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BRIEF REPORT

Evaluation of TeleMOVE: a Telehealth Weight Reduction Intervention for Veterans with Obesity

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Abstract
Background The rates of overweight and obesity are high among United States Veterans, necessitating the development of accessible weight reduction interventions.
Purpose This observational study evaluated the efficacy of a novel home-based telehealth weight loss intervention (TeleMOVE) for Veterans with obesity.
Methods We obtained weight measures of 171 patients before and after one and two 90-day cycles of TeleMOVE.
Results Enrollment in the first 90-day cycle of TeleMOVE was associated with significant weight loss (M = 8.62 lbs, SD = 9.85). Those who subsequently enrolled in the second, identical, cycle lost significantly more weight overall (M = 11.68 lbs, SD = 12.53) than those who only enrolled in the first cycle (M = 5.55 lbs, SD = 8.23). However, this difference was due to two-cycle participants losing significantly more weight during the first cycle alone (M = 10.52, SD = 10.32).
Conclusions TeleMOVE is a promising intervention, warranting a further investigation of its efficacy.

Keywords Obesity · Telehealth · Home-based interventions · Weight loss · TeleMOVE · Veteran health

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Introduction

Overweight and obesity are highly prevalent among the general population in the USA [1] and are present among US veterans at comparable or even higher levels [2, 3]. Relative to normal weight of veterans, Veterans Affairs (VA) patients with obesity had significantly higher prevalence of hypertension, dyslipidemia, diabetes, arthritis, and coronary artery disease and were more likely to report poor health, more disability days due to poor health, and limitations in their activities due to these health problems [4]. These data suggest that veterans receiving VA care are a population that is particularly vulnerable to overweight, obesity, and comorbid health conditions.

In response to the prevalence of obesity and associated health risks among veterans, the VA initiated the MOVE! program (www.move.va.gov). Program evaluation research suggests that the MOVE! program is successful in helping veterans achieve weight loss, with veterans losing 3.60 lb on average at 6 months after the start of treatment [5, 6]. Unfortunately, this same research suggests that only a small percentage of eligible veterans become involved in MOVE! [5, 7]. Veterans who were younger than 55, current smokers, and widowers were less likely to enroll in the MOVE! program [7]. The likelihood of participation in the MOVE! program was also lower among those who resided more than 30 miles away from the medical center, suggesting that increasing accessibility of the program might increase enrollment [7].

TeleMOVE is a new VA program designed to expand MOVE! participation options for veterans. The TeleMOVE intervention takes place in the veteran's home via a telehealth monitor connected to a phone line. Patients use the equipment daily over a 90-day (or a 180-day) treatment period, with their participation and adherence tracked by a local TeleMOVE coordinator. Although the VA initiated the TeleMOVE

program at hospital sites beginning in 2009, we are unaware of studies evaluating the effectiveness of the TeleMOVE program or its benefits relative to the standard MOVE! program.

Study Hypotheses

We hypothesized that (1) TeleMOVE enrollment would be associated with a statistically significant weight loss compared to pretreatment status after both the first and the second 90-day treatment cycles and (2) veterans choosing to enroll in two treatment cycles (a total of 180 days) would lose significantly more weight than those who enrolled in only the first 90-day cycle. To be able to make preliminary comparisons with the existing published evaluations of the MOVE! program [5, 7, 8], we used weight change (vs. body mass index (BMI) change) to test the hypotheses.

Methods

Participants and Data Collection

Participants were veterans (N=171) from the VA San Diego Healthcare System (VASDHS) who met criteria for obesity (BMI≥30) or overweight (25≤BMI≤29.9) and were referred to the VASDHS MOVE! program. After the initial MOVE! intake meeting, the veterans received several options to assist with their weight loss goals, including the TeleMOVE program to complete in their homes. All data for the present study were collected by the first author via a chart review of all participants who enrolled in the TeleMOVE program at the VASDHS between October 2010 and August 2012 and participated in at least 1 day of the program. The data consisted of weights collected by a trained nurse (at baseline) and using a standardized scale (posttreatment). The VASDHS Institutional Review Board (IRB) reviewed and approved the study. Because this study involved a retrospective review of clinical records, no informed consent was necessary or obtained as part of IRB approval.

TeleMOVE Program Description

TeleMOVE participants received a telehealth monitor, a standardized digital scale, a pedometer to track steps, and a MOVE! handout booklet for use at their home. The handout booklet contains instructions on how to keep accurate food records and provides assistance with developing goals. The telehealth monitor is a phone-sized stationary electronic device with a screen, several buttons, and a speaker that is connected to the landline in the veteran's homes. At an agreed-upon time, daily for 90 days, the monitor delivers 5-min educational modules on the screen and reads them aloud. The topics covered by these modules include nutritional information, behavioral modification, goal setting, and other topics relevant to weight loss. After each module, the telehealth monitor asks the participants a series of questions and offers multiple-choice answers to select from on the screen. If the patients answer correctly, the monitor provides positive feedback. If patients provide an incorrect answer, the monitor refers them to the page in the MOVE! manual that covers the topic.

In addition to using the monitor to learn new information and answer the questions, veterans had the option to send their food logs by mail or email to their assigned care coordinator once every 2 weeks for review. Veterans weighed themselves regularly using the standardized scale provided by the TeleMOVE program. Their weight data were electronically sent to the program coordinator for review, and the coordinator contacted them if they gained weight or lost more than 2 lb per week. After the first 90-day cycle was complete, the veterans had an option to either enroll in the second, identical, 90-day cycle or to discontinue TeleMOVE and return the monitor and the scale to the VA. Veterans were free to make the decision to re-enroll or discontinue based on their preference.

Measures

In addition to standard demographic measures, study variables included height (single measure; in the case of a height discrepancy, we used the MOVE! intake class height) and weight. Weight was collected over three time points: (1) the day of enrollment in TeleMOVE, collected in-person at the VA Hospital; (2) the day of completion of the first TeleMOVE treatment cycle, collected via a standardized electronic TeleMOVE scale at veteran's home; and (3) the day of completion of the second 90-day TeleMOVE treatment cycle (to comprise 180 days of treatment total, if available, collected via the same scale and procedure as weight after the first cycle). For those who enrolled in TeleMOVE but did not complete their 90-day treatment, we obtained weights recorded at the participant's last day of enrollment.

Statistical Analyses

We used a series of repeated measures and mixed-model ANOVAs with post hoc contrasts to test whether weight change between any of the time points was significant. Because enrollment in one TeleMOVE cycle vs. two TeleMOVE cycles was voluntary (not randomized), we ran separate ANOVAs to assess the impact of the first and the second cycles of the program. To test hypothesis 1, we used repeated measures ANOVA to assess whether enrollment in the first cycle of TeleMOVE was associated with significant weight change. The model included weights at baseline and after the first cycle of treatment. We then tested hypothesis 2 (that enrollment in two cycles of TeleMOVE would be associated with more weight loss than enrollment in just the first cycle) using a

Table 1 Descriptive statistics for participants separated by participation in one TeleMOVE cycle vs. two TeleMOVE cycles

	Total participants	Participants in first cycle *only*	Participants in two cycles
Number of patients	171	65	106
Mean age (years)	51.0	47.2	53.3
Percent of female	21.6	30.8	16.0
Race (%)			
American Indian or Alaskan Native	1.2	3.1	0
Asian or Asian American	1.8	0	2.9
African or African-American	20.5	36.9	10.5
Native Hawaiian or other Pacific Islander	1.2	0	1.9
Caucasian	62.6	49.2	70.8
Racially mixed	10.0	7.7	11.4
Missing data	2.7	3.1	2.5
Ethnicity (%)			
Hispanic/Latino	12.9	10.8	14.3
Non-Hispanic/Latino	83.6	87.7	81.9
Missing data	3.5	1.5	3.8
Mean baseline weight (lb)	261.1	257.9	263.0
Mean baseline body mass index	38.6	38.4	3807
Baseline body mass index categories (%)			
Overweight (25≤BMI≤29.9)	1.2	1.5	0.9
Obese (30≤BMI≤39.9)	29.2	30.8	28.8
Morbidly obese (BMI≥40)	68.4	67.7	70.2

mixed-model ANOVA with weight at different time points included as within-person factor, and enrollment in one cycle vs. two cycles of TeleMOVE as a between-person factor. We then ran a repeated measures ANOVA to clarify weight changes after the first cycle vs. the second cycle among those who enrolled in both cycles.

Results

The sample of 171 TeleMOVE participants included 37 (21.6 %) women and 134 men. Table 1 lists the descriptive statistics for demographic variables and baseline weight for (a) the entire sample, (b) those who enrolled in only the first cycle of TeleMOVE, and (c) those who enrolled in both cycles of the program. Participants' age ranged from 25.00 to 72.00 years (M=50.96, SD=11.68), weight at baseline ranged from 174.60 to 418.30 lb (M=261.06, SD=44.42), and BMI ranged from 28.18 to 55.73 (M=38.61, SD=5.34). According to the National Institute of Health BMI classification, 1.2 % of the sample was overweight (BMI=25–29.9), 29.2 % were obese (BMI=30–39.9), 68.4 % were morbidly obese (BMI=40+), and 1.2 % had missing data.

Figure 1 illustrates the TeleMOVE enrollment at different time points. Of a total of 171 participants enrolled in the program, 65 people (38 % of the entire sample) enrolled in the

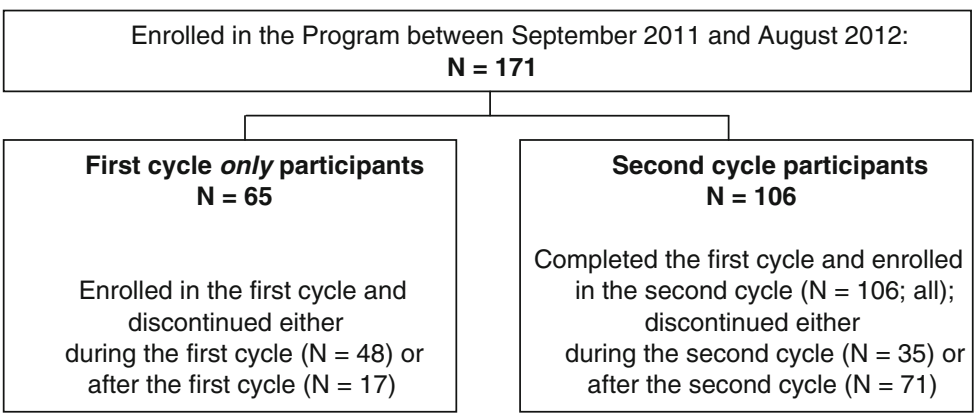

Fig. 1 TeleMOVE enrollment flowchart

first cycle but discontinued either during (48 people or 21 %) or after (17 people or 9.9 %) the first cycle. These individuals constitute the group of those who enrolled in the *first cycle only.* The remaining 106 participants (62 %) completed the first cycle and enrolled in the second cycle. Of these, 35 individuals (20.5 %) discontinued during the second cycle and 71 (41.5 %) completed the second cycle.

Those who enrolled in the first cycle only participated for an average of 54.4 days (SD=28.7, median=60.0). Those who enrolled in both the first and the second cycles participated for an average of 167.3 days of the program (SD=20.6, median=180.0). The duration of enrolment was positively correlated with age (r=.32, p<0.0001), and the average duration of enrollment was significantly higher for men than for women (t(169)=2.30, p=0.02). However, the weight change during either the first or the second cycle was not correlated with demographic variables. Finally, the percent weight loss after the first cycle of TeleMOVE was positively correlated with the number of days of enrollment (r=.29, p=0.0002); however, the percent weight loss after two cycles was unrelated to enrollment duration (r=.07, n.s.).

Hypothesis 1: Weight Loss Associated with Enrollment in the First Cycle of TeleMOVE

Enrollment in the first cycle of TeleMOVE was associated with significant weight loss (F(1,164)=126.26, p<0.0001). Participants lost on average 8.62 lb (SD=9.85; median=7.50 lb; range from 12.00-lb gain to 43.10-lb loss) during the first cycle of TeleMOVE.

Hypothesis 2: Weight Loss Associated with Enrollment in Both Cycles of TeleMOVE

Hypothesis 2 stated that those enrolled in both the first and the second cycles of TeleMOVE would lose significantly more weight than those who only enrolled in the first cycle. Analyses showed a significant interaction between enrollment in only the first cycle vs. two cycles and treatment (F(1,165)=11.93, p=0.001). By the end of treatment, those who only enrolled in the first cycle lost on average 5.55 lb (SD=8.23), whereas those who enrolled in two cycles lost on average 11.68 lb (SD=12.53). Although post hoc comparison revealed that outcome *weights* were not significantly different for those who enrolled in one cycle vs. two cycles of TeleMOVE (p=0.70), a comparison of weight *loss* suggests that those who enrolled in both cycles *lost* significantly more weight than those who only participated in the first cycle (F(1,165)=11.55, p=0.001) (Fig. 2).

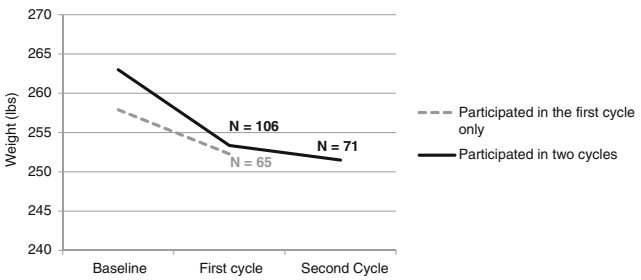

Fig. 2 Weight associated with enrollment in one TeleMOVE cycle vs. two TeleMOVE cycles

To clarify differential weight loss associated with the first vs. the second TeleMOVE cycle enrollment, we tested whether those who only enrolled in the first cycle differed from those who subsequently enrolled in the second cycle in their weight loss *during the first cycle alone*. The interaction between time and enrollment in one cycle vs. two cycles was significant (F(1,163)=10.47, p=0.001). Those who only enrolled in the first cycle lost on average 5.55 lb (SD=8.23, F(1,62)=28.61, p<0.0001) during the first cycle. Those who *subsequently enrolled in the second cycle* lost on average 10.52 lb (SD=10.32), during the first cycle alone (F(1,101)=105.89, p<0.0001). These participants subsequently lost an average of additional 1.16 lb (SD=6.32) during the second cycle, and this change was not statistically significant (p=0.11). Combined, these results indicate that even though those who enrolled in both cycles of TeleMOVE lost more weight by the end of reatment than those who only enrolled in the first cycle, their success was mainly due to greater weight loss during this first cycle.

Discussion

This paper describes perhaps the first empirical results for a home-based telehealth program for weight management in veterans called TeleMOVE. Overall, the TeleMOVE treatment demonstrated promise in helping veterans reduce weight. Enrollment in TeleMOVE was associated with significant weight loss. Interestingly, those who enrolled in both cycles of this program did not lose additional weight during the second cycle; however, during the first cycle, they lost more than those who *only* enrolled in the first cycle but discontinued before starting the second one. One explanation for this finding is that those who ultimately enrolled in the second cycle completed the first cycle, benefitting from all 90 days of enrollment, whereas those who only enrolled in the first cycle completed on average 54.4 days, due to high dropout rates. Together with the positive correlation between days of enrollment and weight loss during the first cycle, this suggests that effects of TeleMOVE may be dose specific, with longer enrollment (at least during the first cycle) being associated with better treatment outcomes. Another explanation for greater weight loss during the first cycle among those who subsequently enrolled in the second cycle is that those who benefited from the first cycle were more likely to re-enroll, albeit only to maintain their weight loss. Finally, it is also possible that those who ultimately enrolled in both cycles

had greater motivation from the start and thus lost more weight in the beginning. Understanding the factors contributing to TeleMOVE success is important for future research in order to maximize the benefits of the program.

Although no direct comparison of treatment outcomes has been published to date, review of MOVE! outcome literature suggests that TeleMOVE demonstrates efficacy at least comparable to standard MOVE! treatment. By the end of treatment, TeleMOVE participants lost on average 5.55 lb if they enrolled in only the first cycle and 11.68 lb if they subsequently enrolled in the second cycle. In contrast, MOVE! patients lost on average about 3.60 lb at 6 months after the start of treatment (same time period since the start of treatment as the end of the second TeleMOVE cycle [5]). Overall, these results suggest that TeleMOVE is at least as effective as the MOVE! treatment; however, a randomized comparison between treatments is needed to make definitive conclusions.

One of the main reasons for the development of TeleMOVE was to increase accessibility of the program to patients who may be unable to participate in the standard MOVE!. Several differences in patient demographics suggest the possibility that the new TeleMOVE program appeals to a slightly different population. For instance, the average age of MOVE! participants was 57.6 years [5], compared to the average age of 51.0 among TeleMOVE participants. Interestingly, age was positively associated with duration of enrollment in the MOVE! [5] and the TeleMOVE programs. These findings suggest that age is positively linked to treatment retention in both treatment programs, though TeleMOVE appeals to a younger population on average. Results also suggest that TeleMOVE appeals to a greater percentage of women: 21.6 % were enrolled in TeleMOVE vs. 10.1 % in MOVE!. However, the duration of enrollment was lower for women than for men and the percentage of women dropped in half between the first and the second cycles, indicating that the treatment may have lost its appeal to women over time, despite their initial higher rates of enrollment in this treatment, as compared to the MOVE! program. Finally, the average baseline BMI of TeleMOVE participants in this study was 38.61, whereas the average BMI of MOVE! patients was somewhat lower, 34.19 in the self-management support condition and 36.56 in supportive group session condition [8]. Although this difference may not be clinically significant, it is possible that TeleMOVE appeals to individuals with higher BMI who may find coming in for an in-person treatment to be a greater challenge. Again, a direct comparison between TeleMOVE and other weight loss interventions would be necessary to draw more definitive conclusions.

Limitations and Future Directions

The main limitation of this study is its nonrandomized design and the lack of a control group. Because of this limitation, it is not possible to conclude whether enrollment in both TeleMOVE cycles vs. the first cycle only resulted in differential weight loss or whether those who chose to enroll in both cycles would have lost more weight without the intervention. The present study used a preliminary format for examining the potential efficacy of TeleMOVE, enrollment patterns, and predictors of success and produced results that are likely to generalize to typical veterans voluntarily enrolling in TeleMOVE programs. This does not, however, negate the need for a rigorous randomized control trial, whether comparing TeleMOVE to the in-person MOVE program or comparing participants randomized to one cycle vs. two cycles of TeleMOVE.

Another notable limitation of this study is that we examined the impact of a single treatment on weight changes, without accounting for other treatments potentially pursued by TeleMOVE participants. Although VA electronic medical records allowed us to keep track and exclude participants who were receiving or awaiting bariatric surgery, we cannot rule out all other unmeasured treatments (e.g., enrollment in non-VA weight loss programs) or the effects of unmeasured confounding variables (e.g., consultation with a weight loss specialist at the VA). Additionally, in the present study, we were unable to track information on veterans sending in their food logs or receiving telephone feedback from the program coordinator. Because of this, observed weight changes cannot be attributed specifically to the measured components of TeleMOVE. Should future studies on TeleMOVE tackle this question, the first step might be to track other components of the TeleMOVE program (e.g., sending in food logs) and evaluate whether these components contribute to differential outcomes. The second step might be to assess whether prior enrollment in *other* VA weight loss programs (e.g., MOVE!) is associated with TeleMOVE outcomes.

Finally, overall dropout rates during the first cycle of the program remain high, suggesting the need to identify and address enrollment barriers that interfere with fuller engagement in the program. Prior studies indicate that combining modalities of treatment (i.e., technology and in-person communications) is associated with higher compliance [9], suggesting that scheduling additional in-person or phone contact with patients early in treatment might decrease early dropout rates.

Summary

In this observational study of veterans enrolling in a novel TeleMOVE program for weight loss, we observed that although enrollment was associated with significant weight loss after one 90-day cycle, results varied, with days of enrollment correlating with weight reduction. Enrolment in two consecutive cycles of the program was associated with greater weight loss than enrollment in only the first cycle; however, this was due to those enrolling in both cycles losing more weight during the first cycle alone and then maintaining their weight during the second cycle. Our findings are limited by the

nonrandomized design but offer preliminary support for TeleMOVE interventions and suggest areas for future research.

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Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Jane A. Skoyen, Thomas Rutledge, Julie A. Wiese, and Gina N. Woods declare that they have no conflict of interest. The VA San Diego Healthcare System Institutional Review Board (IRB) and research and development committee each reviewed and approved the study. Because this study involved a retrospective review of clinical records, no informed consent was necessary or obtained as part of IRB approval.

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