


# Diabetes prevention program outcomes by in-person versus distance delivery mode among ethnically diverse, primarily lower-income adults

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## Abstract

**Objective:** Physical activity and weight loss outcomes of a diabetes prevention program were compared for ethnically diverse adults, with the majority participating in public assistance programs. Outcomes were compared for those who completed the program in person versus by distance delivery.

**Methods:** A two-group, pre-post study design compared National Diabetes Prevention Program outcomes based on in-person delivery (2018–2020 pre-COVID-19 pandemic,  $n = 47$ ) and distance delivery (after March 2020,  $n = 31$ ). Outcomes were measured or self-reported depending on the delivery method. Linear mixed models with a random intercept for coach and covariates were used to assess delivery mode group differences in percent weight loss and weekly physical activity minutes.

**Results:** Completion rates were similar by in-person versus distance delivery mode (57% vs. 65%). Among those who completed the program, the mean age was 58 years, the mean baseline body mass index was 33, and 39% were Hispanic. The majority were female (87%), participating in a public assistance program (63%), and living in a micropolitan area (61%). Percent weight loss was greater in the distance delivery group (7.7%) compared to the in-person group (4.7%) in the unadjusted analysis ( $p = 0.009$ ) but not when adjusted for covariates. No differences were observed in adjusted weekly physical activity minutes between the in-person (219 min) versus the distance group (148 min).

**Conclusions:** No differences were observed by delivery mode in percent weight loss or weekly physical activity minutes, indicating that distance delivery does not compromise program effectiveness.

## Keywords

Diabetes prevention program, in-person delivery, distance delivery, adults, weight loss, physical activity

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## Introduction

The prevalence of diabetes and prediabetes in the US has been estimated at 13% and 35%, respectively, with disparities in prevalence by race and ethnicity and socioeconomic status.<sup>1</sup> National Health Interview Survey data from 2011 to 2014 showed that disparities in diagnosed diabetes based on the socioeconomic position were observed for White, Black, and Hispanic adults.<sup>2</sup> Adults with lower family income were more likely to have been diagnosed with diabetes (14.1% of those <100% family poverty level

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compared to 5.6% of those at 500% or more of the family poverty level).<sup>1</sup> Prevalence estimates of US adults with diagnosed diabetes by race and ethnicity include 14.5% of American Indian or Alaska Native, 12.1% of non-Hispanic Black, 11.8% of Hispanic, and 7.4% of non-Hispanic White adults.<sup>1</sup>

The US National Diabetes Prevention Program (NDPP) established by the US Centers for Disease Control and Prevention (CDC) was a lifestyle change intervention designed for participants at high risk of type 2 diabetes over one year using one-to-one counseling by lifestyle coaches (LCs) aimed at attaining a 5% to 7% weight loss and a moderate increase in physical activity.<sup>3</sup> The NDPP was initially tested in a three-arm randomized controlled clinical trial beginning in 1996. Results showed a 59% reduction in the incidence of type 2 diabetes versus placebo for those 45 to 59 years and a 71% reduction for those  $\geq 60$  years.<sup>3</sup> Gruss et al.<sup>4</sup> reported that the year-long program has also resulted in successful weight loss when adapted for various lower-cost delivery modes in subsequent years including internet-based and online delivery methods.

Several studies have shown that the NDPP has less success in achieving program outcomes among lower-income, ethnically diverse participants. For example, Ely et al.<sup>5</sup> found that the odds of meeting the weight loss goal were lower for non-Hispanic Black and those in other race/ethnicity categories compared to non-Hispanic White adults. The effect of race/ethnicity on weight loss achieved through participation in the NDPP was modified by income in another study.<sup>6</sup>

Gaps exist in NDPP participation among priority populations including racial and ethnic, low-income, and rural participants. LCs serving mostly participants with lower incomes reported more barriers to participation and lifestyle change than coaches serving mostly participants with higher incomes.<sup>7</sup> Data from another study showed higher initial “no shows” for Latino enrollees and a lower likelihood of attending the NDPP at least once compared to non-Hispanic White enrollees.<sup>8</sup> Disparities in access to the NDPP in the US have been observed among those in urban counties with 48% having access to at least one NDPP partnership site versus 15% for rural counties.<sup>9</sup> Through the University of Minnesota Extension, the NDPP is delivered to groups where the majority are eligible to participate or are participating in the Supplemental Nutrition Assistance Program (SNAP), primarily in non-metropolitan areas with a high proportion of Latino residents. Before the COVID-19 pandemic, the University of Minnesota Extension delivered all NDPP courses in-person followed by adaptation to distance delivery of all courses in March 2020 when the pandemic restricted in-person delivery. Because previous studies have shown lower effectiveness of or participation in the NDPP for some demographic subgroups,<sup>7–9</sup> additional research is needed to examine how delivery mode affects the NDPP outcomes among ethnically diverse participants who may have lower income.

The purpose of this study was to compare physical activity and weight loss outcomes among a group of ethnically diverse adults, with the majority participating in public assistance programs, in primarily non-metropolitan areas who completed the NDPP implemented in-person (standard) versus distance delivery.

## Methods

### Study design and setting

This study was conducted as a non-randomized, two-group study with a pre–post study design. The University of Minnesota Extension SNAP-Ed has been successfully delivering the NDPP since 2013. LCs deliver the program in partnership with counties and community-based organizations, as well as healthcare entities. Partner agency involvement includes referring participants, recruitment, and serving as host sites. The program is led by trained LCs who guide groups of individuals toward behavior change and provide education about healthy eating, increased movement, as well as how social and emotional well-being influences health choices.

### Participants

For the current study, outcomes were evaluated for those participating in the NDPP from 2018 to 2022 in seven in-person courses (2018–2020) and five distance delivery courses (2020–2022). Distance courses were delivered at the start of the COVID-19 pandemic when restrictions prohibited further in-person contact.

Participants were eligible for the program if they were 18 years of age or older, had a body mass index (BMI) of 25 or greater (23 or greater if Asian), and had been diagnosed as having prediabetes based on a blood test (fasting plasma glucose, oral glucose tolerance test, hemoglobin A1c), or having clinically diagnosed gestational diabetes mellitus (GDM) during a previous pregnancy, or a screening result indicating high risk from the American Diabetes Association Type 2 Diabetes Risk Test.<sup>10</sup> Participants were recruited using a variety of methods including flyers, email listservs, healthcare clinic staff referrals, word of mouth, and/or previous participation in other SNAP-Ed programs. The University of Minnesota Institutional Review Board determined that the evaluation activities reported in the paper were not research involving human subjects as defined by the US Department of Health and Human Services and US Food and Drug Administration regulations, therefore, participant consent was not required.

### Intervention

The University of Minnesota Extension SNAP-Ed used the 2016, CDC Prevent T2 NDPP curriculum.<sup>11</sup> This year-long lifestyle change program is designed to help adults who

have prediabetes or are at high risk of type 2 diabetes to prevent or delay the onset. Outcomes are achieved through lifestyle modifications, working toward a currently recommended weight loss goal of 4% to 7% of their body weight, and incorporation of 150 min of physical activity weekly. The program is led by trained LCs who facilitate group sessions around healthy eating, physical activity, stress management, and coping with triggers. To help monitor progress throughout the program, participants keep track of their weight, food intake, and physical activity.

The curriculum is delivered in two phases.<sup>12</sup> Phase one occurs in months 1–6 with participants meeting with their LCs for 16 1-h-long weekly sessions. Following the completion of the weekly sessions, participants continue meeting with their LCs and cohort on a monthly basis for phase two of the program, or months 7–12. During months 7–12 (weeks 27–52), LCs deliver at least one session in each of the 6 months for a minimum of 6 sessions. The duration (1-year) and intensity (minimum of 22 sessions) are considered key to program success.<sup>12</sup>

### Delivery mode

For the in-person mode, the program was delivered 100% in-person by trained LCs who were physically present in a classroom with participants. Classroom locations varied depending on local availability, but often would take place in local fitness facilities, clinics, or community centers. Each cohort had a single LC who facilitated the program.

The distance learning delivery mode was delivered 100% by trained LCs where coaches were present in one location and participants joined via Zoom videoconferencing or calling synchronously from separate locations. Distance learning cohorts utilized a co-facilitation model for program delivery. Co-facilitators met prior to each session to determine their division of responsibilities and to plan their content delivery strategy for each lesson, based on the T2 NDPP curriculum. LCs typically met on a weekly basis for the first six weeks and then as needed with an organizational master trainer supported by the Emory Diabetes Training and Technical Assistance Center to review lesson plans, provide feedback and adaptation support, develop basic powerpoints to cover key lesson materials and assure the lesson retained fidelity to the Prevent T2 NDPP curriculum.

LCs connected with participants one-on-one before the start of the course to begin to build rapport and demonstrate the personalized support they provide throughout the course. The preferred method of communication and internet access were discussed and a basic overview of Zoom functionality was provided. This opportunity to provide individual consultation was intended to optimize the virtual participant experience.

During sessions, one LC served as the primary facilitator whose role was covering lesson content and managing discussions. The co-facilitator served in a supportive capacity and provided technical assistance to those who needed it, monitored the chat, and prepared engagement activities such as polls and breakout rooms. This model was designed to assist with logistics and enhance acceptance of the delivery method by participants and LCs.

### Measures

**Demographic characteristics.** Self-reported demographic characteristics were collected from an initial questionnaire either in person or electronically depending on the program delivery mode. Participation in public assistance programs was calculated based on a positive response to at least one of the federal food assistance programs and state assistance programs, and meeting 165% or 185% of the federal poverty income level. Community type was determined using Rural–Urban Commuting Area (RUCA) codes. RUCA codes are measures of population density, urbanization, and daily commuting based on the 2010 decennial census and the 2006–2010 American Community Survey.<sup>13</sup> Subcodes were assigned based on each participant's corresponding zip code and collapsed from three subcategories to one category to represent each metropolitan, micropolitan, and small-town area. A single rural area subcode represented the rural category.

**Program completion and outcomes.** For those who had been in the program for  $\geq 9$  months, the criteria for completing the program were attending  $\geq 9$  sessions in months 1 to 6 and attending  $\geq 3$  sessions in months 7 to 12.<sup>12</sup> Outcomes from a total of 12 courses were reported (seven in-person and five distance). Ten courses had 26 total sessions, whereas one had 27 and one had 22 sessions. Therefore, the percentage of sessions attended was calculated based on the total sessions for the particular course. Physical activity was calculated as the average of self-reported weekly minutes of moderate-to-vigorous activity from the fourth session when activity tracking was introduced. For the in-person delivery group, weight was measured by coaches using recommended procedures for measuring weight.<sup>12</sup> For the distance delivery mode, the same procedures were recommended to participants who were asked to measure their weight under similar circumstances (wearing similar clothing, measurements taken at the same time of the day). If participants did not have a scale, a digital scale (Inevift Body Scale, Model I-BS003S, Inevift, Santa Barbara, CA) was mailed to their homes. Weight loss (%) was calculated as the difference in weight from baseline to the last session attended divided by baseline weight and multiplied by 100. Baseline BMI ( $\text{kg}/\text{m}^2$ ) was calculated from the first session weight and self-reported height for all participants, except for those

who did not attend the first session or make-up session the next day or several days later ( $n = 6$  in the in-person group). For these participants, baseline BMI was calculated based on the first weight measure conducted.

### Data analysis

All statistical analyses were completed using SAS (SAS Institute Inc., Cary, NC, 2002–2012, version 9.4). The analyses included participants who met the completion criteria established by CDC<sup>12</sup> for recognition in an ongoing registry of programs that have been approved by the Diabetes Prevention Recognition Program (DPRP) based on using a CDC-approved curriculum and agreeing to the specified intensity and duration requirements. The DPRP standards ensure broad use of effective type 2 diabetes prevention lifestyle interventions in the US.

Differences between delivery mode groups at baseline for those completing the program were assessed using *t*-tests for continuous variables (age, weight, and BMI) and chi-square analysis for categorical variables (sex, race, ethnicity, education, participation in public assistance programs, region, and community type). Differences in program characteristics (course language and coach) were also assessed with chi-square analysis. Differences in characteristics by whether the course was completed were also assessed using *t*-tests for continuous variables and chi-square analysis for categorical variables.

Linear mixed-effects models with a random intercept for coach and covariates (age, sex, education, ethnicity, baseline BMI, participation in public assistance programs, region, class language, and percentage sessions attended) were used to assess delivery mode group differences in percent weight loss and weekly physical activity minutes. Program outcomes that were not normally distributed were square root transformed prior to statistical analysis to approximate normality. Original values were provided in tables to facilitate interpretation. Significance was determined by  $\alpha < 0.05$ .

### Results

Of the 130 participants who enrolled in the course, 78 met the criteria for completion, with 47 of 82 (57%) from the in-person group and 31 of 48 (65%) from the distance group (Table 1). The mean age of all participants was 58 years with a mean baseline BMI of 33. The majority of participants were female (87%), participating in a public assistance program (63%), and living in a micropolitan area (61%). About one-third of participants identified as Hispanic (39%) and had a high school education or less (31%). No differences were observed between groups in demographic characteristics, except that those in the distance group were more likely to be a college graduate or have less than a high school diploma than those in the

in-person group ( $p = 0.025$ ). Participants in the in-person and distance delivery groups had prediabetes diagnosed by a blood glucose test ( $n = 27$ , 57% and  $n = 17$ , 55%, respectively), by clinical diagnosis of GDM during a previous pregnancy ( $n = 5$ , 11% and  $n = 4$ , 13%, respectively), or by a risk test ( $n = 42$ , 89% and  $n = 27$ , 87%, respectively), with no differences between the group in the number diagnosed by any criteria.

More participants in the in-person group attended sessions where the class language was Spanish compared to the distance group ( $p = 0.004$ ). Of the eight LCs, two taught both in-person and distance groups, four taught only in-person groups, and two taught only distance groups ( $p < 0.0001$ ).

The percent weight loss was greater in the distance group (7.7%) versus the in-person group (4.7%) in unadjusted analysis ( $p = 0.009$ ), however, percent weight loss did not differ in the distance group (5.4%) versus the in-person group (2.9%) after adjusting for covariates ( $p = 0.146$ ) (Table 2). Weekly physical minutes were not different between groups (220 min in the in-person group and 232 min in the distance group) in either unadjusted or adjusted analysis.

Those who met the criteria ( $n = 78$ ) versus those who did not meet the criteria ( $n = 52$ ) for program completion were older ( $p < 0.0001$ ), and had a lower baseline mean BMI ( $p = 0.039$ ) (Table 3). Those completing the program versus those not completing the program were also more likely to be non-Hispanic ( $p = 0.010$ ), but differences in course language or coach were not identified. In addition, those completing the program versus those not completing the program were less likely to be participating in public assistance ( $p = 0.001$ ) and less likely to have prediabetes diagnosed based on GDM during a previous pregnancy ( $p = 0.045$ ).

### Discussion

This study examined outcomes for ethnically diverse adults, with the majority participating in public assistance programs in primarily non-metropolitan areas in Minnesota who completed the NDPP in-person or by distance delivery. In the adjusted analysis, no differences were observed in percent weight loss or weekly physical activity minutes by the delivery group.

Studies evaluating the effectiveness of the NDPP by distance delivery are limited, especially among low-income, ethnically diverse, and rural participants.<sup>14</sup> From 2015 to 2018 among almost 13,000 adults enrolled in an online NDPP in the US, the majority were primarily non-Hispanic White (58%) and from an urban core area (83%). In addition, methodological concerns for studies involving distance delivery include participant-reported outcomes and the use of a single pre-post test study design. The current study compared weight loss in an in-person standard delivery group where weight was measured versus a distance delivery group

**Table 1.** Demographic and program characteristics of participants who completed the program by delivery mode group ( $n=78$ ).

	Delivery mode			<i>p</i> -value <sup>a</sup>
	All ( $n=78$ )	In-person ( $n=47$ )	Distance ( $n=31$ )	
	Mean (SD)	Mean (SD)	Mean (SD)	
Age	57.6 (16.0)	59.2 (17.4)	55.1(14.0)	0.279
Baseline weight	194.5 (42.2)	188.9 (41.5)	202.9 (42.4)	0.152
Body mass index	33.1 (6.1)	32.8 (6.1)	33.6 (6.2)	0.549
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>p</i> -value <sup>b</sup>
Sex				0.986
Male	10 (12.8)	6 (12.8)	4 (12.9)	
Female	68 (87.2)	41 (87.2)	27 (87.1)	
Ethnicity				0.165
Hispanic or Latino	30 (38.5)	21 (44.7)	9 (29.0)	
Not Hispanic or Latino	48 (61.5)	26 (55.3)	22 (71.0)	
Race				
American Indian or Alaska Native	1 (1.3)	1 (2.1)	0 (0.0)	0.414
Black or African American	2 (2.6)	1 (2.1)	1 (3.2)	0.764
Native Hawaiian or Other Pacific Islander	1 (1.3)	0 (0.0)	1 (3.2)	0.215
White	71 (90.1)	42 (89.4)	29 (93.6)	0.527
Education				0.025
No high school diploma or GED	10 (12.8)	4 (8.5)	6 (19.4)	
High school graduate	14 (18.0)	11 (23.4)	3 (9.7)	
Some college or technical school	15 (19.2)	10 (21.3)	5 (16.1)	
College graduate	22 (29.5)	9 (19.2)	14 (45.2)	
Not reported	16 (20.5)	13 (27.7)	3 (9.7)	
Participation in assistance programs <sup>c</sup>				0.010
Participation in any program	49 (62.8)	33 (70.2)	16 (51.6)	
No program participations	29 (37.2)	14 (27.7)	15 (48.4)	

(continued)

Table 1. Continued.

	Delivery mode			<i>p</i> -value <sup>a</sup>
	All ( <i>n</i> = 78)	In-person ( <i>n</i> = 47)	Distance ( <i>n</i> = 31)	
	Mean (SD)	Mean (SD)	Mean (SD)	
Region				<0.0001
Southwest	35 (44.9)	29 (61.7)	6 (19.4)	
Southeast	32 (41.0)	10 (21.3)	22 (71.0)	
Northwest	5 (6.4)	5 (10.6)	0 (0.0)	
Northeast	6 (7.8)	3 (6.4)	3 (9.7)	
Community type <sup>d</sup>				0.200
Rural area	3 (3.9)	2 (4.3)	1 (3.2)	
Small town	20 (25.6)	13 (27.7)	7 (22.6)	
Micropolitan area	47 (60.3)	30 (63.8)	17 (54.8)	
Metropolitan area	8 (10.3)	2 (4.3)	6 (19.4)	
Session language				0.004
English	49 (62.8)	30 (63.8)	19 (62.3)	
Spanish	23 (29.5)	17 (36.2)	6 (19.4)	
Both English and Spanish	6 (7.7)	0 (0.0)	6 (19.4)	
Lifestyle coach				<0.0001
1	27 (34.6)	10 (21.3)	17 (54.8)	
2	5 (6.4)	5 (10.6)	0 (0.0)	
3	3 (3.9)	3 (6.4)	0 (0.0)	
4	10 (12.8)	10 (21.3)	0 (0.0)	
5	5 (6.4)	5 (10.6)	0 (0.0)	
6	5 (5.4)	0 (0.0)	5 (16.1)	
7	20 (25.6)	14 (29.8)	6 (19.4)	
8	3 (3.9)	0 (0.0)	3 (9.7)	

<sup>a</sup>*t*-test for unadjusted mean differences between the groups for continuous variables.

<sup>b</sup>Chi-square test for differences in distributions of categorical variables.

<sup>c</sup>Participation/eligibility for public assistance = indicates participation in Head Start, free/reduced price school meals, MN Family Investment Program, Nutrition Assistance Program for Seniors, Supplemental Nutrition Assistance Program, Special Supplemental Nutrition Program for Women, Infants, and Children, public subsidized housing, Supplemental Security Income, or an MN government assistance program including general assistance, medical assistance or MN supplemental aid or indicating gross monthly income lower than 165% or 185% of the federal poverty level.

<sup>d</sup>Community type—determined by zipcodes corresponding to Rural-Urban Commuting Area (RUCA) codes (USDA, ERS<sup>13</sup>).



**Table 2.** Program outcomes for those completing the program by delivery mode.

	Unadjusted		Adjusted <sup>a</sup>			
	In-person (n=47)	Distance (n=31)		In-person (n=47)	Distance (n=31)	
	Mean (SD)	Mean (SD)	p-value	Least-squares mean (SD)	Least-squares mean (SD)	p-value
Percent weight loss	4.7 (4.3)	7.7 (5.5)	0.009	2.9 (1.9)	5.4 (2.6)	0.146
Weekly physical activity minutes (square root transformed)	14.2 (4.1)	14.7 (4.0)	0.631	13.6 (1.6)	12.7 (2.3)	0.527
Weekly physical activity minutes (original values)	220 (126)	232 (157)		219 (57)	148 (77)	

<sup>a</sup>Mixed models adjusted for age, sex, ethnicity, education, baseline BMI, participation in public assistance programs, region, class language, and percent sessions attended, with coach as a random effect.

where weight was reported by participants with no differences in weight loss observed by delivery mode in an adjusted analysis. Both groups achieved a 4.7% weight loss or better based on the unadjusted analysis, which is close to the 4% to 7% weight loss promoted by the NDPP over one year via in-person classes or distance learning.<sup>11</sup> Another study of obese/overweight veterans reported a similar mean weight loss of 4.7% at 6 months and 3.7% at 12 months after participation in an online asynchronous DPP program,<sup>15</sup> therefore, asynchronous programs may effectively address the need to be available at the time sessions are scheduled. In addition, given no differences in effectiveness in the current study (with the limitation of possible data inaccuracy based on input bias for the distance group), virtual delivery may facilitate a wider geographic reach to micropolitan, small town and rural areas where in-person programs are limited or for those who are unable to travel to in-person sessions or attend at specific times. Rural internet fiber optics are a priority to ensure that rural residents have access to distance-delivered health promotion programs. Distance delivery may also facilitate reach to low-income populations based on time or schedule constraints.

Barriers to engagement in remote health interventions for type 2 diabetes were identified by Alvarado et al.<sup>16</sup> including technology inaccessibility and illiteracy. In the current study, technologies evaluated for remote delivery were primarily internet- or mobile-phone-based methods. The COVID-19 pandemic provided an opportunity for the widespread adoption of videoconferencing technology allowing for face-to-face communications for remote education, work, and interactions with healthcare professionals. Issues involving digital technology disparities, social and linguistic needs, and security and privacy concerns need to be addressed to enhance the success of virtual health

promotion programs.<sup>17</sup> In addition, social support and connection with other participants may be experienced differently via in-person versus synchronous distance-delivered NDPP sessions. LCs may need special training to address these needs and differences. In another study, barriers to participation in an in-person health promotion program for Latino families included having facilitators with inadequate facilitation skills or those who were obligated to deliver the program.<sup>18</sup> In the current study, the LC was added to the mixed models as a random effect given that the skills and attitudes of the LC may affect participant perceptions.

The duration and intensity of NDPP session attendance have been associated with a higher percent weight loss based on CDC registry data from 2012 to 2016.<sup>5</sup> Those who were older and non-Hispanic White were more likely to attend a higher number of sessions than their counterparts with no differences by sex or baseline BMI. These findings are consistent with the current study where those who met the criteria for program completion were more likely to be older and non-Hispanic White. However, in contrast to the study by Ely et al.,<sup>5</sup> those in the current study with a lower baseline BMI were more likely to complete the program. Additionally in the current study, those completing the program were less likely to have prediabetes diagnosed based on GDM during a previous pregnancy versus those not completing the program. Common risks of GDM include obesity, an ethnicity with a high prevalence of diabetes, and maternal age >35 years.<sup>19</sup> Several of these characteristics were also consistent with not completing the NDPP in the current study including having a higher baseline BMI and being more likely to identify as Hispanic or Latino. Future implementation of the NDPP could focus on retaining younger, non-White adults with a higher baseline BMI to improve program completion and weight loss outcomes.

**Table 3.** Differences in demographic and program characteristics by program completion ( $N=130$ ).

	Program completion		<i>p</i> -value <sup>a</sup>
	No ( <i>n</i> = 52)	Yes ( <i>n</i> = 78)	
	Mean (SD)	Mean (SD)	
Age	42.9 (12.3)	57.6 (16.2)	<0.0001
Body mass index	35.8 (7.7)	33.1 (6.1)	0.039
	<i>n</i> (%)	<i>n</i> (%)	<i>p</i> -value <sup>b</sup>
Gestational diabetes history			0.045
Yes	13 (25.0)	9 (11.5)	
No	39 (75.0)	69 (88.5)	
Ethnicity			0.010
Hispanic or Latino	32 (61.5)	30 (38.5)	
Not Hispanic or Latino	20 (38.5)	48 (61.5)	
Participation in assistance programs <sup>c</sup>			0.001
Participation in any program	47 (90.4)	49 (62.8)	
No program participations	5 (9.6)	29 (37.2)	
Region			0.007
Southwest	27 (51.9)	35 (44.9)	
Southeast	8 (15.4)	32 (41.0)	
Northwest	6 (11.5)	5 (6.4)	
Northeast	11 (21.2)	6 (7.7)	
Session language			0.071
English	22 (42.3)	49 (62.8)	
Spanish	24 (46.2)	23 (29.5)	
Both English and Spanish	6 (11.5)	6 (7.7)	
Coach			0.056
1	6 (11.5)	27 (34.6)	
2	5 (9.6)	5 (6.4)	

(continued)



Table 3. Continued.

	Program completion		p-value <sup>a</sup>
	No (n = 52)	Yes (n = 78)	
	Mean (SD)	Mean (SD)	
3	7 (13.5)	3 (3.9)	
4	5 (9.6)	10 (12.8)	
5	6 (11.5)	5 (6.4)	
6	2 (3.9)	5 (6.4)	
7	17 (32.7)	20 (25.6)	
8	4 (7.7)	3 (3.9)	

<sup>a</sup>t-test for unadjusted mean differences between the groups for continuous variables.

<sup>b</sup>Chi-square test for differences in distributions of categorical variables.

<sup>c</sup>Participation/eligibility for public assistance = indicates participation in Head Start, free/reduced price school meals, MN Family Investment Program, Nutrition Assistance Program for Seniors, Supplemental Nutrition Assistance Program, Special Supplemental Nutrition Program for Women, Infants, and Children, public subsidized housing, Supplemental Security Income, or an MN government assistance program including general assistance, medical assistance or MN supplemental aid or indicating gross monthly income lower than 165% or 185% of the federal poverty level.

The strengths of this study are the inclusion of ethnically diverse participants with the majority participating in public assistance programs and residing in micropolitan, small town, and rural communities. Limitations include the use of a small exploratory, convenience sample of primarily female participants with internet access who may not have been representative of the US population. The study design did not include a control group. Weight loss data were self-reported in the distance delivery group and physical activity data were self-reported in both groups. Participants in the distance delivery groups may have experienced changes in contextual factors such as jobs, schedules, or childcare based on the effects of the COVID-19 pandemic that influenced their ability or willingness to participate in the NDPP or modify their lifestyle. Future studies could compare the effectiveness of in-person delivery to distance delivery post-pandemic, with a particular focus on participant experience and engagement throughout all sessions.

In the current study, NDPP weight loss and physical activity outcomes did not differ by delivery mode among ethnically diverse participants, with the majority participating in public assistance programs. These findings are in line with a systematic review by Gentry et al.<sup>20</sup> indicating that the growth of telemedicine has produced high levels of participant satisfaction and program retention, while demonstrating similar outcomes and success to in-person program delivery.<sup>20</sup> Therefore, increasing access to evidence-based health education programs, such as the

NDPP, through telehealth and multiple distance formats is a critical next step for infrastructure investments. The US Department of Agriculture has committed funding for rural high-speed internet fiber optic cable installation with further investments in rural distance learning and telemedicine.<sup>21</sup> The digital divide is also a factor for urban residents as evidenced by broadband adoption in the last five years not significantly increasing for urban and suburban Americans, and around 15 million urban or metro households going without broadband.<sup>22</sup> While access to broadband is an issue for rural residents, urban residents face different challenges such as digital literacy and affordability, especially in communities of color.

Establishing and maintaining distance learning options for health education is critical to increasing access for those who prefer to attend through telemedicine platforms. The intervention described in this study provided an orientation to the online platform and personalized feedback, which may have contributed to the success of the distance model similar to what was described in the meta-analysis of telehealth diabetes education programs.<sup>23</sup> This research demonstrates that both in-person and distance delivery modes are equally effective in producing desired program outcomes for participants. Health education programs delivered in a synchronous digital format have the potential to reduce program delivery costs over in-person delivery modes. Further research is needed to establish a greater understanding of which features of online learning contribute to successful health outcomes achieved through distance learning platforms.

## Conclusions

NDPP outcomes including weight loss and physical activity did not differ by delivery mode indicating that distance delivery did not compromise effectiveness among ethnically diverse participants, with the majority participating in public assistance programs.

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