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ORIGINAL ARTICLE

The Effectiveness of Telemedicine for Weight Management in the *MOVE!* Program

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Abstract

Purpose: To examine the effectiveness of videoconferencing technology for delivering comprehensive weight management treatment.
Methods: This retrospective cohort study was conducted by extraction of data from medical records for the years 2008-2010. The treatment included a series of 12 weekly *MOVE!*® classes delivered using videoconferencing. Data were extracted from the time of baseline weight to 1 year after baseline weight for the *MOVE!* participants (n = 60) and from a concurrent control group (n = 60) that did not participate in *MOVE!* treatment.
Findings: Results indicated that the *MOVE!* group lost weight while the control group gained weight, resulting in a mean difference between the groups of −5.5 ± 2.7 kg (95% CI = −8.0 to −3.0; $P < .0001$).
Conclusions: These results indicate that videoconferencing is an effective method to provide the *MOVE!* Weight Management Program to veterans. Weight loss was maintained for one year after baseline in the *MOVE!* group. This is very promising as weight re-gain is a common issue and these results support using videoconferencing for a long-term weight management treatment option.

Key words health promotion, obesity, telemedicine, videoconferencing, weight loss.

The National Health and Nutrition Examination survey estimated that the prevalence of obesity (body mass index [BMI] ≥ 30 kg/m^2) for 2009-2010 in the United States was 35.5% for men and 35.8% for women.[1] In 2002-2006 US veterans who had a primary care appointment at veterans' health care facilities had a 35.5% incidence of obesity.[2] These high rates of obesity led to the creation of a comprehensive approach to weight management for the veteran population called the *MOVE!* Weight Management Program.[3] The *MOVE!* Weight Management Program was developed by the Veterans Health Administration (VHA) National Center for Health Promotion and Disease Prevention beginning in 2002 and used evidence-based practices and guidelines from the National Institutes of Health. Nationwide implementation of the *MOVE!* program occurred in January 2006.[3] However, even with effective programs there are barriers in obtaining weight management care, particularly

for people living in rural areas.[4] The Sioux Falls VA Health Care System has community-based outpatient clinics (CBOCs) in 5 smaller communities located over 85 miles from the main VA hospital in Sioux Falls, South Dakota. The majority of veterans participating in *MOVE!* through the CBOCs live in rural to highly rural areas (less than 1,000 people per square mile to less than 7 people per square mile, respectively). The distance for these rural veterans can create several barriers to receiving effective weight management care including cost, travel time, weather conditions, and lack of availability of services in their local area. Subspecialties in nutrition treatment for bariatric surgery, home enteral nutrition, and diabetic care were evaluated using videoconferencing, with promising results for both patients and providers.[5-10] There are few studies on the effectiveness of using videoconferencing for weight management.[11-14] According to a study by Jean Harvey-Berino on using interactive television to treat obesity, results were similar for weight loss, calorie reduction, and physical activity changes between an in-person treatment group and a videoconferencing treatment group.[12] According to a study by Meyer et al, when comparing the cost between videoconferencing, a taped video group, and a face-to-face group using a behavioral weight loss program, the videoconferencing treatment was the most cost-effective treatment modality with similar weight loss results.[13]

Previous studies did not include baseline demographics on participants with medical conditions including Posttraumatic Stress Disorder (PTSD), depression, schizophrenia, bipolar disorder, anxiety, diabetes, cardiovascular disease, sleep apnea, hypertension, or medications that may impact weight gain or loss. People with medical conditions or taking medications that may influence weight are an important population to consider for effective weight management treatment strategies. This is a vital consideration for residents in rural areas, as they tend to have greater rates of obesity and chronic disease.[4,15,16] The purpose of this retrospective cohort study was to determine the effectiveness of delivering the *MOVE!* Weight Management Program using videoconferencing technology including participants with multiple medical conditions and medications that may impact weight. The primary measure of effectiveness was the difference in the first-year change in body weight between the *MOVE!* participants and a concurrent control of veterans who chose not to participate.

Methods and Procedures

A retrospective cohort study was conducted to compare changes in body weight between a *MOVE!* group and a control group. To be eligible for this study, veterans needed a BMI > 25 kg/m^2 and an age of 18-85 years. The participants in the *MOVE!* group attended at least 1 *MOVE!* class in 2008-2010 delivered by videoconferencing.

Table 1 *MOVE!* Weight Management Program Treatment

Description	
Diet information	Mindful eating, label reading, portion control, how to trim excess fat from diet, how to increase fiber intake, increasing water intake, carbohydrate counting, calorie counting, and grocery shopping tips.
Physical activity information	Increasing physical activity to 150-250 min/wk, checking target heart rate, exercise safety, barriers to exercise with problem solving.
Behavior modification	Diet and physical activity records, goal setting, problem solving, weekly weights with graphs, cognitive restructuring, positive self-talk, stimulus control, and stress relief.

MOVE! Program materials can be found at www.move.va.gov.

Description of *MOVE!* Treatment

The *MOVE!* Weight Management team for this study included 3 registered dietitians, a psychologist, a physical therapist, and a wellness nurse (RN). All classes were taught by members of the *MOVE!* team broadcasting from the Sioux Falls VA Health Care System. Nine of the 12 classes were taught by the primary *MOVE!* dietitians. One class was taught by the psychologist, 1 class was taught by the physical therapist, and 1 class was taught by the wellness nurse. The videoconference providers broadcast to 3 patient sites in CBOC's located in Aberdeen, South Dakota; Spirit Lake, Iowa; and Sioux City, Iowa. According to data pulled from the VHA ProClarity (Microsoft Corp., Redmond, Washington) analytics server through April 2013, 64% of *MOVE!* veterans from these 3 outpatient clinics were considered to be located in rural areas, 17% were in urban locations, and 19% were unknown. Veterans in the treatment group attended a group weekly class series for 12 weeks (size limit 8 participants due to conference room size). These classes (1 hour each) incorporated an interdisciplinary approach to weight management and included information on diet, physical activity, and behavioral modifications (Table 1).

Videoconferencing Equipment Used

The *MOVE!* classes were broadcast using a 1,700 Tandberg unit for the provider with remote for sound and visual control with an IP bandwidth of 384 kbps, and an ISDN bandwidth of 6b/384 kbps. Broadcasts were on a FIPS 140.2 encryption standard secure line to protect privacy and confidentiality. Each VA CBOC had

a large screen monitor (36-42 inch) with remote to control sound and camera view.

Selection of Participants

The *MOVE!* group was selected through a database search of the Sioux Falls VA Health Care computerized patient record system for veterans participating in the *MOVE!* Weight Management Program in the years 2008-2010. All veterans who participated in the CBOC *MOVE!* classes were included in the sample if they met the eligibility criteria. The control group was pulled from the same VA CBOCs as the *MOVE!* group and met all of the qualifications to participate in the *MOVE!* program but had declined treatment.

The control group was selected by matching to *MOVE!* participants for CBOC location, date of baseline weight, and BMI. For each *MOVE!* participant, a control subject was matched at the same CBOC. They were matched for baseline weight (recorded within 30 days of the *MOVE!* participant's baseline weight) to control for seasonality. The controls had to be within 2 BMI kg/m^2 points of their *MOVE!* counterpart. Matching for the 3 criteria provided an eligible pool of control subjects from which 1 control subject was randomly selected for each *MOVE!* participant. A control subject was not found for 6 *MOVE!* participants that had a high BMI (41.5-51.3) within the 30-day baseline weight criteria. For these 6 *MOVE!* subjects, matching of baseline weight was extended to within 1 year of the *MOVE!* subject's baseline weight.

Exclusion Criteria

Veterans with active cancer, end-stage conditions such as chronic obstructive pulmonary disease, congestive heart failure, Parkinson's, amyotrophic lateral sclerosis, and multiple sclerosis were excluded. Veterans who resided in a long-term care facility were also excluded, as well as those with moderate to severe cognitive impairment such as dementia or significant stroke. Veterans with active substance abuse, active psychosis, AIDS, or anorexia or who had bariatric surgery within the years 2008-2010 were also not included.

A total of 88 participants were enrolled in the *MOVE!* Weight Management Program in the Sioux Falls VA Health Care System CBOCs during 2008-2010. Sixteen subjects were not included in the final sample because their start date in the program was too late to collect follow-up data for 1 year. Eight subjects were excluded due to participation in the *MOVE!* Weight Management Program via correspondence or telephone only without attending the videoconferencing classes. Three veterans were excluded due to incomplete data (no weight available 1 year after baseline). One veteran was excluded due to bariatric surgery within the data collection period. A total of 60 *MOVE!* veterans remained after exclusions and were included in the final sample.

Data Collection

The data for this study were collected from the Sioux Falls VA Health Care System (SFVAHCS) computerized patient record system during a retrospective chart review. Baseline information was gathered to determine how comparable the groups were, and to make statistical adjustments for differences between groups at baseline. Data for this comparison included race, gender, age, diabetes, cardiovascular disease, hyperlipidemia, glucose intolerance, glucose, triglycerides, sleep apnea, hypertension, depression, anxiety, posttraumatic stress disorder, bipolar disorder, and schizophrenia as well as medications that may cause weight gain or loss (antidepressants, antianxiety, antipsychotics, prescription weight loss medications, corticosteroids, diuretics, thyroid medication, and diabetic medications including oral agents and insulin). BMI and weight were extracted at baseline and 12 months after baseline for comparison.

The number of *MOVE!* videoconferencing visits attended and reason for discontinuation of attendance in *MOVE!* classes were recorded for each subject in the treatment group to determine treatment fidelity.

Data Analysis

Baseline characteristics were described using the mean and standard deviation of continuous variables and proportions (expressed as percentages) for categorical variables. To test the primary null hypothesis that the changes in body weight 1 year after baseline would be the same in each group, multivariable linear regression of the calculated changes in weight was used in an intent-to-treat analysis. The estimated difference in changes in weight, including 95% confidence intervals, was estimated as regression coefficient for the variable representing the treatment group. Observed differences in baseline characteristics that might have led to differences in changes in weight including baseline weight were entered as control variables. Although subjects were matched by clinic site and other variables, the matching process was ignored during data analysis. A secondary analysis that was clustered by site was conducted to account for the possibility that the changes in subjects' weight could be correlated within sites. The Kruskal-Wallis one way analysis of variance (ANOVA) on Ranks and the Dunn's method for multiple comparison were used to compare 1-year changes in weight in

subgroups categorized by the number of *MOVE!* sessions attended. The analyses were completed using Stata (version 10.1, StataCorp LP, College City, Texas) and Sigma Stat 3.1 software (Systat Software, Inc., Chicago, Illinois) software.

Based on review of changes in weight recorded in a preliminary sample of 10 charts for each group (control and *MOVE!* participants), it was determined that 60 subjects per group would be required to detect a difference of 3.4 kg (7.5 pounds) between groups to obtain a power of 80%, with a 2-tailed alpha error of 0.05, using an estimated pooled standard deviation of the changes in weight of 6.36 kg (14 pounds).

The study protocol was reviewed and approved by the Sioux Falls VA Health Care System Research and Development Committee and by the affiliate University of South Dakota Institutional Review Board (USD-IRB) as an expedited category 5 research study with a waiver of the process of informed consent, and a full waiver of HIPAA authorization. The South Dakota State University IRB concurred with the USD-IRB approval.

Table 2 Subject Demographics

Variable	All Subjects (n = 120)	Control Group (n = 60)	*MOVE!* Group (n = 60)
Gender			
Male	112 (93%)[a]	57 (95%)[b]	55 (92%)[c]
Female	8 (7%)	3 (5%)	5 (8%)
Marital status			
Single	41 (34%)	21 (35%)	20 (33%)
Married	79 (66%)	39 (65%)	40 (67%)
Ethnicity and race			
None recorded	42 (35%)	28 (46%)	14 (23%)
Caucasian	73 (61%)	30 (50%)	43 (72%)
Hispanic	1 (1%)	1 (2%)	0
Am. Indian	2 (2%)	0	2 (3%)
Asian	0	0	0
Black	2 (2%)	1 (2%)	1 (2%)
Lifestyle habits			
Quitting smoking	9 (8%)	5 (8%)	4 (7%)
Physical limitations	67 (56%)	30 (50%)	37 (62%)
Seasonality			
Spring/summer[d]	56 (47%)	28 (47%)	28 (47%)
Fall/winter[e]	64 (53%)	32 (53%)	32 (53%)

[a]% of all subjects.
[b]% of control group.
[c]% of *MOVE!* group.
[d]Time of baseline weight was April through September.
[e]Time of baseline weight was October through March.

Results

Baseline Comparison

The baseline characteristics of the *MOVE!* program participants and the control group are summarized in Tables 2–4 . There was a greater prevalence of diabetes mellitus in the *MOVE!* group (31 subjects, 52%) versus the control group (18 subjects, 30%). The mean baseline glucose for the control group was 112 ± 19 mg/dL (mean ± SD) and 130 ± 40 mg/dL in the *MOVE!* group. Triglycerides were also higher at baseline in the treatment group at 177± 90 mg/dL compared to 154 ± 116 mg/dL in the control group. The mean age for the control group was 62 ± 11.1 years and the mean age for the treatment group was 57 ± 10.1 years. The baseline values for BMI and body weight were well matched.

Weight Change

The mean unadjusted difference in changes in body weight between the treatment and control group was –5.2 kg ± 2.5 (95% CI = –7.4 to –3.0 kg; $P < .0001$) 12 months after baseline. After adjusting the estimate of the treatment effect for differences in baseline characteristics that might have contributed to differences in the changes in weight (baseline weight, age, diabetes, glucose, triglycerides, antipsychotic use, depression, anxiety, sleep apnea, insulin, oral diabetic medication use, and use of antidepressants), the mean adjusted difference in weight between the 2 groups was –5.5 kg ± 2.7 (95% CI = –8.0 to –3.0; $P < .0001$). The *MOVE!* participants retained approximately 95% of their weight loss from week 12 through week 52. See Table 5 for a summary of the mean BMI at baseline, and the mean weights in the 2 groups at baseline, after 12 weeks and 1 year after baseline.

When the data were analyzed based on the number of classes attended in the 12-week period (1-4 classes, 5-8 classes, or 9-12 classes), those attending 9-12 classes lost the greatest amount of weight at the end of 12 weeks versus those attending only 1-4 sessions, as seen in Figure 1. Those participating in more than 5 *MOVE!* sessions had greater weight loss compared to the control (Figure 2) and maintained the weight loss for up to 1 year.

Discussion

To our knowledge this is the first study conducted to evaluate the effectiveness of the *MOVE!* Weight Management Program using videoconferencing technology. The results indicate that videoconferencing is an effective method to provide the *MOVE!* Weight Management Program to distant outpatient clinics. A significant mean weight loss was observed compared to a concurrent control group and was maintained for up to 1 year.

Table 3 Medical Diagnoses

Medical Diagnoses[a]	All Subjects (n = 120)	Control Group (n = 60)	*MOVE!* Group (n = 60)
Diabetes Mellitus	49 (41%)[b]	18 (30%)[c]	31 (52%)[d]
Glucose intolerance	22 (18%)	12 (20%)	10 (17%)
Hypertension	96 (80%)	51 (85%)	45 (75%)
Edema	17 (14%)	6 (10%)	11 (18%)
Hyperlipidemia	97 (81%)	51 (85%)	46 (77%)
Cardiovascular disease	32 (27%)	15 (25%)	17 (28%)
Depression	39 (33%)	16 (27%)	23 (38%)
Bipolar disorder	3 (3%)	0 (0%)	3 (5%)
Anxiety	16 (13%)	5 (8%)	11 (18%)
Sleep Apnea	38 (32%)	15 (25%)	23 (38%)
Schizophrenia	5 (4%)	1 (2%)	4 (7%)
Posttraumatic Stress Disorder	17 (14%)	9 (15%)	8 (13%)

[a]Based on diagnoses at time of baseline weight.
[b]Values in parentheses = % of all subjects
[c]Values in parentheses = % of control group
[d]Values in parentheses = % of *MOVE!* group

Table 4 Baseline Medication Use

Medications[a]	All Subjects (n = 120)	Control Group (n = 60)	*MOVE!* Group (n = 60)
Statins	76 (63%)[b]	38 (63%)[c]	38 (63%)[d]
Insulin	13 (11%)	4 (7%)	9 (15%)
Oral diabetic	58 (48%)	22 (37%)	36 (60%)
Antidepressants	51 (43%)	18 (30%)	33 (55%)
Antipsychotics	9 (8%)	1 (2%)	8 (13%)
Antianxiety	13 (11%)	4 (7%)	9 (15%)
Anticonvulsants	12 (10%)	3 (5%)	9 (15%)
Diuretics	46 (38%)	22 (37%)	24 (40%)
Levothyroxine	16 (13%)	7 (12%)	9 (15%)

[a]Based on medication use at time of baseline weight.
[b]Values in parentheses = % of total group.
[c]Values in parentheses = % of control group.
[d]Values in parentheses = % of *MOVE!* group.

Table 5 Changes in Body Weight and BMI

	Control Group (n = 60)	*MOVE!* Group (n = 60)
Weight (kg)		
Baseline	121.9 ± 25.6	124.7 ± 27.4
12 weeks	Not determined	121.3 ± 27.9
12 months	123.8 ± 26.9	121.5 ± 26.0
12-month change	2.0 ± 4.4 (0.8 to 3.1)	−3.3 ± 7.5[a] (−5.2 to −1.3)
BMI (kg/m^2)		
Baseline	38.6 ± 7.2	38.9 ± 7.3
12 months	39.2 ± 1.0	37.9 ± 0.9
12-month change	0.68 ± 1.5 (0.28 to 1.09)	−0.97 ± 2.4[a] (−1.59 to −0.35)

Data are mean ± standard deviation (95% confidence interval).
[a]*P* value < .0001 for unadjusted difference between groups.

Furthermore, the weight loss correlated with the total number of sessions attended in the first 12 weeks of the program (Figure 1).

The use of videoconferencing for people living in rural areas should be considered due to multiple barriers such as reduced access to reliable weight management programs and increased rates of obesity, heart disease, and diabetes compared to people living in urban areas.[4,15,16] The majority of participants in the *MOVE!* videoconferencing group (>64%) were from rural areas in the Midwest.

In comparison with a meta-analysis of the literature, individuals typically maintain only 67% of their initial weight loss after 1 year.[17] Our results indicated that participants in the *MOVE!* videoconferencing group maintained 95% of their weight loss after 1 year. It is important to note that without treatment, the control group gained weight 1 year after baseline measurement (Figure 2). It is worthy to consider that preventing further weight gain through the *MOVE!* program would likely yield health benefits over time.

In a *MOVE!* study using in-person (face-to-face) group treatment by Dahn et al,[18] veterans had an average weight gain (2 kg) in the year prior to entering the program. This was comparable to the weight gain we observed in our control group over the year of the study (1.7 kg). The in-person participants who completed the *MOVE!* group course had an average weight loss of 1.6 kg/yr.[18] In our study, the *MOVE!* videoconferencing group had a mean weight loss of 3.3 kg after 1 year, suggesting that videoconferencing is also an effective intervention. Results from other behavioral weight

Figure 1 This figure shows weight changes at the end of the 12 weeks versus baseline for subjects completing 1-4 sessions (2.1 ± 0.3 sessions = mean ± SEM, n = 10), 5-8 sessions (6.8 ± 0.2, n = 22), or 9-12 sessions (10.3 ± 0.2, n = 28). The data points are median values with the numbers in parentheses representing the 25th and 75th percentiles. Those completing 9-12 sessions had a significantly lower body weight at the end of 12 weeks versus those completing 1-4 sessions ($P < .05$).

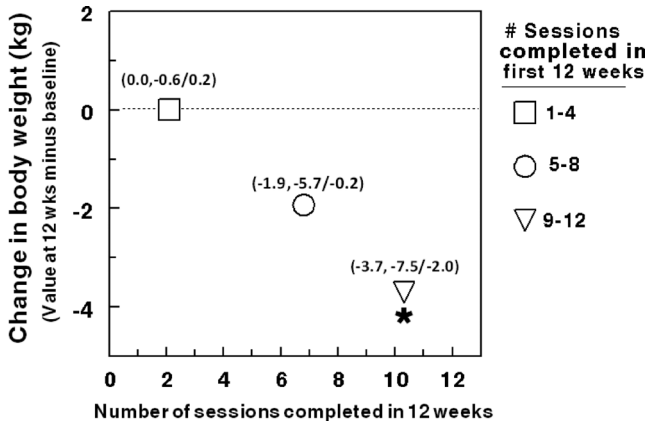
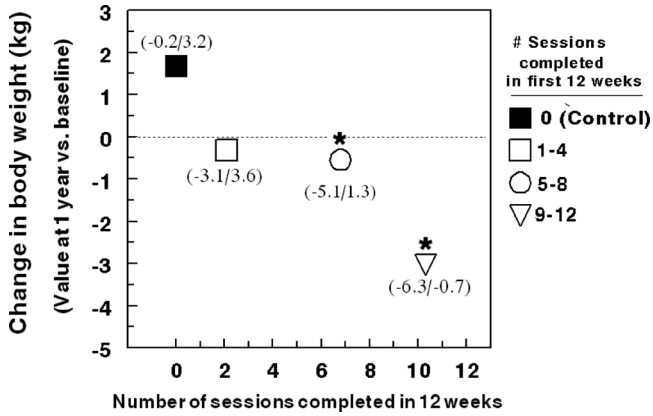


Figure 2 This figure shows weight changes at the end of the 52 weeks versus baseline for control subjects (n = 60) or *MOVE!* participants completing 1-4 sessions (2.1 ± 0.3 sessions = mean ± SEM, n = 10), 5-8 sessions (6.8 ± 0.2, n = 22) or 9-12 sessions (10.3 ± 0.2, n = 28) total. The data points are median values with the numbers in parentheses representing the 25th and 75th percentiles. Those completing either 5-8 or 9-12 sessions in the first 12 weeks significantly lower body weights at the end of 52 weeks versus that seen in control subjects ($P < .05$).



management programs indicate similar weight loss results at 12 weeks of treatment (average weight loss of 4.0 kg compared to a 3.4 kg weight loss in the *MOVE!* videoconferencing group).[19,20]

There are some limitations to consider when interpreting these results. The correlation between weight loss and the number of sessions attended (Figures 1 and 2) may be biased by other factors such as level of motivation at baseline or dropouts due to lack of initial success in losing weight or program acceptance. The intervention for this study was not randomly assigned and there may have been some self-selection bias. We attempted to control for observed differences in baseline characteristics; however, there may be some important unmeasured differences such as the level of motivation to lose weight. This retrospective study also relied on the accuracy of medical records. The identified population for this study was overweight and obese veterans. Most of these veterans were males and Caucasian. In a review of the literature, for comparison of weight change it was noted that many studies include predominately women in the treatment groups.[11,12,19,20] Part of the purpose of this study was to provide evidence of effective treatment methods for individuals with medical conditions, taking medications that may contribute to weight and that were living in rural populations as these individuals may reflect candidates seeking weight management treatment.[4,21,22] Another important detail in this particular population was the number of veterans with mental illness diagnoses (Table 3). People with mental illness may struggle with weight management as many of the medications to treat mental health conditions have side effects of increased

appetite and weight gain.[23,24] Increased eating for comfort has also been reported.[23,24] Therefore, caution needs to be taken in extending results beyond this sample.

Conclusion

This study demonstrates that videoconferencing is an effective form of treatment for weight management. Additional research is needed to compare videoconferencing with other populations and modes of treatment delivery (eg, videos on the Internet or videoconferencing to the home) for weight management in rural areas. Continued research on videoconferencing with follow-up appointments after the initial 12 weeks (extended length of treatment) and long-term outcomes (2-5 years) is essential.

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