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Tele-Motivational Interviewing for Cancer Survivors: Feasibility, Preliminary Efficacy, and Lessons Learned

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Abstract

Objective: Determine the feasibility, acceptability, and efficacy of tele-Motivational Interviewing (MI) for overweight cancer survivors.

Design: Six-month nonrandomized phase 2 clinical trial.

Setting: Urban garden and remote platforms.

Participants: Overweight and obese cancer survivors post active treatment.

Intervention: Remote tele-MI from a trained registered dietitian nutritionist (RDN).

Main Outcome Measures: Feasibility, acceptability, and preliminary efficacy.

Analysis: Groups were stratified as users and nonusers based on tele-MI use. Qualitative survey data and remote MI interaction logs were analyzed for trends. Two-sample *t* tests were performed to assess pre-post intervention changes in physical activity and dietary behaviors, quality of life, self-efficacy, and clinical biomarkers.

Results: A total of 29 participants completed the intervention. There were 17 tele-MI users (59%) and 12 nonusers (41%). Users were primarily female (88%), breast cancer survivors (59%),

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SUPPLEMENTARY DATA

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.

college educated (82%), with a mean age of 58 years. Users set 50% more goals, lost more weight (4.8 vs 2.6 kg), significantly improved quality of life ($P = .03$), and trended more positively in clinical biomarkers (eg, cholesterol, blood pressure) than did nonusers.

Conclusions and Implications: Findings from this study indicate that tele-MI is a feasible and acceptable intervention for overweight cancer survivors after active therapy. Larger randomized trials are needed to establish efficacy and generalizability to a variety of demographic populations.

Keywords

motivational interviewing; telehealth; cancer survivor; lifestyle; technology

INTRODUCTION

The number of cancer survivors in the United States is expected to increase from 15 to 19 million by 2024.¹ In response, a paradigm shift is necessary in providing cancer care that alters the focus from acute treatment to chronic disease management.² This transformation calls for continued care for the cancer survivor, including individualized survivorship support and tailored follow-up well beyond active cancer treatment.³ Because the majority of cancer survivors are also overweight or obese, the myriad of health challenges in this vulnerable population are compounded and increase the risk of all-cause mortality.⁴

Evidence-based recommendations for the care of cancer survivors include adoption of a primarily plant-based diet and regular physical activity. These guidelines also encourage survivors to achieve and maintain a normal body weight. This is of particular importance considering a recent International Agency for Research on Cancer Report,⁵ which links 13 cancers (eg, pancreatic, colorectal) to excess body fatness. Accordingly, several organizations, including the World Cancer Research Fund/American Institute for Cancer Research, American Cancer Society, and American Heart Association, consistently support adherence to a primarily plant-based dietary pattern and the use of trained interventionists such as registered dietitian nutritionists (RDNs) to improve behaviors and health outcomes.⁶⁻⁸ However, current evidence suggests that these recommendations are not consistently followed or consistently recommended.⁹

Targeted behavioral interventions for overweight and obese individuals often emphasize self-regulation, behavior modification, and goal setting.¹⁰ Albert Bandura's Social Cognitive Theory (SCT) outlines the importance of self-regulation with consideration of 3 major components: (1) self-monitoring, (2) judgment of one's own actions compared with personal standards, and (3) choosing behaviors based on anticipated internal reactions.¹¹

Motivational interviewing (MI) is a clinical counseling approach used by trained interventionists that builds on SCT constructs. Initially developed to address addictive behaviors such as substance abuse, MI uses reflective listening, open-ended questions, and affirmations while emphasizing client autonomy to enhance an individual's internal motivation to change behaviors.¹² The main tenet of MI is to address an individual's ambivalence regarding behavior change.¹³ Related to cancer survivors specifically, MI has

been used to encourage positive lifestyle behaviors, particularly via promoting improvements in dietary and physical activity patterns in survivors.¹⁴ Other efficacious MI-based interventions have addressed perceptions of fatigue, pain, postsurgical complications, and stress.¹⁵⁻¹⁹

The US Department of Health and Human Services defines telehealth as the use of technology to deliver health care, health information, or health education at a distance.²⁰ Remote telehealth platforms have been successfully applied in a variety of health services to promote behavior change, provide emotional support, and serve as a source of motivation and reinforcement for clients.^{21,22} Literature documents the benefits of remote coaching interventions in the improvement of physical activity, quality of life (QOL), dietary patterns, and clinical biomarkers such as cholesterol.^{23,24} Indeed, use of interactive technologies, including remote coaching, computer-based programs, and devices, are increasing in popularity in weight loss interventions, yet continue to yield mixed results. Although they have proven more cost effective per kilogram of body weight lost than traditional weight loss interventions, inconsistencies in delivery remain.²³⁻²⁹

Telephonic interventions, including those supplemented by additional aspects of electronic connectivity such as text messaging and website access, have shown to be efficacious, feasible, and acceptable.^{28,30,31} Compared with controls or enhanced controls (ie, passive education), interactive computer-based behavioral interventions emphasizing 2-way communication resulted in greater weight loss and weight maintenance in the overweight and obese population. Yet despite this success, compared with face-to-face interventions, these produced relatively modest improvements.³² Therefore, although technology-based interventions, including telehealth, are becoming widely available and have proven efficacious, cost-effective, and acceptable in the treatment and management of various conditions, these novel methods of delivery may be best received when paired with traditional counseling.^{26,30}

Over 90% of cancer survivors fail to meet evidence-based dietary and physical activity guidelines; therefore, it is critical for clinicians to develop and test novel telehealth interventions targeting high-risk cancer survivors to improve lifestyle behaviors and health outcomes.³³ High-risk survivors include those who have undergone aggressive oncology treatments that increase the risk of secondary malignancies or comorbidities (eg, cardiovascular disease) or possess clinical health indices that increase the risk of a cancer recurrence or a second cancer (eg, morbid obesity).^{8,33,34} Telehealth interventions using MI from a trained interventionist (RDN) may affect behavior change in overweight and obese cancer survivors. The purpose of this study was to determine the feasibility, acceptability, and efficacy of targeted tele-MI, provided by a trained RDN, for overweight and obese cancer survivors harvesting at an urban garden.

METHODS

Participants and Recruitment

Adult cancer survivors were recruited from local oncology clinics and community cancer centers to participate in this phase 2 trial. Participants were screened for eligibility by trained

study personnel, and all eligible participants were invited to attend a baseline clinic visit. The study inclusion criteria included adult (aged ≥ 18 years) cancer survivors who had completed active therapy within the previous 36 months; the ability to read, write, and speak English; access to telephone, e-mail, or texts; and body mass index (BMI) ≤ 25 kg/m².

Study exclusion criteria included cancer survivors who were cognitively unable to consent or who had physical or mental limitations that would prevent full participation in the program; survivors taking medications for which increasing produce consumption was contraindicated (ie, warfarin); those consuming nonprescription substances (ie, herbals, botanicals, or alternative products); and survivors with active metabolic or digestive illnesses or malabsorptive disorders (Crohn's disease, irritable bowel syndrome), renal insufficiency, hepatic insufficiency, cachexia, or short bowel syndrome.

Informed consent was obtained from all participants included in the study at baseline clinic visits. All procedures were performed in accordance with the ethical standards of The Ohio State University's institutional review board and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Study Design

James *Care for Life*, a component of The Ohio State University Comprehensive Cancer Center, provides programming and services to cancer patients and survivors. One survivorship program is centered on a 2.5-acre garden called the Garden of Hope, located on the main academic campus. Survivors and their caregivers are invited to harvest fruits, vegetables, and herbs from the Garden of Hope weekly during growing seasons. Beginning in 2013, this garden has served as a platform for several garden-based interventions for cancer survivors.³⁵⁻³⁷ As such, in 2015, a phase 2 nonrandomized intervention trial aimed at improving adherence to the evidence-based dietary guidelines for cancer prevention and survivorship was conducted.^{36,38} Specific components of the 6-month intervention included: (1) weekly harvesting at an urban garden, (2) semi-monthly group education classes with cooking demonstrations, and (3) remote motivational interviewing coaching (tele-MI).³⁵

Tele-Motivational Interviewing coaching.—Tele-Motivational Interviewing coaching was provided by an experienced and licensed RDN with advanced training in oncology nutrition. The RDN was trained by an expert in MI. Initial MI training consisted of 4 2-hour, one-on-one training sessions covering the pillars of MI as well as role-playing, questions and answers, and tailored feedback. Upon completion of the MI training, sample participant interactions were randomly recorded and coded by the MI expert for fidelity using the Motivational Interviewing Treatment Integrity Fidelity Tool.³⁹ Based on these assessments, the RDN was deemed competent in MI.

Participants were introduced to the tele-MI coach at orientation and encouraged to use tele-MI throughout the intervention. Participants also provided their preferences for future remote contact (via Skype, telephone, e-mail, and/or texts). The tele-MI coach followed up by contacting all participants remotely within 1 week of the study orientation to reintroduce herself, answer inquiries, and encourage the use of services. Thereafter, remote contact was attempted weekly with each participant over the course of the 6-month study.

All interactions with participants were informed by MI constructs and SCT. The objectives of the tele-MI interactions were guided by participant preference and served to reinforce evidence-based concepts, review self-monitoring data, address ambivalence of behavioral change, empower participants to set and achieve goals, probe for barriers to success, provide additional resources, and/or address general inquiries. In electronic communications, the tele-MI coach used open-ended questions and affirmations, and encouraged autonomy, while telephonic and in-person interactions further emphasized reflective listening. Samples of remote interactions are located in Supplementary Table 1.

When a participant initiated contact or replied to the tele-MI coach, the coach followed up within 24 (weekday) to 48 (weekend) hours. If the tele-MI coach reached out to a participant and received no response, follow-up would be attempted again the following week, and this pattern continued throughout the entirety of the study. In addition to individual weekly communications, group contact was made 1–2 times/wk via email to share recipes, encourage the use of external resources, reinforce information from educational sessions, and remind participants of upcoming harvests and classes.

Self-monitoring tools.—Participants received a pedometer as well as access to a secure online platform through which they were encouraged to log daily steps and weekly weight. The tele-MI coach had administrative back-end access and reviewed this information weekly. The coach created individual and deidentified group graphical tracking records of weekly progress for both weight loss and steps and shared these records with participants over the course of the 6-month intervention. The intent of tracking was to serve as a motivator and reinforcer for positive behaviors. If a participant failed to log weight or steps, the tele-MI coach would contact him or her individually to encourage future adherence.

Secure Web portal.—All participants received a unique study identifier number that allowed personal access to a secure Web portal during the study. Included in the Web portal was a tele-MI section that housed healthy plant-based recipes, Tips of the Week, and additional evidence-based resources for cancer survivors. Recipes provided were oncology dietitian-approved recipes from the American Institute for Cancer Research.³⁸ Tips of the Week were developed by the tele-MI coach to reinforce the evidence-based survivorship guidelines. Samples of Tips of the Week and recipes are located in Supplemental Table 2 and the Supplemental Figure, respectively.

Other features maintained by the tele-MI coach included Web links to current research and details on accessing additional services for survivors (eg, farmers' markets, health screenings, support groups, recipes, and exercise programs). Another tab on the Web portal included Group Progress, which allowed participants to view the group's mean weekly steps and weight loss. Ancillary resources as well as group education PowerPoint slides and handouts from the group sessions were uploaded to the Web portal for future reference. These original materials and presentation slides were developed by experts in nutrition, oncology, and medicine on topics related to survivorship. They focused on plant-based dietary patterns, safe food handling and food safety practices, food preservation and storage, physical activity, and other survivor-specific health and wellness topics.

Data Collection

Data were collected at baseline (month 0) and postintervention (month 6) with participants serving as their own controls. Surveys were created on REDCap (Research Electronic Data Capture, Vanderbilt University, Nashville, TN, 2004) using validated tools to assess both subjective and objective measures as well as program evaluation.⁴⁰ Participants also completed an online graphical food frequency questionnaire (FFQ) to assess dietary patterns and obtain Healthy Eating Index 2010 (HEI-2010)⁴¹ scores. Biochemical and anthropometric data were similarly collected at both time points.

Feasibility and acceptability.—The researchers measured tele-MI feasibility by evaluating the intervention's reach, demand, implementation, practicality, adaptation, and acceptability.⁴² Reach was measured via recruitment and enrollment data. Demand and implementation were measured by tele-MI encounters logged, the number of interactions initiated by participants, and ease of program application. Practicality was measured by the variety of communication methods adopted and expediency of implementation. Adaptation was assessed by the use of occasional program alterations aligning with participant feedback throughout the intervention. Acceptability was assessed via evaluations and a comprehensive post-evaluation survey.

Tele-Motivational Interviewing encounters.—The tele-MI coach was accessible to all participants throughout the course of the intervention via e-mail, telephone, text messages, and Skype; face-to-face contact was available at the discretion of participants during garden harvests and before or after educational sessions. Every interaction was recorded, coded, and quantified on a tele-MI interaction log, including: (1) date of each encounter; (2) method of contact (eg, phone, e-mail, text); (3) length of encounter (in 5-minute increments); (4) interaction initiator (tele-MI coach or study participant); and (5) detailed summary of the encounter (including classification of the general outcomes, eg, education, goal setting, barrier identification).

Interactions that resulted in 2-way communications between a participant and the coach were considered reciprocal interactions. Instances in which the coach reached out to participants and the participant did not respond were recorded as passive interactions. If communication occurred between a participant and the tele-MI coach over the course of several e-mail or text messages (ie, if several messages were sent back and forth), but they were generally part of the same conversation, these were collectively designated as 1 unique reciprocal interaction. If face-to-face interactions were initiated at the study garden but carried over to remote platforms, the interaction was classified as a remote encounter.

Survey measurements.—Sociodemographic questions were adapted from the Behavioral Risk Factor Surveillance System.⁴³ Perceived physical well-being, psychological well-being, social concerns, and spiritual well-being were measured via the validated Quality of Life Patient/Cancer Survivor Version questionnaire (maximum score of 410; Cronbach $\alpha = .93$).⁴⁴ Self-efficacy was measured via the New General Self-efficacy scale (maximum score of 40; Cronbach $\alpha = .76-.89$).⁴⁵

Dietary intake.—Dietary patterns were assessed at baseline and postintervention via the VioScreen (Viocare, Inc, Princeton, NJ) 30-day FFQ.⁴⁶ This algorithm-driven, computer-delivered FFQ was based on paper FFQs developed at the Fred Hutchinson Cancer Research Center and used the food and nutrient information database, Nutrition Data System for Research (NDSR-V45), developed by the Nutrition Coordinating Center at the University of Minnesota, for dietary analysis.⁴⁷ The NDSR database was also used to calculate HEI-2010 scores from dietary intake data.⁴¹ The HEI-2010 scores are a valid, reliable measure of diet quality and reflect compliance with the 2010 US Department of Agriculture Dietary Guidelines for Americans.^{48,49} Total HEI and individual component scores were compared with guidelines for cancer survivorship.

Physical activity.—Participants were provided Omron pedometers (Omron Healthcare Co, Inc, Lake Forest, IL) at study orientation and were encouraged to strive for 10,000 steps/d or 150 minutes of physical activity per week.^{8,50} Participants logged their daily steps and body weight on a secure Web portal.

Clinical measurements.—Participants completed baseline and 6-month clinic visits. Trained research RDNs obtained anthropometric measurements. Weight and height were measured with participants wearing light clothing and without shoes. Weight was obtained using a standard and calibrated Pro Plus digital scale (Health-o-Meter Professional Products, Pelstar LLC, Bridgeview, IL). Height was obtained using a standard fixed stadiometer (Health-o-Meter Professional Products). Waist circumference was measured 3 times at the iliac crest to the nearest 1 mm and averaged. Skin carotenoids were measured using a Pharmanex NuSkin Biophotonic Scanner (NuSkin Enterprises, Provo, UT). This scanner uses Raman spectroscopy to estimate skin carotenoids and is correlated with fruit and vegetable intake.⁵¹⁻⁵³ The researchers obtained blood pressure using an Omron Autocuff (Omron Healthcare Co, Ltd). Trained clinical research nurses obtained blood samples via venipuncture for analysis of total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, and plasma carotenoids.

Statistical Analysis

At baseline, all individuals were encouraged to use tele-MI. Throughout, the tele-MI coach logged all participant encounters on a spread-sheet. Aligning with the tenets of MI, the authors were interested in understanding how survivors perceived their interactions and utilization of tele-MI coaching. Therefore, participants were grouped postintervention, based on their self-reported use of tele-MI as determined by their response to the survey question: *Did you use individualized health coaching?* Dietary, self-efficacy, QOL, and sociodemographic data were downloaded directly from participant surveys, whereas anthropometric, physical activity, and biochemical data were extracted from a secure database. Only data from completed surveys were used in the final analyses. The mean number of interactions, percentage of interactions using various remote methods, and percentage of fully remote interactions were obtained from the tele-MI interaction logs.

Qualitative data obtained from participant surveys and tele-MI logs were analyzed to assess feasibility and acceptability and review for trends. Two members of the research team

independently reviewed the open-ended program evaluation responses for feasibility and acceptability and the tele-MI encounter logs for general themes of goal setting. The research team reached agreement on the thematic framework and interrater reliability was set at 85%. After final analysis, the research team reviewed results in detail.

Two sample *t* tests were used to compare the pre-post differences between groups in sociodemographic data, QOL, self-efficacy, dietary behaviors, physical activity, anthropometric data, skin carotenoids, blood pressure, and laboratory data. Paired *t* tests were used to evaluate within-group changes. Values for total cholesterol, HDL, LDL, and triglycerides were log transformed before analysis owing to heteroscedasticity. Using the .05 level of significance, between 7 and 8 false positives were expected for the number of tests performed. All analyses were conducted in SPSS (version 23, SPSS, Inc, Chicago, IL) or SAS (version 9.4, SAS Institute, Cary, NC).

RESULTS

The tele-MI coach responded and reached out to all participants during the course of the intervention. After the intervention, participants were classified as users or nonusers based on their perceptions of use. Of the cohort, 59% indicated they used tele-MI, although all participants interacted with the tele-MI coach at some point, either in person or via remote means.

Both tele-MI users and nonusers had similar sociodemographic profiles. Of the 29 participants who completed the 6-month intervention, 17 were tele-MI users (59%) and 12 were nonusers (41%) (Table 1). Tele-MI users were primarily breast cancer survivors (59%), Caucasian (76%), female (88%), married (53%), had at least 4 years of college education (82%), and a mean age of 58 years.

On average, 71% of all reciprocal interactions occurred via e-mail (76% of user interactions; 66% of nonuser interactions); 57% of participants used telephonic interactions (71% of users; 42% of nonusers) and 10% of participants used text messages (12% of users; 8% of nonusers). Although some participants used face-to-face contact (27% of users; 16% of nonusers), remote implementation remained prevalent as 78% of all interactions were fully remote (84% of user interactions; 73% of nonuser interactions). The average number of reciprocal interactions was higher in tele-MI users compared with nonusers (13.6 vs 7.5). The amount of reciprocal interactions initiated by the participant (as opposed to initiation by the tele-MI coach) was greater in users as well (23% vs 12%). After the intervention, 10 tele-MI users rated tele-MI as excellent (59%), whereas 5 rated it as very good (29%) and 2 as good (12%). Of the nonusers, reasons cited for not using the service included *did not need it*, *chaotic life did what I could do*, and *did not have any specific questions that weren't answered in classes*.

Regarding goal setting, 94% of tele-MI users set at least 1 goal over the course of the intervention. Overall, the tele-MI users set 50% more goals compared with nonusers (8 vs 4) over the 6-month intervention. Among users who set goals, 69% of the goals were related to dietary patterns whereas 18% were related to physical activity. Both users and nonusers

achieved most of the goals set (57% and 60%, respectively). Overall, tele-MI users experienced greater improvements in self-efficacy scores (+1.6) (Table 2) that trended higher than in nonusers, who experienced an overall decrease (−0.2).

Related to behavior change and measures of dietary patterns, tele-MI users experienced significant improvements in total HEI ($P = .02$), whereas nonusers experienced improvements in HEI that trended positively ($P = .15$) (Table 3). The tele-MI users also experienced significant within-group improvements in scores for total fruits, total vegetables, fatty acids, refined grains, and empty calories, yet this group also demonstrated a decrease in the score for sodium (indicating an increase in sodium consumption) (Table 3). Regarding physical activity, tele-MI users experienced an improvement in total steps per day. Although this was less than that experienced by nonusers (+984 vs +1,528), neither was significant (Table 4).

Both groups had significant within-group decreases in waist circumference (−5.3 cm, $P < .001$ users; −5.8 cm, $P = .001$ nonusers) and weight, although users had nearly double the amount of weight loss after the intervention compared with nonusers (−4.8 kg, $P = .002$ users; −2.6 kg, $P = .02$ nonusers). Differences between groups were not significant, however. The tele-MI users had significant within-group improvements in systolic blood pressure (−10.8 mm Hg, $P = .04$ users; −7.6 mm Hg, $P = .07$ nonusers) and total cholesterol (−13.8 mg/dL, $P = .02$ users; −7.6 mg/dL, $P = .23$ nonusers) that trended higher than for nonusers for each. Users also experienced greater improvements in LDL cholesterol (−8.7 mg/dL users vs −1.6 mg/dL nonusers).

There were significant between-group differences in QOL after the intervention (Table 5). Users experienced an increase in total QOL scores compared with nonusers (+25.3 users; +3.0 nonusers; $P = 0.03$). Significant differences were noted for users compared with nonusers in terms of fatigue (+1.9 users; −0.5 nonusers; $P = .005$), appetite changes (+1.3 users; −1.3 nonusers; $P = .007$), sleep changes (+1.4 users; −1.0 nonusers; $P = .01$) fear of a second cancer (+1.8 users; −0.3 nonusers; $P = 0.03$), fear of cancer recurrence (+2.0 users; −0.3 nonusers; $P = 0.01$), spirituality (+2.6 users; −1.9 nonusers; $P < .001$), and feelings of hopefulness (+0.9 users; +0.1 nonusers; $P = .05$).

DISCUSSION

Previous research suggested that technological platforms can be an important component and viable option for targeting health behaviors in various populations, including cancer survivors.^{22,54} The results of this study document that tele-MI for overweight cancer survivors after active therapy is feasible and acceptable. A total of 59% of participants used tele-MI, and although it was anticipated that significant differences would exist in sociodemographic characteristics between users and nonusers, this was not the case. Both cohorts were similar to those previously noted in the literature, although the percentage of females in this study was slightly higher.^{24,55}

Interventions using specific technological platforms such as mobile phone messaging (texts) have documented modest effects.^{26,31} Offering a variety of remote platforms resulted in

more positive and consistent results in this study. Unfortunately, many studies do not allow remote platform flexibility or promote participant preferences. The few that do report that multiple methods of communication, including the telephone, can allow for better interactions.^{56,57} Another consideration is participants' preference for face-to-face contact, especially for seniors, which should not be ignored.⁵⁸ The results of this study document that tele-MI users appreciated the option to use both remote and face-to-face interactions. Ensuring timely 2-way interactions was also integral to continued engagement and satisfaction.⁵⁶

Although goal setting in lifestyle and coaching interventions is often encouraged, the amount and nature of goals set as well as differences among individuals are rarely reported. In the current study, tele-MI users set double the number of goals, although the nature of goals did not differ between groups. Social Cognitive Theory indicates that when individuals observe discrepancies between their current and desired states, they are encouraged to set more goals to advance toward preferred end points.¹¹ It is suspected that tele-MI users set more goals in an effort to meet their internal standards and desired outcomes owing to the increased accountability associated with use of the tele-MI coach.¹¹ The majority of goals set by participants related to dietary patterns. Throughout the intervention, the evidence-based cancer survivorship guidelines were continually enforced. More than half of these guidelines directly related to dietary patterns (eg, eat a variety of vegetables, fruits, whole grains, and legumes). The educational emphasis on these guidelines may explain why most goals focused on dietary intake.

No differences in self-efficacy between groups were noted at baseline, although users had better baseline measures of health (eg, BMI, skin carotenoids, total HEI scores). In the current study, the researchers speculate that those with better baseline health measures may have had increased internal motivation. These characteristics may have encouraged participants to seek additional guidance and support on methods to improve their existing health behaviors, resulting in increased total engagement with the tele-MI coach.⁵⁹ Interestingly, those who enrolled in the study earlier seemed more eager to engage with the tele-MI coach, which may have related to levels of motivation and may be useful for informing future approaches.

The results of the current study were consistent with previous studies documenting the promise of telehealth use for vulnerable populations to influence physical activity, dietary patterns, and weight management.^{22,24,55} Improvements in dietary patterns and HEI scores among tele-MI users were consistent with previous lifestyle interventions in cancer survivors.^{24,55,60} The authors suspect that these improvements resulted from increased interactions with the tele-MI coach as well as greater accountability, which encouraged better study adherence and compliance. Dietary improvements were also consistent with the evidence-based recommendations specific to cancer prevention and survivorship, with the exception of sodium consumption, which increased among tele-MI users.⁸ The authors suspect that this increase in sodium consumption resulted from an enhanced focus on improvement in plant food intake, nonusers which may have included the use of salt or sodium-based seasonings to improve palatability, especially among participants for whom plant foods were not habitually consumed at baseline. Although nonusers achieved greater

pre-post improvements in physical activity, users averaged 500 more steps in total physical activity per day than did nonusers postintervention.

Tele-MI users also achieved almost double the weight loss compared with nonusers (5.7% vs 3.0% weight loss), which indicated that users achieved a clinically significant weight loss.⁶¹ Other studies have used body composition measurements in addition to measures of weight to better define the effects of interventions on body fatness.⁶² Similar results were reported in lifestyle interventions for cancer survivors, although not consistently with concomitant improvements, such as QOL.⁶³ Previous work has also reported improvements in biomarkers of cardiovascular health, which were consistent with the current findings for total cholesterol and LDL, after the coaching intervention.²³

A paucity of studies reported positive QOL changes in response to telehealth compared with usual care or controls.^{24,54,64} Tele-MI users reported significant improvements in total QOL scores compared with nonusers, as well as reduced fatigue, depression, and increased hopefulness. The authors attributed this effect to MI, because it emphasizes client autonomy in decision making, which is related to QOL in the context of chronic illness.⁶⁵

Telehealth interventions also have proven to be cost-effective.⁶⁶ Previous estimates indicated that costs per participant per kilogram of weight lost were \$59.95 for standard care and \$129.15 for group weight loss education, vs \$51.43 for technology-based interventions and \$55.42 for in-person interventions combined with technological components.²⁵ Similar work outlined the cost savings of electronic vs live counseling interventionists, indicating 12-month payer costs of \$207 and \$110 per person for face-to-face and Web-based interventions, respectively.²³ Despite these data, the Centers for Medicare and Medicaid Services currently only reimburse for weight loss programs using in-person interactions.⁶⁶

Limitations of this study included the small sample size and homogeneity of the cohort, which restricted evaluation of efficacy and generalizability. In addition, because the tele-MI intervention was part of a multifaceted study, it could not be determined whether all improvements were the sole result of tele-MI coaching, or whether remote coaching had a synergistic effect with the other intervention components. A larger, randomized, controlled trial is needed to evaluate whether tele-MI has any effect or an independent, synergistic, or additive effect in the context of a multicomponent behavioral intervention.

Another limitation of this study was reliance on participants' perceptions to classify them as users or nonusers, because participants were all encouraged to use the tele-MI coach from initiation of the intervention. In reviewing all interactions with the tele-MI coach (among users and nonusers), individuals within both groups may have been placed in the opposing group based on the perception of the tele-MI coach. Understanding participants' appraisal of interactions and relationship with the tele-MI coach remains a priority, because these may represent engagement, positive rapport, or meaningful 2-way communication, through which theory-driven counseling approaches (ie, MI, SCT) are delivered.

Owing to budget constraints, the researchers were unable to employ more accurate and expensive measures of body composition (eg, dual-energy X-ray absorptiometry). Instead, they relied on body weight, BMI, and waist circumference. Finally, the length of the study (6

months) limited the ability to assess long-term efficacy of the intervention or the sustainability of the positive behavior changes.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The results of this study will inform future remote-delivered interventions to support cancer survivors, particularly those who are overweight or obese. Based on these results, ongoing research should consider employing MI-competent RDNs as telehealth coaches, particularly for cancer survivors, as is consistent with other research.^{67,68} Similarly, future research should consider incorporating a variety of electronic platforms to allow clients to self-select and use the tools that they perceive to be most helpful and user-friendly. In addition, health coaching interventions that are part of a comprehensive intervention should employ statistical methods to evaluate whether health coaching has an independent, additive, or synergistic effect.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Participant Characteristics and Comparisons of Sociodemographic Data of Tele-Motivational Interviewing Users and Nonusers (Based on Perception of Use)

Table 1.

Participant Characteristics	Users (n = 17) (% [n])	Nonusers (n = 12) (% [n])
Age, y	58	58
Sex		
Male	12 (2)	25 (3)
Female	88 (15)	75 (9)
Race/ethnicity		
Black/African American	18 (3)	0
White/Caucasian	76 (13)	100 (12)
Asian	6 (1)	0
Marital status		
Married	53 (9)	75 (9)
Divorced	12 (2)	17 (2)
Never married	18 (3)	8 (1)
Widowed	12 (2)	0
Prefer not to answer	6 (1)	0
Education		
Grade 12 or equivalent	12 (2)	8 (1)
College 1–3 y	6 (1)	17 (2)
College 4 y	35 (6)	58 (7)
Professional or graduate	47 (8)	17 (2)
Employment		
Employed or self-employed	59 (10)	42 (5)
Retired	35 (6)	58 (7)
Out of work <1 y	6 (1)	0
Salary		
Prefer not to answer	24 (4)	8 (1)
\$10,000 to \$24,999	18 (3)	17 (2)
\$25,000 to \$49,999	6 (1)	17 (2)

Participant Characteristics	Users (n = 17) (% [n])	Nonusers (n = 12) (% [n])
\$50,000 to \$74,999	12 (2)	25 (3)
>\$75,000	41 (7)	25 (3)
Don't know/not sure	0	8 (1)
Medical history		
Primary cancer diagnosis, by sex and age, y		
Male	68	63
Female	53	52
Primary cancer site		
Breast	59 (10)	25 (3)
Prostate	12 (2)	25 (3)
Ovarian/uterine	0	33 (4)
Colorectal	6 (1)	8 (1)
Lymphoma	18 (3)	0
Other ^a	6 (1)	8 (1)

^a Pancreatic, brain.

Note: All values indicate means among all participants (n = 29).

Table 2.
Comparison of New General Self-efficacy Between Tele-Motivational Interviewing Users and Nonusers (Based on Perception of Use)

New General Self-efficacy Item	Baseline (mean $\pm$ SD)		Postintervention (mean $\pm$ SD)		Difference (95% Confidence Interval)		<i>P</i>	
	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)
Total score	32.8 $\pm$ 3.17	32.1 $\pm$ 3.29	34.4 $\pm$ 3.30	31.9 $\pm$ 3.23	+1.6 (−0.22 to 3.52)	−0.2 (−1.96 to 1.63)	.08	0.84
I will be able to achieve most of the goals that I have set for myself.	4.2 $\pm$ 0.56	4.0 $\pm$ 0.43	4.5 $\pm$ 0.51	3.9 $\pm$ 0.52	+0.3 (−0.10 to 0.69)	−0.1 (−0.51 to 0.34)	.14	0.67
When facing difficult tasks, I am certain that I will accomplish them.	4.1 $\pm$ 0.60	3.8 $\pm$ 0.62	4.3 $\pm$ 0.59	3.8 $\pm$ 0.58	+0.2 (−0.15 to 0.50)	+0.0 (−0.24 to 0.41)	.27	0.59
In general to I think that I can obtain outcomes that are important to me.	4.2 $\pm$ 0.53	4.1 $\pm$ 0.79	4.4 $\pm$ 0.49	4.2 $\pm$ 0.58	+0.2 (−0.20 to 0.55)	+0.1 (−0.24 to 0.41)	.33	0.59
I believe I can succeed at most any endeavor to which I set my mind.	3.9 $\pm$ 0.56	4.0 $\pm$ 0.74	4.5 $\pm$ 0.51	3.8 $\pm$ 0.45	+0.6 (0.16 to 0.90)	−0.2 (−0.65 to 0.15)	.008*	0.19
I will be able to overcome many challenges successfully.	4.1 $\pm$ 0.60	4.1 $\pm$ 0.67	4.2 $\pm$ 0.56	4.0 $\pm$ 0.43	+0.1 (−0.32 to 0.56)	−0.1 (−0.51 to 0.34)	.58	0.67
I am confident that I can perform effectively on many different tasks.	4.2 $\pm$ 0.53	4.3 $\pm$ 0.62	4.4 $\pm$ 0.49	4.2 $\pm$ 0.58	+0.2 (−0.15 to 0.50)	−0.1 (−0.41 to 0.24)	.27	0.59
Compared with other people, I can do most tasks very well.	3.9 $\pm$ 0.66	3.9 $\pm$ 0.52	4.0 $\pm$ 0.61	4.0 $\pm$ 0.60	+0.1 (−0.23 to 0.35)	+0.1 (−0.10 to 0.27)	.67	0.34
Even when things are tough to I can perform quite well.	4.1 $\pm$ 0.56	4.0 $\pm$ 0.60	4.2 $\pm$ 0.64	4.1 $\pm$ 0.67	+0.1 (−0.28 to 0.52)	+0.1 (−0.42 to 0.59)	.54	0.72

* *P* .05.

Notes: Values are reported as mean scores before and after the intervention with SDs, differences in scores, and confidence intervals. Paired *t* tests were used to evaluate within-group differences, and 2-sample *t* tests for between-group differences.

Table 3.

Comparisons of Healthy Eating Index 2010 (HEI-2010) Scores Between Tele-Motivational Interviewing Users and Nonusers (Based on Perception of Use)

HEI-2010 Component (n = 29)	Maximum Score	Baseline (mean ± SD)		Postintervention (mean ± SD)		Difference (95% Confidence Interval)		P	
		Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)
Total diet	100	72.3 ± 13.46	69.6 ± 8.81	76.9 ± 9.20	74.5 ± 9.21	+46(0.68 to 8.67)	+4.9 (−2.04 to 11.79)	.02*	.15
Adequacy (higher score indicates higher consumption)									
Total fruit	5	3.7 ± 1.63	3.5 ± 1.26	4.5 ± 1.10	4.3 ± 1.01	+0.8 (0.23 to 1.40)	+0.8 (−0.24 to 1.89)	.01*	.12
Whole fruit	5	4.3 ± 1.32	4.1 ± 1.29	4.8 ± 0.63	4.7 ± 0.77	+0.5 (−0.07 to 1.12)	+0.6 (−0.04 to 1.29)	.08	.06
Total vegetables	5	4.4 ± 0.94	4.6 ± 0.73	5.0 ± 0.17	4.7 ± 0.60	+0.6 (0.09 to 1.05)	+0.1 (−0.58 to 0.73)	.02*	.80
Greens and beans	5	4.3 ± 1.29	4.4 ± 0.98	4.8 ± 0.65	4.3 ± 1.41	+0.5 (−0.03 to 0.96)	−0.1 (−1.09 to 0.91)	.06	.84
Whole grains	10	6.0 ± 3.81	5.9 ± 3.43	5.7 ± 3.68	5.7 ± 3.38	−0.3 (−1.24 to 0.65)	−0.2 (−2.20 to 1.87)	.52	.86
Dairy	10	7.0 ± 2.56	8.4 ± 1.77	6.0 ± 3.11	7.9 ± 2.09	−1.0 (−2.17 to 0.30)	−0.5 (−1.76 to 0.83)	.13	.45
Total protein Foods	5	4.6 ± 0.66	4.8 ± 0.25	4.4 ± 1.05	4.5 ± 0.85	−0.2 (−0.69 to 0.34)	−0.3 (−0.80 to 0.19)	.48	.20
Seafood and plant proteins	5	4.3 ± 0.99	4.4 ± 1.06	4.6 ± 0.99	4.5 ± 0.79	+0.3 (−0.18 to 0.79)	+0.1 (−0.18 to 0.33)	.20	.54
Moderation (higher score indicates lower consumption)									
Fatty acids	10	5.1 ± 3.24	4.1 ± 2.42	6.9 ± 2.99	4.9 ± 2.93	+1.8 (0.66 to 2.99)	+0.8 (−1.26 to 2.81)	.004*	.42
Refined grains	10	9.3 ± 1.22	7.8 ± 3.01	9.9 ± 0.20	9.5 ± 1.04	+0.6 (0.09 to 1.28)	+1.7 (−0.29 to 3.75)	.03*	.09
Sodium	10	3.3 ± 2.95	1.9 ± 2.49	1.9 ± 3.01	2.7 ± 2.84	−1.4 (−2.77 to −0.04)	+0.8 (−1.58 to 3.15)	.04*	.48
Empty calories	20	16.2 ± 3.89	15.8 ± 3.63	18.5 ± 2.58	16.8 ± 3.73	+2.3 (0.54 to 4.06)	+1.0 (−1.39 to 3.42)	.01*	.37

* $P < .05$. HEI indicates Healthy Eating Index.

Notes: Values are reported as mean scores before and after the intervention with SDs, differences in scores, and confidence intervals. Paired t tests were used to evaluate within-group differences, and 2-sample t tests for between-group differences.

Comparison of Biochemical and Clinical Data Between Tele-Motivational Interviewing Users and Nonusers (Based on Perception of Use)

Variable (n = 29)	Baseline (mean ± SD)		Postintervention (mean ± SD)		Difference (95% Confidence Interval)		P		Between Groups
	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	
Weight, kg	83.6 ± 15.78	87.6 ± 17.20	78.8 ± 14.89	85.0 ± 19.00	-4.8 (-7.46 to -2.10)	-2.6 (-4.66 to -0.57)	.002*	.02*	.21
Body mass index, kg/m ²	31.3 ± 5.50	32.6 ± 4.65	29.6 ± 5.36	31.5 ± 5.34	-1.7 (-2.75 to -0.75)	-1.1 (-1.80 to -0.28)	.002*	.01*	.22
Waist circumference, cm	98.1 ± 10.84	107.6 ± 15.54	92.8 ± 11.39	101.8 ± 15.07	-5.3 (-6.93 to -3.68)	-5.8 (-8.61 to -2.97)	<.001*	.001*	.73
Physical activity, steps/d	6,976.4 ± 2,959.86	5,969.4 ± 4,046.65	7,960.1 ± 3,747.72	7,496.9 ± 3,319.43	+983.7 (-578.19 to 2,545.63)	+1,527.5 (-251.50 to 3,306.61)	.40	.32	.63
Systolic blood pressure, mm Hg	130.3 ± 18.20	123.9 ± 11.38	119.5 ± 14.66	116.3 ± 10.48	-10.8 (-20.90 to -0.74)	-7.6 (-16.14 to 0.81)	.04*	.07	.63
Diastolic blood pressure, mm Hg	75.2 ± 9.46	74.8 ± 6.63	74.3 ± 9.31	71.7 ± 5.58	-0.9 (-4.64 to 2.87)	-3.1 (-8.09 to 1.76)	.63	.19	.43
Total cholesterol, mg/dL ^a	193.7 ± 25.58	185.8 ± 34.96	179.9 ± 31.93	178.2 ± 33.98	-13.8 (-24.94 to -2.59)	-7.6 (-20.71 to 5.55)	.02*	.23	.40 ^a
High-density lipoprotein, mg/dL ^a	56.4 ± 12.09	52.8 ± 15.23	54.8 ± 10.81	51.4 ± 15.99	-1.6 (-4.49 to 1.32)	-1.4 (-7.74 to 5.07)	.26	.66	.86 ^a
Low-density lipoprotein, mg/dL ^a	116.8 ± 25.66	108.8 ± 32.92	108.1 ± 28.59	107.2 ± 30.82	-8.7 (-18.12 to 0.83)	-1.6 (-11.13 to 7.96)	.07	.72	.23 ^a
Triglycerides, mg/dL ^a	122.2 ± 54.67	148.8 ± 47.74	106.5 ± 45.75	122.5 ± 42.43	-15.7 (-33.74 to 2.22)	-26.3 (-56.27 to 3.77)	.08	.08	.48 ^a
Skin carotenoids (resonance Raman spectroscopy)	30,791.9 ± 12,543.10	27,690.6 ± 9,997.78	33,716.1 ± 16,336.86	34,313.0 ± 11,934.05	+2,924.2 (-2,726.41 to 8,574.82)	+6,622.4 (3,010.16 to 10,234.76)	.29	.002*	.30
Plasma carotenoids, μmol/L	1,892.7 ± 1,011.18	1,546.6 ± 608.71	2,436.1 ± 1,384.40	2,179.8 ± 981.81	+543.4 (-2.57 to 1,089.20)	+633.2 (109.88 to 1,156.60)	.05*	.02*	.81

^aData log-transformed before analysis

*P .05.

Notes: Values are reported as means before and after the intervention with SDs and confidence intervals. Paired *t* tests were used to evaluate within-group differences, and 2-sample *t* tests for between-group differences.

Table 5.
Comparisons of Significant Quality of Life Items Between Tele-Motivational Interviewing Users and Nonusers (Based on Perception of Use)

Item (n = 29)	Baseline (mean ± SD)		Postintervention (Mean ± SD)		Difference (95% Confidence Interval)		P	Nonusers (n = 12)	P	Between Groups
	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)				
Quality of life (total score)	281.9 ± 40.84	250.3 ± 60.22	307.2 ± 37.58	253.3 ± 54.57	+25.3 (12.60 to 37.99)	+3.0 (-14.46 to 20.46)	.001 *	.71	.03	
Physical well-being										
Fatigue	5.2 ± 2.65	6.2 ± 2.62	7.1 ± 2.29	5.7 ± 3.14	+1.9 (0.80 to 3.08)	-0.5 (-1.79 to 0.79)	.002 *	.41	.005 *	
Appetite changes	7.1 ± 2.55	9.1 ± 1.73	8.4 ± 2.15	7.8 ± 2.44	+1.3 (0.18 to 2.29)	-1.3 (-2.86 to 0.36)	.02 *	.12	.007 *	
Sleep changes	6.1 ± 2.62	7.8 ± 2.26	7.5 ± 1.88	6.8 ± 2.93	+1.4 (0.39 to 2.31)	-1.0 (-2.84 to 0.84)	.009 *	.26	.01 *	
Psychological well-being										
How good is your quality of life?	7.9 ± 1.09	6.1 ± 3.03	8.3 ± 1.21	8.3 ± 1.29	+0.4 (-0.40 to 1.10)	+2.2 (0.16 to 4.17)	.33	.04 *	.05 *	
How useful do you feel?	7.6 ± 2.24	6.7 ± 1.97	8.4 ± 1.62	6.9 ± 1.78	+0.8 (0.03 to 1.50)	+0.2 (-0.42 to 0.92)	.04 *	.43	.30	
How much depression do you have?	8.5 ± 1.66	6.6 ± 3.18	8.9 ± 1.97	6.5 ± 3.26	+0.4 (0.04 to 0.66)	-0.1 (-1.00 to 0.83)	.03 *	.85	.27	
To what extent are you fearful of:										
Future diagnostic tests	6.1 ± 2.98	4.3 ± 3.11	7.3 ± 1.96	5.3 ± 2.60	+1.2 (-0.58 to 2.93)	+1.0	.18 (0.28 to 1.55)	.009 *	.80	
A second cancer	5.6 ± 2.83	5.9 ± 3.18	7.4 ± 2.62	5.6 ± 3.06	+1.8 (0.44 to 3.21)	-0.3 (-1.56 to 0.89)	.01 *	.56	.03 *	
Recurrence of cancer	5.1 ± 2.61	4.4 ± 3.70	7.1 ± 2.63	4.1 ± 3.58	+2.0 (0.62 to 3.38)	-0.3 (-1.16 to 0.49)	.007 *	.39	.01 *	
Social concerns										
To what degree has your illness and treatment interfered with your employment?	7.2 ± 3.07	6.5 ± 3.78	8.9 ± 1.76	8.2 ± 2.59	+1.7 (0.35 to 2.94)	+1.7 (-0.14 to 3.47)	.02 *	.07	.99	
To what degree has your illness and treatment interfered with your activities at home?	7.0 ± 2.65	6.8 ± 2.41	8.2 ± 1.74	6.3 ± 2.90	+1.2 (0.01 to 2.34)	-0.5 (-2.14 to 1.14)	.05	.52	.08	
Spiritual well-being										
How much has your spiritual life changed as a result of your cancer diagnosis?	4.8 ± 3.77	5.8 ± 2.70	7.4 ± 2.87	3.9 ± 2.64	+2.6 (0.86 to 4.31)	-1.9 (-3.13 to -0.54)	.006 *	.01 *	<.001	

Item (n = 29)	Baseline (mean $\pm$ SD)		Postintervention (Mean $\pm$ SD)		Difference (95% Confidence Interval)		Users (n = 17)	Nonusers (n = 12)	P
	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)	Users (n = 17)	Nonusers (n = 12)			Between Groups
Do you sense a purpose/ mission for your life or a reason for being alive?	7.4 $\pm$ 2.45	6.2 $\pm$ 1.95	8.4 $\pm$ 2.43	6.2 $\pm$ 1.95	+1.0 (0.06 to 2.06)	0.0 (-1.08 to 1.08)	.04	1.00	.14
How hopeful do you feel?	8.1 $\pm$ 1.39	7.2 $\pm$ 1.80	9.0 $\pm$ 1.06	7.3 $\pm$ 1.91	+0.9 (0.44 to 1.44)	+0.1 (-0.71 to 0.87)	.001	.82	.05*

* P .05.

Notes: Values were reported as mean scores before and after the intervention with SDs, differences in scores, and confidence intervals. Paired t tests were used to evaluate within-group differences, and 2-sample t tests for between-group differences.