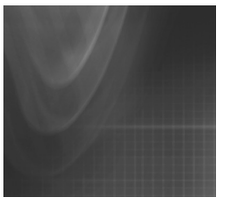
Adapted Diabetes Prevention Program Lifestyle Intervention Can Be Effectively Delivered Through Telehealth



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Purpose

The purpose of this study was to assess the feasibility of delivering an adapted group-based version of the Diabetes Prevention Program's (DPP) lifestyle intervention through telehealth video conferencing.

Methods

In 2009, the Montana Department of Public Health and Human Services in collaboration with Holy Rosary Heathcare implemented the DPP lifestyle intervention, which was provided to an on-site group in 1 community and simultaneously through telehealth to a second group in a remote frontier community. Participants obtained medical clearance from their primary care physician and were eligible if they were overweight and had 1 or more of the following risk factors: prediabetes, impaired glucose tolerance/impaired fasting glucose (IGT/IFG), a history of gestational diabetes (GDM) or the delivery of an infant >9 pounds, hypertension, or dyslipidemia.

Results

A total of 13 and 16 eligible adults enrolled in the on-site and the telehealth program, and 13 (100%) and 14 (88%) participants completed the 16-week program, respectively. Both the on-site and telehealth groups achieved high levels of weekly physical activity and there were no

significant differences between groups. Over 45% of on-site and telehealth participants achieved the 7% weight loss goal with the average weight loss per participant greater than 6.4 kg in both groups.

Conclusions

Our findings suggest that it is feasible to deliver an adapted group-based DPP lifestyle intervention through telehealth resulting in weight loss outcomes similar to the original DPP.

The prevalence of type 2 diabetes mellitus in the United States has increased over the past decade primarily because of the increase in the prevalence of obesity.[1] Recent clinical trials in China, Finland, Japan, India, and the United States have demonstrated that modest weight loss achieved through increased physical activity and decreased fat and caloric intake can reduce the incidence of diabetes.[2-6] In the United States, high-risk participants in the lifestyle arm of the Diabetes Prevention Program (DPP) study had a 58% reduction in the incidence of diabetes compared with participants in the placebo arm, and had a significant improvement in their cardiometabolic risk factor profile.[4,7-8] The DPP lifestyle intervention was found to be cost effective overall and in all age groups.[9] The 10-year follow-up of the DPP study found that the incidence of diabetes was reduced by 34% in the lifestyle group indicating that the prevention or delay of diabetes can persist for at least a decade.[10]

Utilizing telehealth video conferencing to deliver the group-based DPP lifestyle intervention has the potential to increase the number of persons receiving the intervention, reduce the overall cost per participant, and reach remote rural communities whose residents may have barriers accessing these services. However, to our knowledge, no previous studies have reported the delivery of the DPP lifestyle intervention through telehealth, and relatively few previous studies have evaluated the delivery of lifestyle interventions promoting weight loss targeting persons at high risk for cardiovascular disease and diabetes through video conferencing.[11,12]

In 2008, we successfully implemented an adapted group-based DPP lifestyle intervention targeting persons at high-risk for diabetes and cardiovascular disease in urban and rural health care facilities, which achieved similar weight loss outcomes to the original DPP.[13] In 2009, we tested the feasibility of delivering the adapted DPP lifestyle intervention through telehealth video conferencing. The intervention was delivered to an on-site group at an established site in 1 community and simultaneously through telehealth video conferencing to a second group in a remote frontier community. The purpose of this study was to assess the feasibility of delivering an adapted group-based version of the DPP lifestyle intervention through telehealth video conferencing.

Methods

Setting

In September 2009, the Montana Department of Public Health and Human Services in collaboration with Holy Rosary Healthcare in Miles City, Montana, implemented a pilot study to assess the feasibility of delivering a cardiometabolic risk reduction intervention based on the intensive lifestyle curriculum of the DPP to both an on-site group of high-risk participants and simultaneously to an off-site group of participants through telehealth. The on-site group intervention was delivered at Holy Rosary Healthcare, which is located in Custer County in southeastern Montana. Custer County is designated as a frontier County (less than 6 people per square mile), with a 2000 census population of 11 696.[14] The telehealth site was located in Baker, Montana (79 miles from Miles City), at the Fallon Medical Complex also in southeastern Montana. Baker is located in Fallon County, with a 2000 census population of 2837.[14]

The adapted lifestyle curriculum was delivered by 2 lifestyle coaches (0.5 full-time equivalent each) who were staff members of their American Diabetes Association (ADA) recognized diabetes self-management education program and 1 paid support staff at the on-site facility (0.25 full-time equivalent). One lifestyle coach is a registered dietician and a certified diabetes educator. The second lifestyle coach has training in the exercise sciences. The telehealth site was coordinated by a health care professional (0.05 FTE) from the local medical facility.

Participants

The majority of participants in both Miles City and Baker were recruited by referral from local primary care

practices and through newspaper advertisements. The lifestyle coaches from Holy Rosary Healthcare conducted a face-to-face intake visit with potential participants in Miles City and in Baker to assess their eligibility for the program and their readiness to make lifestyle changes related to the program goals. Eligible participants had medical clearance from their primary care provider, were 18 years or older, were ready to make changes in their diet and physical activity level, were overweight (body mass index [BMI] ≥25 kg/m^2), and possessed 1 or more of the following risk factors for diabetes or cardiovascular disease: a previous diagnosis of prediabetes, impaired glucose tolerance or impaired fasting glucose, high blood pressure (≥130/85 mm Hg or treatment) or dyslipidemia (triglycerides >150 mg/dL, low-density lipoprotein cholesterol >130 mg/dL or treatment, or high-density lipoprotein [HDL] cholesterol <40 mg/dL for men and <50 mg/dL for women), a history of gestational diabetes (GDM), or having given birth to an infant of greater than 9 pounds (4.1 kg). In addition, participants were not eligible if they were pregnant or planning to become pregnant in the next 6 months. Participant readiness to change dietary and physical activity behaviors were assessed using questions from various motivational interviewing instruments. Participants also agreed to and signed a contract specifying what their personal responsibilities were and what they would receive from the lifestyle coaches and the program. Participants were also required to pay $150 to participate in the program, which was paid by the participant, their employer, or through a scholarship made available for anyone unable to pay.

Adapted DPP Intervention

The lifestyle coaches used an adapted version of the DPP curriculum developed by the Healthy Native Community Partnership designed for group delivery.[15] Prior to delivering the intervention the lifestyle coaches were trained by individuals with experience in the original DPP trial. They attended a 2-day training covering the DPP background, core and after-core curriculum, and standardized procedures for collecting anthropometric measures.

The lifestyle coaches taught the 16 weekly core curriculum sessions and the 6 monthly after-core sessions. The lifestyle coach with training in the exercise sciences taught the sessions specifically related to physical activity. The goals of the intervention were the same as the DPP (7% weight loss and moderately intense physical activity for ≥150 minutes per week). Each session was approximately 1 hour in length. The telehealth group simultaneously participated in the weekly and monthly sessions via telehealth video conferencing. The lifestyle coaches, the telehealth coordinator, and all participants at both sites could see and hear each other through the video conferencing system. Each participant was provided a manual covering each of the 16 weekly sessions, a log book to track daily fat and caloric intake and physical activity minutes, and a book that helps participants estimate the fat and caloric content of specific foods.

The lifestyle coaches organized 2 to 4 weekly supervised physical activity sessions for the on-site participants. Although there are no public exercise or pool facilities in Miles City, the lifestyle coaches developed community partnerships and identified resources to provide the required physical activity sessions. Telehealth participants were recommended to utilize the local recreation center. The lifestyle coaches coordinated with the staff at this center to ensure that participants utilizing the center received assistance regarding initiating and maintaining their physical activity. Examples of the supervised physical activity sessions provided for participants included aerobics, strength training, yoga, dance classes, Pilates, and water aerobics provided in pool space provided by a local hotel in Miles City and at the local recreation center in Baker.

The lifestyle coaches measured both the on-site and telehealth participants' height and weight at an initial preenrollment assessment. Referring physicians provided baseline information regarding the participants' blood glucose, lipid values, current medications for hypertension and dyslipidemia, and current medications for weight loss or prediabetes (eg, metformin).

Participants began self-monitoring and documenting fat intake and weight at the second core session, physical activity minutes per day at session 5, and if necessary, caloric intake at session 7. Daily self-monitoring data were maintained by participants in a log book and collected weekly by the lifestyle coach and the telehealth coordinator. The telehealth site coordinator mailed participant log books to the lifestyle coaches for review. The lifestyle coaches reviewed the self-monitoring logs for participants in each group and provided written weekly feedback for each participant. Each participant's weight was measured each week by the lifestyle coaches and the

telehealth coordinator. Participants who dropped out of the 16-week core curriculum or missed more than 3 consecutive sessions were considered to not have completed the program.

Data Collection and Outcomes

Deidentified data were provided to the State Diabetes Program for monthly data analysis. These data were analyzed to provide feedback to the site regarding enrollment and participants lost-to-follow-up, self-monitoring measures (fat intake and physical activity levels), and weight loss outcomes.

To assess self-monitoring goal achievement, a self-monitoring score was constructed for each component (fat grams, calories, physical activity, and weight). We assumed that participants who did not attend visits or did not turn in records were not self-monitoring and did not meet goals. Fat gram intake was the average of the self-reported daily intake in the participant food record. A participant was considered to have met the physical activity goal if his/her average physical activity over the 16-week core was at least 150 minutes/week. The final weight from the core sessions was defined as the last weight assessed during the 16-week curriculum.

Institutional review board approval for this project was not required by the Montana Department of Public Health and Human Services as previous research has established the safety and efficacy of the lifestyle intervention.[4,10]

Data Analysis

Data analyses were completed using Statistical Analysis Software Version 9 (Cary, NC). Paired *t* tests were used to assess weight loss from initial weight to final weight at the end of the 16-week curriculum, as well as the change in BMI. Chi-squared statistics were used to compare weight loss and physical activity goal achievement, as well as intake demographic characteristics and risk factors for cardiovascular disease and diabetes. *T* tests were used to compare age and BMI at intake between groups.

Results

A total of 13 and 16 eligible adults enrolled in the on-site and the telehealth program, and 13 (100%) and 14 (88%) participants completed the 16-week program, respectively. The mean age of on-site and telehealth participants was 53 and 50 years of age, respectively (Table 1). The majority of participants in both groups were female. Participants in both groups had multiple cardiometabolic risk factors. Participants in the telehealth group had a significantly higher prevalence of glycemic abnormalities and hypertension at baseline compared with participants in the on-site group. There were no statistically significant differences in the mean number of weeks of participation in the 16-week core curriculum between the on-site group (mean = 14.2 weeks [SD 2.1]) and the telehealth group (mean = 14.7 weeks [SD 2.5], $P = .53$).

Table 1

Baseline Characteristics of Participants Completing the Telehealth and On-site Cardiovascular Disease and Diabetes Prevention Lifestyle Program

	Telehealth Group (N = 14)	On-site Group (N = 13)	
	Mean (SD)	Mean (SD)	*P* Value
Age	50 (7)	53 (14)	.44
BMI (kg/m^2)	38.7 (8)	34.0 (7)	.11
	% (n)	% (n)	
Female	93 (13)	69 (9)	.11
History of GDM	7 (1)	8 (1)	.96
History of baby >9 lbs	36 (5)	31 (4)	.79
Prediabetes, IFG, IGT	50 (7)	15 (2)	.06
Diagnosed hypertension	71 (10)[a]	23 (3)[a]	.01
Triglycerides >150 mg/dL	29 (4)	33 (4)	.79
Low HDL[b]	21 (4)	55 (6)	.09
Elevated LDL[c]	29 (4)	17 (2)	.47
Elevated total cholesterol[d]	36 (5)	30 (3)	.77

Abbreviations: BMI, body mass index; GDM, gestational diabetes; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; HDL, high-density lipoprotein; LDL, low-density lipoprotein.
[a]$P < .05$.
[b](HDL < 50 mg/dl for men, or HDL < 40 mg/dl for women).
[c]LDL > 130 mg/dl or taking medication.
[d]Total cholesterol > 200 mg/dL or taking medication.

Table 2

Achievement of Goals for Fat Intake, Physical Activity, Weight Loss Goals, and Measured Weight Loss Among Telehealth and On-site Participants Completing the Cardiovascular Disease and Diabetes Prevention Lifestyle Program

	Telehealth Group (N = 14)	On-site Group (N = 13)	
	% (n)	% (n)	*P* Value
Goal achievement			
Met fat goal	38 (5)	54 (7)	.49
Met 7% weight loss goal	50 (7)	46 (6)	.84
	Mean (SD)	**Mean (SD)**	
Physical activity and weight loss			
Weekly physical activity minutes achieved	197 (103)	243 (146)	.37
Weight loss (kg)	6.7 (3.7)	6.5 (3.1)	.85
Reduction in BMI (kg/m^2)	2.7 (1.3)	2.5 (1.0)	.62

Abbreviation: BMI, body mass index.

There were no significant differences in the achievement of the weekly fat goals or the physical activity minutes per week between these groups (Table 2). Over 40% of the on-site and telehealth group participants achieved the 7% weight loss goal, and the overall mean weight loss in both groups was greater than 6.4 kg.

Discussion

Our findings suggest that adults at high-risk for cardiovascular disease and diabetes who participate in a group-based DPP lifestyle intervention delivery through telehealth video conferencing can achieve similar diet, physical activity, and weight loss outcomes as a group of participants receiving the intervention on-site. Participants in the telehealth group also achieved similar levels of weight loss and physical activity in the original DPP, where 50% of participants met their weight loss goal and 74% met their physical activity goal after completing the 16-session intervention.[4]

Our findings are also comparable to 2 previous studies using telecommunication technology to deliver a lifestyle intervention. Harvey-Berino conducted a 12-week behavioral weight control intervention delivered to 1 group through interactive television and a second group led by a therapist (in-person).[11] The interactive television group achieved similar weight lost outcomes (mean 7.6 kg) compared with the on-site therapist led group (7.9 kg). In 2006, Liou and colleagues conducted a pilot study testing the feasibility of delivering a 12-week weight loss intervention delivered through Internet video conferencing using a pre and posttest design.[12] Participants experienced a significant reduction in mean weight (5.6 kg) and waist circumference (10.2 cm).

An additional potential strategy to increase access to the DPP lifestyle intervention could include providing the curriculum in an online format. McTigue and colleagues have pilot tested this approach by adapting the DPP curriculum for Internet delivery.[16] Participants who were overweight and had 1 or more weight related cardiovascular disease risk factors and completed the Internet program achieved significant weight loss after 12 months of enrollment (mean = 4.8 kg reduction) and improvements in systolic blood pressure (mean = 7 mmHg reduction).

There are a number of limitations to our study. First, self-reported physical activity and diet measures were collected as part of this intervention. These data sources may be biased, however participant weight loss was similar to other studies. Second, participants had their blood pressure, lipid, and glucose values measured after completing the 16-week intervention, but the sample size for both groups was too small to detect a significant change from baseline. Third, we included a qualitative evaluation to assess participant satisfaction with the program and to assess the delivery of the program through video conferencing. However, only a subgroup of participants from the on-site and telehealth groups completed this evaluation. Among those on-site and telehealth participants completing the qualitative assessment, the overall satisfaction with the program was high and no problems were identified regarding the delivery of the intervention through video conferencing. Finally, the number of participants in this study was small; however,

the results strongly suggest that the telehealth delivery of the DPP lifestyle intervention is feasible.

Implications

Our findings have a number of potential implications related to the delivery of lifestyle interventions for persons at high-risk for cardiovascular disease and diabetes. First, delivering the DPP lifestyle intervention through telehealth would allow a larger number of persons to participate, could reduce the per participant cost, and thus improve the cost-effectiveness of the intervention. The average cost per participant enrolled in the on-site group was approximately $560.[17] The addition of the telehealth participants in this feasibility assessment reduced the average cost per enrolled participant to approximately $470. Secondly, utilizing telehealth could also reduce barriers to accessing this intervention in remote rural communities, which often do not have registered dietitians, certified diabetes educators, or other adequately trained health professionals to provide these services. Third, telehealth could also be utilized to deliver the lifestyle intervention to multiple sites simultaneously. As an example, telehealth could be utilized to transmit the program from 1 campus in an urban area to 2 additional campuses, 1 in the same urban area, and 1 in a neighboring suburb. Further research is needed to assess the potential of utilizing telehealth to deliver lifestyle intervention services in these different settings.

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