that there were very few participants who were successful at reaching the ≥ 5% or ≥ 10% weight-loss thresholds with no minutes of self-monitoring.

There was also a significant difference in the average number of daily log-ins to self-monitor every month, with those losing either ≥ 5% or ≥ 10% of baseline weight having more self-monitoring log-ins than those who lost ≤ 5% or < 10% (Table 2). Those participants who lost either ≥ 5% or ≥ 10% logged in to the journal Web page significantly more times per day (1.6 vs. 2.4, $P < 0.001$ for < 5% vs. ≥ 5%; 1.7 vs. 2.7, $P < 0.001$ for < 10% vs. ≥ 10%).

It would appear that to be successful, self-monitoring needs to occur at least two to three times a day rather than during a single sitting.

Finally, consistency in daily self-monitoring was also important, as those with successful weight losses (i.e., ≥ 5% and ≥ 10% weight loss) recorded on significantly more days out of the month both early in the program (month 1) as well as later in treatment (month 6) than did those who lost < 5%. Though the number of days with any dietary self-monitoring diminishes slightly over time, participants who were most successful (≥ 10% weight loss) were still recording on an average of 20 days per month in month 6.

Discussion

Successful participants, those losing ≥ 5% or ≥ 10% of baseline weight, were spending about 23 to 24 minutes per day recording dietary intake during the initial month of the program, but this was reduced to only 15 to 16 minutes per day by month 6 of the program. For those still recording, although the time spent journaling was not significantly different based on weight-loss category, the number of times during the course of the day that participants logged in to record their intake was significantly different. The data suggest that logging in to record intake at least twice a day is associated with greater weight-loss success. It would appear that to be successful, self-monitoring needs to occur about three times a day rather than during a single sitting, which suggests that those logging in about three times per day may have been self-monitoring more proximal to their eating episodes and may have had a better idea of their running balance of calories throughout the day, consistent with the program's recommendations.

In fact, those losing ≥ 10% of their baseline weight were journaling approximately three times a day throughout the program. Therefore, it would appear that self-monitoring more frequently is likely related to increased weight-loss success.

These findings related to the importance of the frequency of self-monitoring within each day as well as the consistency throughout a month are similar to previous research which found that frequency of self-monitoring during the course of a day only helped to reduce weight regain when it was coupled with high consistency (> 3 days/week) (12). Krukowski and colleagues (13) similarly found that consistent periods of self-monitoring (recording ≥ 6 days in a row), particularly early in a weight-loss program, were associated with greater likelihood of achieving > 5% weight loss. Though the current study did not evaluate the

number of continuous days of self-monitoring, it did demonstrate that journaling on more days in the month was significantly associated with better weight loss. This is consistent with an extensive literature associating the number of days of self-monitoring with weight-loss outcomes (4).

What is perhaps the most novel contribution here is insights into the actual time required for participants to self-monitor their dietary intake. With these data, it is now possible to estimate for participants the time commitment they should anticipate to enhance the likelihood that they will achieve clinically meaningful weight loss in a behavioral weight-control program. Participants who lost ≥ 10% spent, on average, 23 minutes per day self-monitoring during month 1 and 16 minutes per day during month 6. Twenty-three minutes per day represents about a 2.5-hour time commitment per week for the first month in a behavioral weight-loss program when the participants are learning the self-monitoring system and accumulating their commonly consumed foods. By the sixth month of the program, according to our data, the time engaged in self-monitoring among those who are successful in achieving weight loss may decrease to less than 2 hours per week.

Total minutes spent journaling decreased every month, even for those who continued to engage in the behavior. It is not clear whether this time decrease was because they got "better," and therefore more efficient at the behavior, or they were recording fewer foods or less detail. This data set does not permit evaluation of the number and types of foods reported; however, previous research suggested that participants reported fewer foods as time goes on (12). Fortunately, very detailed or comprehensive dietary self-monitoring journals may not be necessary after the first few months of a weight-loss program (5,12). Individuals who scale back the detail in their self-monitoring were shown to still be very successful in their weight loss (5). The act of self-monitoring consistently may be the key.

In light of this, it is important to keep people engaged in the process of self-monitoring over time. Unfortunately, however, participation in the behavior was shown to decrease (14). The same was true in the current study, with 34.5% of subjects not registering any journaling minutes by month 6. Results from the Diabetes Prevention Program (15) suggested that for every self-monitoring journal submitted during the first 16 weeks of the program, the chances of meeting the 7% weight-loss goal increased by 8%. Therefore, cumulatively, a month of self-monitoring diaries increases the odds of achieving a 7% weight-loss goal by 32%. These are impressive odds, particularly when considered with the time commitment necessary to self-monitor. Increasing the odds of achieving this benchmark weight loss by 32% by just spending about 9 hours a month on self-monitoring would seem a real deal. We also demonstrated that younger individuals and participants who identified as African American were more likely to have stopped self-monitoring by month 6, which is consistent with previous research indicating that younger individuals (16) and those who identify as African American (15) tend to have lower rates of weight loss in behavioral weight-loss programs. Though it is hard to know the direction of the relationship (i.e., whether lack of weight-loss success leads participants to give up on self-monitoring or whether lack of self-monitoring leads to lower weight losses), this finding suggests that there may need to be targeted interventions focused on increasing self-monitoring adherence in these populations.

This study had several strengths and limitations. The sample represents two geographic areas with a high proportion of participants who identified as African American, both men and women included, although the sample size was not specifically powered to examine sociodemographic differences in self-monitoring behaviors. It is also the case that all self-monitoring was done online, and therefore these results cannot be generalized to other forms of dietary self-monitoring. However, electronic forms of self-monitoring (via websites or applications) are far more common in behavioral weight-control programs than are paper and pencil diaries. In fact, these newer systems may take even less time than our Web-based system did. The assessment of time and frequency of self-monitoring in the current study was limited to the first 24 weeks of the intervention and should therefore be extrapolated to self-monitoring behaviors during the weight-loss initiation phase of the study rather than to weight maintenance. It is also the case that participants in this study were enrolled in a weight-loss clinical trial, and results may not be the same for people with obesity who are not engaged in a behavioral weight-loss research program. Finally, we were not able, with our website configuration, to match the number of foods recorded on a specific day to the time spent or number of log-ins to the journal page on that particular day. Despite this, the present analysis provides important new information about time taken to self-monitor and frequency of self-monitoring as they relate to weight-loss success.

Conclusion

The results of this study confirmed that the frequency of self-monitoring is significantly related to weight-loss success in an online behavioral weight-loss intervention, with both the number of days per month of self-monitoring and the number of times per day that the self-monitoring website is accessed associated with weight-loss outcomes (i.e., two to three times per day). Additionally, the time participants need to spend to achieve clinically meaningful weight loss decreases over time, with approximately 20 minutes per day needed early in the program and only 15 minutes required later in the program. This new information allows for the development of very specific self-monitoring goals as well as expectations about the time commitment required.

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TABLE 1

Age, BMI, race, and sex for those with any minutes and 0 minutes of self-monitoring at 6 months

	Any minutes (*n* = 93)	No minutes (*n* = 49)
Sex (%)		
Female	92.5	87.7
Male	7.5	12.2
Race (%)		
African American	17.2	34.7*
Caucasian	82.8	65.3
Age, y (± SD)	51.2 ± 10.7	44.5 ± 8.8**
BMI (± SD)	35.8 ± 5.5	35.8 ± 6.2

*$P < 0.01$.

**$P < 0.001$.

TABLE 2

Average number of days per month of dietary self-monitoring, daily self-monitoring minutes, and daily log-ins to self-monitoring Web page for total sample and among those who lost ≥ 5% and ≥ 10% of baseline weight (using imputed weight) at 6 months

	All	< 5% WL	≥ 5% WL	*P* value	< 10% WL	≥ 10% WL	*P* value
Month 1							
n	142	71	71		108	34	
Minutes/day	23.2 ± 10.1	22.0 ± 8.1	24.5 ± 11.7	0.279	23.2 ± 10.6	23.3 ± 8.4	0.466
Sessions/day	2.5 ± 1.2	2.3 ± 1.0	2.8 ± 1.3	< 0.001	2.3 ± 0.9	3.2 ± 1.7	< 0.001
Days/month	19.4 ± 7.5	17.4 ± 7.1	21.3 ± 7.4	0.001	18.0 ± 7.5	23.7 ± 5.7	< 0.001
Number with no log-ins	0	0	0		0	0	
Month 2							
n	134	66	68		100	34	
Minutes/day	19.3 ± 9.1	19.0 ± 9.2	19.5 ± 9.0	0.566	19.0 ± 9.1	20.0 ± 9.1	0.468
Sessions/day	2.3 ± 1.2	2.0 ± 0.8	2.7 ± 1.5	0.001	2.1 ± 0.8	3.2 ± 1.8	< 0.001
Days/month	17.9 ± 9.0	14.3 ± 9.0	21.3 ± 7.7	< 0.001	15.8 ± 8.7	23.8 ± 7.4	< 0.001
Number with no log-ins	8 (6%)	5 (7%)	3 (4%)	0.719	8 (7%)	0	0.199
Month 3							
n	124	58	66		91	33	
Minutes/day	18.1 ± 10.7	18.0 ± 11.2	18.2 ± 10.3	0.859	18.3 ± 11.3	17.7 ± 9.0	0.897
Sessions/day	2.2 ± 1.2	1.8 ± 0.7	2.5 ± 1.5	< 0.001	1.8 ± 0.6	3.2 ± 1.9	< 0.001
Days/month	16.0 ± 9.9	10.9 ± 8.8	20.4 ± 8.7	< 0.001	12.9 ± 8.8	24.5 ± 7.6	< 0.001
Number with no log-ins	18 (13%)	13 (18%)	5 (7%)	0.075	17 (16%)	1 (3%)	0.073
Month 4							
n	111	47	64		79	32	
Minutes/day	15.6 ± 8.6	14.9 ± 9.4	16.1 ± 7.9	0.422	15.3 ± 8.8	16.2 ± 8.0	0.534
Sessions/day	2.1 ± 1.2	1.7 ± 0.5	2.5 ± 1.4	< 0.001	1.8 ± 0.6	2.9 ± 1.9	0.001
Days/month	15.9 ± 9.4	11.5 ± 8.1	19.1 ± 9.0	< 0.001	12.7 ± 8.1	23.9 ± 7.5	< 0.001
Number with no log-ins	31 (22%)	24 (34%)	7 (10%)	0.001	29 (27%)	2 (6%)	0.009
Month 5							
n	98	37	61		65	33	
Minutes/day	16.1 ± 9.0	15.4 ± 9.3	16.5 ± 8.9	0.420	16.1 ± 9.2	15.9 ± 8.7	0.907

	All	< 5% WL	≥ 5% WL	*P* value	< 10% WL	≥ 10% WL	*P* value
Sessions/day	2.1 ± 1.1	1.7 ± 0.6	2.3 ± 1.3	0.004	1.8 ± 0.6	2.7 ± 1.6	0.001
Days/month	14.2 ± 10.1	9.4 ± 8.1	17.1 ± 10.1	< 0.001	10.9 ± 9.0	20.8 ± 8.9	< 0.001
Number with no log-ins	44 (31%)	34 (48%)	10 (14%)	< 0.001	43 (40%)	1 (3%)	< 0.001
Month 6							
n	93	34	59		61	32	
Minutes/day	14.6 ± 9.6	13.7 ± 8.6	15.1 ± 10.1	0.786	13.9 ± 9.9	16.0 ± 8.8	0.141
Sessions/day	2.1 ± 1.1	1.6 ± 0.5	2.4 ± 1.2	0.001	1.7 ± 0.5	2.7 ± 1.4	< 0.001
Days/month	14.5 ± 10.1	9.0 ± 8.2	17.6 ± 9.8	< 0.001	11.2 ± 8.9	20.8 ± 9.2	< 0.001
Number with no log-ins	49 (34%)	37 (52%)	12 (17%)	< 0.001	47 (43%)	2 (6%)	< 0.001

Results for minutes/day, sessions/day, and days/month include only participants with at least 1 minute of self-reported monitoring within the month. Comparisons for minutes/day, sessions/day, and days/month were conducted using the Wilcoxon rank sum. Comparisons for number with no log-ins was conducted using Fisher exact test. WL, weight loss.