

# A Culturally Adapted, Telehealth, Community Health Worker Intervention on Blood Pressure Control among South Asian Immigrants with Type II Diabetes: Results from the DREAM Atlanta Intervention



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## ABSTRACT

**BACKGROUND:** South Asians face a high prevalence of type II diabetes (DMII) and comorbid hypertension (HTN). Community health worker (CHW) interventions have the potential to improve chronic disease outcomes, yet few have been tailored to South Asian populations in the United States.

**OBJECTIVE:** To test the effectiveness of an evidence-based CHW-led and culturally-tailored HTN and DMII management program for South Asian adults with diabetes and comorbid uncontrolled HTN (systolic blood pressure (SBP) > 130 mmHg or diastolic blood pressure (DBP) > 80 mmHg).

**DESIGN:** Randomized-controlled Trial.

**PARTICIPANTS:** South Asian adults with DMII and comorbid HTN.

**INTERVENTION:** The Diabetes Research, Education, and Action for Minorities (DREAM) Atlanta intervention was a CHW telehealth intervention designed to improve blood pressure (BP). The treatment group received five virtual group-based health education sessions, an action plan, and follow-up calls to assess goal setting activities. The control group received only the first session. Main Measures included: feasibility, improvement in BP control, and decreases in SBP, DBP, weight, and hemoglobin A1c (HbA1c).

**KEY RESULTS:** A total of 190 South Asian adults were randomized (97 to the treatment group and 93 to the control group); 94% of treatment group participants completed all 5 telehealth sessions. At endpoint, BP control increased 33.7% (95% CI: 22.5, 44.9,  $p < 0.001$ ) in the treatment group and 16.5% (95% CI: 6.2, 26.8,  $p = 0.003$ ) in the control group; the adjusted intervention effect was 1.8 (95% CI: 1.0, 3.2,  $p = 0.055$ ). Mean weight decreased by 4.8 pounds (95% CI: -8.2, -1.4,  $p = 0.006$ ) in the treatment group, and the adjusted intervention effect was -5.2 (95% CI: -9.0, -1.4,  $p = 0.007$ ). The intervention had an overall retention of 95%.

**CONCLUSIONS:** A culturally-tailored, CHW-led telehealth intervention is feasible and can improve BP control among South Asian Americans with DMII.

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Comorbid hypertension (HTN) among individuals with type II diabetes (DMII) is common and significantly increases the risk of microvascular and macrovascular complications. South Asian Americans, which include individuals with ancestry from India, Bangladesh, Pakistan, Nepal, Bhutan, the Maldives, and Sri Lanka, are one of the largest and fastest growing ethnic minority populations in the United States (US). This group has been shown to have a higher DMII and HTN prevalence compared with non-Hispanic whites and other racial/ethnic minority groups.<sup>1–7</sup>

Georgia (GA) comprises one of eight states in the “Stroke Belt,” an area of the country that is disproportionately affected by cardiovascular disease (CVD) and has a large and fast-growing population of South Asians. The South Asian population in GA grew by 55% from 2010 to 2019, to approximately 162,157.<sup>8,9</sup> Additionally, South Asian subgroups experience high rates of limited English proficiency (LEP) and have social disadvantages, including limited access to health insurance, transportation, and a lower household income.<sup>10</sup> Despite the growing population of South Asians in GA, their high rates of CVD risk factors, and the known density of stroke in the Southeast US, there has been a lack of culturally and linguistically adapted interventions for comorbid DMII and HTN management specific to South Asian subgroups.

Several groups have published guidelines regarding the co-morbid management of HTN and DMII, including the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, the American Diabetes Association (ADA), and the World Health Organization.<sup>11–14</sup> Strong evidence from clinical trials and

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meta-analyses supports targeting blood pressure (BP) reduction, yet challenges remain in implementing evidence-based strategies to promote HTN management among adults with DMII. Community health worker (CHW) approaches have demonstrated efficacy in delivering culturally relevant programs for DMII and HTN control in African American and Latino populations.<sup>15</sup> Moreover, telehealth platforms may improve glycemic control and communication between patients and health providers.<sup>16, 17</sup> The Diabetes Research, Education, and Action for Minorities (DREAM) Atlanta intervention was a two-arm, randomized-controlled trial designed to improve BP control among South Asian adults with comorbid DMII and HTN in Atlanta, GA.

The purpose of this study was to test the feasibility and efficacy of a CHW-led, patient-centered lifestyle telehealth intervention to improve BP control and DMII management among South Asian adults in Atlanta, GA. In this paper, we report on intervention feasibility and examine the intervention effect on changes in BP control, systolic BP (SBP) and diastolic BP (DBP), weight, BMI, and patient-centered outcomes, including knowledge and behaviors related to DMII and HTN management.

## METHODS

### Study Design and Conceptual Framework

The present study analyzes data from the DREAM Atlanta intervention. We used the CONSORT Checklist when writing our report.<sup>18</sup>

All aspects of the project were guided by the principles of community-based participatory research (CBPR), and the Health Belief Model and Social Support Theory. A coalition guided the project from project initiation and included the DREAM Atlanta project team and CHWs and the Atlanta South Asian Health Alliance, a community advisory board that includes patients with lived diabetes experience and their family members, religious leaders, small business owners, and community leaders in the Atlanta South Asian community.

### Study Recruitment

The 6-month intervention took place over two overlapping rounds, with recruitment for round 1 taking place from July 2020–September 2020 and recruitment for round 2 taking place from December 2020–February 2021. Screened participants were eligible to enroll in the intervention if they confirmed the following criteria: 1) South Asian ethnicity; 2) between the ages of 18 and 85 years; 3) diagnosis of diabetes; and 2) diagnosis of HTN or an uncontrolled BP reading in the past six months or at screening. Ineligibility criteria included: 1) pregnant at time of screening; 2) diagnosis of Type I diabetes or diabetes secondary to other conditions; and 3) inability

to perform unsupervised physical activity determined by self-report at screening. Each participant completed one study round and provided written informed consent before study enrollment. Human subjects' approval was obtained in 2019, and the trial was registered at ClinicalTrials.gov (identifier: NCT04263311). Sample size determination and recruitment strategies are described elsewhere.<sup>19</sup>

Following enrollment, all individuals completed a baseline survey by phone and the first telehealth education session via Zoom. Using IBM SPSS Statistics for Windows, version 28.0, participants were randomized within stratified groups (assigned CHW, age [ $\leq 55$  and  $> 55$ ], and gender) to balance the treatment and control groups by gender, age, and CHW caseload. Spousal/family units were randomized to the same study arm based on the randomization of women and older individuals. There were 26 family units in the treatment group and 17 family units in the control group, and the size ranged from two to five individuals, while most included two. Randomization was completed by LCW, who had no direct contact with CHWs or study participants. Control group participants were not contacted during the intervention period, except for the first intervention session and baseline survey, and to complete the endpoint survey; education sessions were offered at a later date as a point of service and not as part of the research.

### Intervention

The 6-month telehealth intervention was delivered in Bengali and English by three CHWs. A total of five group sessions (the first session plus four additional sessions) were facilitated by the CHWs, each lasting approximately 60 min. The sessions were held monthly and at varying times during the day and week in order to accommodate different schedules. Health education sessions topics included: 1) Overview of DMII and HTN; 2) Nutrition; 3) Physical activity; 4) Stress management; and 5) DMII and HTN management. All sessions were culturally-tailored for South Asians by discussing religious practices, culturally-tailored foods, and gender-specific exercises. Further details on the mode of delivery, session content and cultural tailoring of the intervention have been previously described.<sup>19</sup> Following session 1, participants completed an action plan development form in which participants and CHWs created short-term action plan goals (e.g., eating a healthy diet, being physically active). CHWs followed up on the action plans using motivational interview techniques through one-on-one and progress note phone calls, occurring monthly. During the first round, there were two one-on-one calls and six progress notes. During round two, progress notes were reduced to three. Each encounter lasted approximately 30 min.

## Measures

The primary efficacy study outcome was change in BP control, defined as <130/80 mmHg, between baseline and 6-month study endpoint. BP was collected via EHR chart review and by patient report at screening for study eligibility. EHR chart review was used for clinic recruitment, and patient report was used for community recruitment. At the start of the remote intervention, all participants were mailed both an Alcedo BP Monitor and an Etekcity Digital Body Weight scale, and education was provided on how to check BP at home. BP was collected virtually from participants while monitored by a CHW using a BP monitor provided by the study at baseline and 6-month follow-up. If the CHW was unable to monitor, participants texted a picture of the BP reading to the CHW. At baseline and follow up, one BP reading was provided.

Secondary clinical outcomes included SBP, mmHg, DBP, mmHg, hemoglobin A1c (HbA1c, %), weight (lbs.), and body mass index (BMI,  $\text{km}^2$ ). HbA1c was collected from clinical electronic health records (EHRs), weight was collected virtually from participants using the study provided scale while monitored by a CHW, and height was collected from the EHR or by participant self-report. BMIs were calculated using weight and height.

Feasibility measures included recruitment and enrollment metrics (i.e., proportion of recruited participants who enroll), proportion of participants who complete all sessions, and baseline and follow-up survey completion.

Patient-centered outcomes included self-reported physical activity (culturally modified from the Behavioral Risk Factor Surveillance System<sup>20</sup> [BRFSS]), daily diet intake<sup>21</sup> (culturally modified from the BRFSS), medication adherence (Adherence to Refills and Medications Scale<sup>22</sup> [ARMS]), diabetes self-management, diabetes physician management, health self-efficacy (adapted from the Bandura self-efficacy scale<sup>23</sup>), depression risk (Patient Health Questionnaire-2<sup>24</sup> [PHQ-2]), instrumental support (NIH toolbox), and days of poor physical and mental health (BRFSS).<sup>25</sup> For full details on study outcomes, see Supplemental Table 1. Questions were asked of participants at baseline and endpoint via Zoom or telephone. Assessment of digital utilization skills was obtained for intervention group participants at endpoint during the endpoint survey (Supplemental Table 2).

## Statistical Analyses

We compared baseline characteristics between the treatment and control groups using Pearson Chi-square tests for categorical variables ( $n$  [%]) and Student's  $t$ -tests for continuous variables (mean [95% CI]). To test within-group differences between baseline and endpoint, we used paired  $t$ -tests and McNemar tests for each outcome measure. To assess change

across groups for each continuous outcome, we ran generalized estimating equation (GEE) models for repeated measures over time using the GENMOD procedure in SAS to fit generalized linear models, while adjusting for the arm, time-point the interaction between arm and time point (the intervention effect), age, and sex. The interaction variable tests the intervention effect and indicates if there are significant differences in changes between the two groups. To assess change across groups for dichotomous outcomes, we ran a GEE model using a binomial distribution, and adjusted odds ratios were produced for the intervention effects. SAS Version 9.4 (SAS Institute, Cary, N.C.) was used for all analyses.

## RESULTS

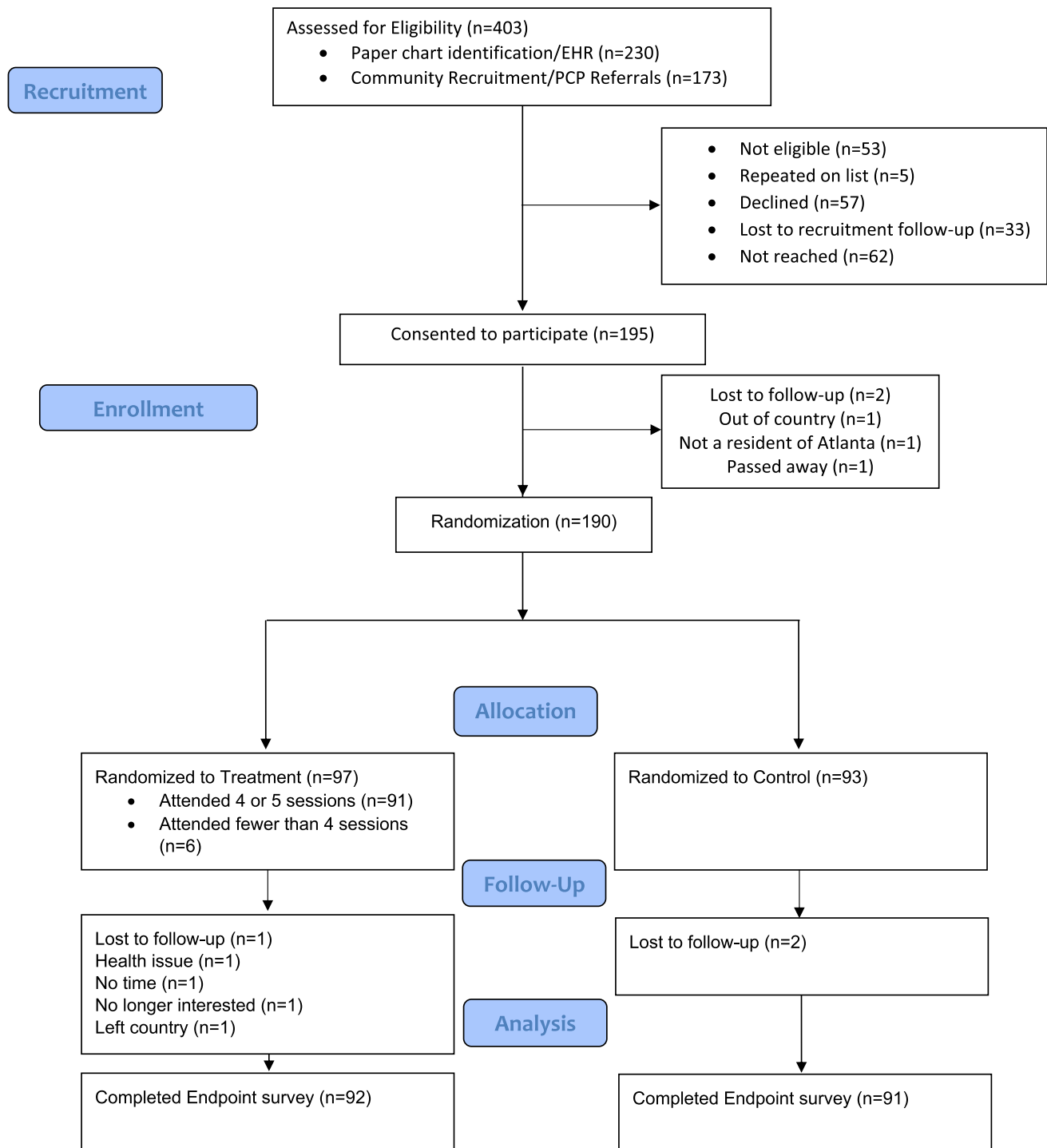
A total of 403 individuals were assessed for eligibility; of these, 53 were not eligible, 5 were repeated on the list, 57 declined, 33 were lost to follow-up during recruitment, and 62 were not reached. Recruitment occurred via clinic/EHR lists (20.0%) and by community recruitment (80.0%). Of 195 consented individuals, 190 were randomized (97 to the treatment group, and 93 to the control group, see Fig. 1).

Baseline socio-demographics and outcome measures of the 190 randomized treatment and control group individuals are presented in Table 1. Just over half of participants (56.3%) were female, mean age was 56.0, and the majority were born in Bangladesh (93.2%) followed by India (3.7%) and Pakistan (3.2%). Most (92.6%) had uncontrolled BP, and mean weight was 156.3. Compared to the control group, the treatment group was significantly more likely to speak English “not well” or “not at all” and less likely to manage diabetes with medication or insulin. Treatment group: 59% medication only, 5% insulin only, and 7% insulin and medication; control group: 67% medication only, 8% insulin only, and 12% insulin and medication.

## Feasibility Outcomes

The majority of the treatment group completed all five sessions ( $n=91$ , 94%), the action plan ( $n=95$ , 98%), three or more progress notes ( $n=90$ , 93%), both one-on-ones ( $n=91$ , 94%), and the follow-up survey ( $n=92$ , 95%). All sessions were performed remotely through Zoom due to the COVID-19 pandemic, and the majority of the sessions ( $\geq 97\%$ ) were group sessions. Among control group participants, the majority completed the follow-up survey ( $n=91$ , 98%).

At the end of the program, treatment group participants reported gaining at least some improvement with technological abilities; this includes using video conference technology like Zoom (78.3%), communicating with a doctor or other



**Figure 1 CONSORT Diagram of DREAM Atlanta Study Sample.**

health professional via email or the internet (29.3%), and using a device such as a computer, smartphone, or tablet (64.0%).

## Efficacy Outcomes

Table 2 presents changes in clinical measurements from baseline to endpoint by study group. At endpoint, BP

control increased 33.7% (95% CI: 22.5, 44.9,  $p < 0.001$ ) in the treatment group, whereas in the control group, BP control increased 16.5% (95% CI: 6.2, 26.8,  $p = 0.003$ ); the adjusted intervention effect was 1.8 (95% CI: 1.0, 3.2,  $p = 0.055$ ).

At endpoint, mean SBP decreased by -13.6 mmHg (95% CI: -17.1, -10.2,  $p < 0.001$ ) in the treatment group, whereas

Table 1 Baseline Characteristics of all Randomized DREAM Atlanta Participants

	Intervention (n = 97)	Control (n = 93)	p-value
Socio-demographics, n (%)			
Female	56 (57.7)	51 (54.8)	0.688
Age in years, mean (95% CI)	56.2 (53.7, 58.7)	55.7 (53.4, 57.9)	0.756
Country of birth			0.606
Bangladesh	92 (94.8)	85 (91.4)	
India	3 (3.1)	4 (4.3)	
Pakistan	2 (2.1)	4 (4.3)	
Years lived in US, mean (95% CI)	14.5 (12.2, 16.9)	16.0 (13.7, 18.2)	0.390
Marital Status			0.760
Married	83 (85.6)	81 (87.1)	
Widowed/Divorced	14 (14.4)	12 (12.9)	
Education level			0.056
Less than high school	18 (18.8)	12 (12.9)	
High school/GED/Some college	38 (39.5)	26 (28.0)	
College graduate	40 (41.7)	55 (59.1)	
Insured	83 (87.4)	86 (92.5)	0.246
Speaks English not well or not at all	52 (53.6)	35 (37.6)	0.027
Clinical measures, mean (95% CI)			
Weight, lbs	156.2 (151.5, 160.8)	156.4 (150.9, 161.9)	0.943
BMI, kg/m <sup>2</sup>	27.5 (26.7, 28.4)	26.6 (25.7, 27.5)	0.147
SBP, mmHg	139.3 (135.9, 142.7)	139.0 (135.7, 142.3)	0.912
DBP, mmHg	84.9 (82.9, 86.8)	84.5 (82.5, 86.4)	0.782
BP Control, n (%)	7 (7.2)	7 (7.5)	0.935
HbA1c, % (n = 53)	7.1 (6.7, 7.5)	7.2 (6.7, 7.6)	0.756
Physical activity, mean (95% CI)			
Moderate weekly activity, minutes	126.0 (78.6, 173.4)	175.1 (120.6, 229.5)	0.178
Vigorous weekly activity, minutes	3.7 (-0.1, 7.6)	14.2 (1.7, 26.8)	0.105
Total weekly activity, minutes	133.5 (85.0, 181.9)	203.5 (141.1, 266.0)	0.078
Recommended weekly PA, n (%)	27 (27.8)	38 (40.9)	0.059
Dietary intake, mean (95% CI)			
Fruit, times per day	0.84 (0.68, 1.00)	1.11 (0.76, 1.45)	0.160
Soda, times per day	0.10 (0.06, 0.14)	0.10 (0.04, 0.15)	0.798
Sugar sweetened beverages, times per day	0.86 (0.67, 1.06)	0.99 (0.71, 1.26)	0.467
Fried potatoes, times per day	0.20 (0.15, 0.25)	0.25 (0.07, 0.42)	0.613
Potatoes, times per day	0.36 (0.26, 0.46)	0.32 (0.22, 0.42)	0.555
Vegetables, times per day	1.50 (1.33, 1.67)	1.42 (1.25, 1.59)	0.494
Adherence to Refills and Medication (ARMS)			
Prescription refill subscale (4–16, 16 = worst adherence)	5.6 (5.3, 6.0)	5.3 (5.0, 5.7)	0.226
Medication taking subscale (8–32, 32 = worst adherence)	10.7 (10.0, 11.4)	10.0 (9.4, 10.6)	0.140
Diabetes Self-Management, n %			
Checks feet every day	17 (17.5)	19 (20.9)	0.559
How do you manage your diabetes?			
Medication or Insulin	69 (71.1)	80 (86.0)	0.013
Diet control	57 (58.8)	55 (59.1)	0.958
Physical activity/exercise	39 (40.2)	40 (43.0)	0.695
Diabetes Physician Management, mean (95% CI)			
Times seen doctor for diabetes in past 12 months	2.4 (2.0, 2.8)	2.5 (2.2, 2.9)	0.636
Times A1c checked by doctor in past 12 months	2.0 (1.6, 2.4)	2.3 (2.0, 2.6)	0.273
Times feet checked by doctor in past 12 months	0.9 (0.6, 1.2)	1.3 (0.9, 1.6)	0.106
Eyes dilated in past year, n (%)	50 (52.1)	46 (50.6)	0.834
Health			
Self-efficacy, 1–4, 4 = highest, mean (95% CI)	2.8 (2.6, 2.9)	2.9 (2.8, 3.1)	0.136
PHQ-2 scale (0–6, 6 = highest risk), mean (95% CI)	2.8 (2.6, 2.9)	2.9 (2.8, 3.1)	0.137
Instrumental support scale (1–5, 5 = highest support), mean (95% CI)	4.5 (4.3, 4.6)	4.5 (4.3, 4.6)	0.894
Days of poor physical health (0–30), mean (95% CI)	4.9 (3.2, 6.6)	2.9 (1.5, 4.3)	0.080
Days of poor mental health (0–30), mean (95% CI)	4.9 (3.4, 6.5)	4.0 (2.5, 5.6)	0.421

among the control group mean SBP decreased by -6.5 mmHg (95% CI: -10.3, -2.7,  $p=0.001$ ); the adjusted intervention effect was -6.7 (95% CI: -11.6, -1.6,  $p=0.009$ ). At endpoint, mean DBP decreased by -8.2 mmHg (95% CI: -10.3, -6.0,  $p<0.001$ ) in the treatment group, whereas among the control group mean DBP decreased by -3.4 mmHg (95% CI: -5.3,

-1.4,  $p<0.001$ ); the adjusted intervention effect was -4.7 (95% CI: -7.5, -1.8,  $p=0.001$ ). At endpoint, mean weight decreased by -4.8 pounds (95% CI: -8.2, -1.4,  $p=0.006$ ) in the treatment group, whereas among the control group mean weight decreased by -0.5 pounds (95% CI: -1.3, 2.4,  $p=0.565$ ); the adjusted intervention effect was -5.2 (95%



**Table 2** Changes in Clinical Measurements of Study Participants from Baseline to Study Endpoint

	Intervention Group					Control Group					Intervention Effect—Adjusted <sup>a</sup>	<i>p</i> -value
	<i>n</i>	Baseline, mean (SD)	Endpoint, mean (SD)	Change	<i>p</i> -value	<i>n</i>	Baseline, mean (SD)	Endpoint, mean (SD)	Change	<i>p</i> -value		
HbA1c, %	28	7.1 (1.1)	6.7 (0.8)	-0.4 (-0.8, -0.1)	0.014	19	7.1 (1.0)	6.9 (0.9)	-0.2 (-0.7, 0.3)	0.382	-0.2 (-0.7, 0.3)	0.493
Weight, lbs	92	157.4 (22.7)	152.6 (26.0)	-4.8 (-8.2, -1.4)	0.006	91	156.7 (26.8)	157.3 (27.5)	0.5 (-1.3, 2.4)	0.565	-5.2 (-9.0, -1.4)	0.007
BMI, kg/m <sup>2</sup>	92	27.8 (4.3)	26.8 (4.5)	-0.9 (-1.6, -0.2)	0.012	91	26.6 (4.3)	26.7 (4.4)	0.1 (-0.2, 0.4)	0.547	-0.1 (-1.7, -0.2)	0.012
SBP, mmHg	92	139.8 (16.4)	126.1 (11.3)	-13.6 (-17.1, -10.2)	<0.001	91	139.0 (16.3)	132.5 (12.4)	-6.5 (-10.3, -2.7)	0.001	-6.7 (-11.6, -1.6)	0.009
DBP, mmHg	92	85.0 (9.5)	76.8 (9.2)	-8.2 (-10.3, -6.0)	<0.001	91	84.3 (9.1)	81.0 (7.4)	-3.4 (-5.3, -1.4)	<0.001	-4.7 (-7.5, -1.8)	0.001
BP Control <sup>b</sup> , <i>n</i> (%)	92	6 (6.5)	37 (40.2)	33.7 (22.5, 44.9)	<0.001	91	7 (7.7)	22 (24.2)	16.5 (6.2, 26.8)	0.003	1.8 (1.0, 3.2)	0.055

<sup>a</sup>Adjusted for age and gender<sup>b</sup>< 130/80 mmHg

CI: -9.0, -1.4,  $p=0.007$ ). HbA1c was available for a small subset of individuals; while a decrease was observed for the treatment group, the intervention effect was not significant between groups. A model was fit for each outcome that included a family unit effect variable, but no differences were observed in the final outcomes and this variable was not included in final models.

Table 3 presents changes in patient-centered outcomes from baseline to endpoint by study group. At endpoint, mean moderate weekly physical activity increased by 191.0 min (95% CI: 127.0, 255.0,  $p<0.001$ ) in the treatment group, whereas among the control group mean moderate weekly physical activity decreased by 22.4 min (95% CI: -86.9, 42.2,  $p=0.493$ ); the adjusted intervention effect was 211.9 (95% CI: 123.5, 300.3,  $p<0.001$ ). At endpoint, recommended weekly physical activity increased 46.7% (95% CI: 33.8, 59.6,  $p<0.001$ ) in the treatment group, whereas among the control group there was no change in recommended weekly physical activity (95% CI: -14.4, 14.4,  $p=1.000$ ); the adjusted intervention effect was 1.6 (95% CI: 1.0, 2.6,  $p=0.060$ ).

At endpoint, mean daily fruit intake increased by 0.2 (95% CI: 0.0, 0.05,  $p=0.094$ ) in the treatment group, whereas among the control group mean daily fruit intake decreased by 0.4 (95% CI: -0.8, 0.0,  $p=0.072$ ); the adjusted intervention effect was 0.6 (95% CI: 0.2, 1.1,  $p=0.003$ ). At endpoint, mean sugar sweetened beverage intake decreased by 0.6 (95% CI: -0.8, -0.4,  $p<0.001$ ) in the treatment group, whereas among the control group mean daily sugar sweetened beverage intake decreased by 0.5 (95% CI: -0.8, -0.2,  $p=0.001$ ); the adjusted intervention effect was -0.1 (95% CI: -0.5, 0.2,  $p=0.561$ ).

At endpoint, the mean of the ARMS Prescription Refill subscale decreased by 1.2 (95% CI: -1.5, -0.8,  $p<0.001$ ) in the treatment group, whereas among the control group the mean of the ARMS Prescription Refill subscale decreased by 0.4 (95% CI: -0.8, 0.0,  $p=0.040$ ); the adjusted intervention effect was -0.7 (95% CI: -1.2, -0.2,  $p=0.008$ ). At endpoint, the mean of the ARMS Medication Taking subscale decreased by 1.4 (95% CI: -2.0, -0.7,  $p<0.001$ ) in the treatment group, whereas among the control group the mean of the ARMS Medication Taking subscale decreased by 0.4 (95% CI: -1.0, 0.2,  $p=0.151$ ); the adjusted intervention effect was -1.0 (95% CI: -1.9, -0.1,  $p=0.025$ ).

At endpoint, checking feet daily increased 23.1% (95% CI: 10.3, 35.9,  $p<0.001$ ) in the treatment group, whereas among the control group checking feet daily increased 11.2% (95% CI: -1.4, 23.8,  $p=0.722$ ); the adjusted intervention effect was 1.2 (95% CI: 0.7, 2.1,  $p=0.541$ ). At endpoint, managing diabetes with diet control increased 25.0% (95% CI: 12.2, 37.8,  $p<0.001$ ) in the treatment group, whereas among the control group managing diabetes with diet control increased 5.4% (95% CI: -9.0, 19.8,  $p=0.171$ ); the adjusted intervention effect was 1.8 (95% CI: 1.1, 2.8,  $p=0.018$ ). At endpoint, managing diabetes with physical activity increased 34.8% (95% CI: 21.3, 48.5,  $p=0.003$ ) in the treatment group, whereas among the control group managing diabetes with physical activity increased 5.5% (95% CI: -8.9, 19.9,  $p=0.345$ ); the adjusted intervention effect was 1.6 (95% CI: 1.0, 2.5,  $p=0.055$ ). At endpoint, managing diabetes with medication or insulin decreased 3.3% (95% CI: -16.7, 10.1,  $p=0.167$ ) in the treatment group, whereas among the control group managing diabetes with medication or insulin increased 5.4% (95% CI: -16.7, 10.1,  $p=0.167$ ).

**Table 3** Changes in Patient-Centered Outcomes of Study Participants from Baseline to Study Endpoint

	Intervention Group					Control Group					Intervention Effect—Adjusted <sup>a</sup>	p-value
	n	Baseline, mean (SD)	Endpoint, mean (SD)	Change	p-value	n	Baseline, mean (SD)	Endpoint, mean (SD)	Change	p-value		
Physical activity												
Moderate weekly activity, minutes	90	123.8 (226.6)	314.8 (281.1)	191.0 (127.0, 255.0)	<0.001	89	173.9 (270.0)	151.6 (218.4)	-22.4 (-86.9, 42.2)	0.493	211.9 (123.5, 300.3)	<0.001
Vigorous weekly activity, minutes	90	3.3 (18.8)	1.3 (8.9)	-2.0 (-6.4, 2.4)	0.370	89	14.9 (62.0)	2.1 (12.5)	-12.8 (-26.2, 0.6)	0.061	9.9 (-3.6, 23.2)	0.150
Total weekly activity, minutes	90	130.5 (232.6)	317.5 (281.3)	187.0 (123.4, 250.6)	<0.001	89	203.7 (309.6)	155.7 (217.6)	-48.0 (-115.1, 19.12)	0.159	232.3 (142.6, 322.0)	<0.001
Recommended weekly PA, n (%)	90	26 (28.9)	68 (75.6)	46.7 (33.8, 59.6)	<0.001	89	35 (39.3)	35 (39.3)	0.0 (-14.4, 14.4)	1.000	1.6 (1.0, 2.6)	0.060
Dietary intake												
Fruit, times per day	92	0.9 (0.8)	1.1 (1.0)	0.2 (0.0, 0.5)	0.094	89	1.1 (1.7)	0.7 (0.7)	-0.4 (-0.8, 0.0)	0.027	0.6 (0.2, 1.1)	0.003
Soda, times per day	92	0.1 (0.2)	0.0 (0.1)	-0.1 (-0.1, 0.0)	<0.001	88	0.1 (0.3)	0.1 (0.1)	0.0 (-0.1, 0.0)	0.167	0.0 (-0.1, 0.0)	0.173
Sugar sweetened beverages, times per day	90	0.9 (1.0)	0.3 (0.5)	-0.6 (-0.8, -0.4)	<0.001	89	1.0 (1.3)	0.5 (0.8)	-0.5 (-0.8, -0.2)	0.001	-0.1 (-0.5, 0.2)	0.561
Fried potatoes, times per day	90	0.2 (0.2)	0.1 (0.1)	-0.1 (-0.2, -0.1)	<0.001	88	0.3 (0.9)	0.2 (0.5)	-0.1 (-0.2, 0.1)	0.484	-0.1 (-0.2, 0.1)	0.504
Potatoes, times per day	88	0.4 (0.5)	0.2 (0.3)	-0.2 (-0.3, -0.1)	<0.001	86	0.3 (0.5)	0.3 (0.3)	-0.1 (-0.2, 0.0)	0.217	-0.1 (-0.3, 0.0)	0.101
Vegetables, times per day	86	1.5 (0.8)	1.6 (1.0)	0.1 (-0.2, 0.4)	0.482	87	1.4 (0.8)	1.4 (1.6)	0.0 (-0.3, 0.4)	0.879	0.1 (-0.3, 0.6)	0.650
ARMS Scales												
Prescription refill (4–16, 16 = worst adherence)	89	5.6 (1.8)	4.5 (1.0)	-1.2 (-1.5, -0.8)	<0.001	91	5.3 (1.7)	4.9 (1.3)	-0.4 (-0.8, 0.0)	0.040	-0.7 (-1.2, -0.2)	0.008
Medication taking (8–32, 32 = worst adherence)	89	10.5 (3.3)	9.2 (1.9)	-1.4 (-2.0, -0.7)	<0.001	90	9.9 (2.9)	9.5 (2.0)	-0.4 (-1.0, 0.2)	0.151	-1.0 (-1.9, -0.1)	0.025
Self-management												
Checks feet every day, n (%)	91	16 (17.6)	37 (40.7)	23.1 (10.3, 35.9)	<0.001	89	17 (19.1)	27 (30.3)	11.2 (-1.4, 23.8)	0.722	1.2 (0.7, 2.1)	0.541
Manages diabetes with medication or insulin, n (%)	92	65 (70.7)	62 (67.4)	-3.3 (-16.7, 10.1)	0.167	91	78 (85.7)	82 (90.1)	4.4 (-5.1, 13.9)	0.754	0.3 (0.2, 0.6)	0.002

Table 3 (continued)

	Intervention Group					Control Group					Intervention Effect—Adjusted <sup>a</sup>	p-value
	n	Baseline, mean (SD)	Endpoint, mean (SD)	Change	p-value	n	Baseline, mean (SD)	Endpoint, mean (SD)	Change	p-value		
Manages diabetes with diet control, n (%)	92	53 (57.6)	76 (82.6)	25.0 (12.2, 37.8)	<0.001	91	54 (59.3)	49 (53.9)	5.4 (-9.0, 19.8)	0.711	1.8 (1.1, 2.8)	0.018
Manages diabetes with physical activity, n (%)	92	36 (39.1)	68 (73.9)	34.8 (21.3, 48.5)	0.003	91	38 (41.8)	43 (47.3)	5.5 (-8.9, 19.9)	0.345	1.6 (1.0, 2.5)	0.055
Diabetes Physician Management												
Times seen by doctor for diabetes in past 12 months	91	2.4 (1.9)	2.8 (1.2)	0.4 (0.0, 0.7)	0.018	91	2.5 (1.7)	2.8 (1.3)	0.4 (0.0, 0.7)	0.029	0.1 (-0.4, 0.5)	0.828
Times A1c checked by doctor in past 12 months	86	2.0 (1.8)	2.5 (1.2)	0.4 (0.1, 0.8)	0.111	89	2.3 (1.4)	2.6 (1.4)	0.3 (0.0, 0.5)	0.892	0.3 (-0.1, 0.8)	0.145
Times feet checked by doctor in past 12 months	85	0.9 (1.4)	1.2 (1.3)	0.3 (-0.1, 0.6)	0.029	89	1.3 (1.6)	1.3 (1.2)	0.0 (-0.3, 0.3)	0.038	0.0 (0.0, 0.0)	1.000
Eyes dilated in past year, n (%)	90	47 (52.2)	57 (63.3)	11.1 (-3.2, 25.4)	0.110	87	46 (52.9)	55 (63.2)	10.3 (-4.0, 25.4)	0.136	1.0 (0.6, 1.5)	0.866
Health												
Self-efficacy, 1–4, 4=highest	91	2.7 (0.9)	2.9 (0.8)	0.1 (0.0, 0.3)	0.009	91	2.9 (0.8)	3.0 (0.8)	0.1 (0.0, 0.2)	0.016	0.0 (-0.1, 0.2)	0.762
PHQ-2 scale	92	1.2 (1.3)	0.4 (0.8)	-0.8 (-1.0, -0.5)	<0.001	91	1.1 (1.6)	0.6 (1.3)	-0.5 (-0.8, -0.1)	0.009	-0.3 (-0.8, 0.1)	0.108
Instrumental support scale	91	4.5 (0.8)	4.3 (0.9)	-0.1 (-0.3, 0.0)	0.041	89	4.5 (0.7)	4.3 (0.9)	-0.2 (-0.4, -0.1)	0.004	0.1 (-0.1, 0.3)	0.538
Days of poor physical health	92	4.8 (8.5)	1.6 (4.1)	-3.2 (-4.9, -1.5)	<0.001	91	3.0 (6.9)	3.4 (7.0)	0.4 (-1.4, 2.2)	0.670	-3.7 (-6.0, -1.3)	0.003
Days of poor mental health	91	4.6 (7.3)	1.8 (4.2)	-2.8 (-4.3, -1.4)	<0.001	90	4.0 (7.4)	3.3 (6.8)	-0.7 (-2.4, 0.9)	0.384	-2.4 (-4.6, -0.2)	0.032

<sup>a</sup>Adjusted for age and gender

-9.0, 19.8,  $p=0.754$ ); the adjusted intervention effect was 0.3 (95% CI: 0.2, 0.6,  $p=0.002$ ).

At endpoint, mean days of poor physical health decreased by -3.2 (95% CI: -4.9, -1.5,  $p<0.001$ ) in the treatment group, whereas among the control group mean days of poor physical health increased by 0.4 (95%: -1.4, 2.2,  $p=0.670$ ); the adjusted intervention effect was

-3.7 (95% CI: -6.0, -1.3,  $p=0.003$ ). At endpoint, mean days of poor mental health decreased by -2.8 (95% CI: -4.3, -1.4,  $p<0.001$ ) in the treatment group, whereas among the control group mean days of poor mental health decreased by -0.7 (95%: -2.4, -0.2,  $p=0.384$ ); the adjusted intervention effect was -2.4 (95% CI: -4.6, -0.2,  $p=0.032$ ).



## DISCUSSION

In this culturally adapted, CHW-led telehealth intervention for South Asians with DMII and uncontrolled HTN, we found the intervention was highly feasible and demonstrated improvements in cardiovascular health. About a third of treatment group participants achieved BP control of < 130/80 mmHg, compared to 16.5% of the control group. The treatment group participants also reported significant, positive changes in several patient-centered outcomes, including medication adherence, engagement in moderate intensity physical activity, and diet control as a part of diabetes management.

Our findings on patient reported outcomes and BP control are consistent with other CHW-led trials for minority patients with diabetes.<sup>26, 27</sup> A recent scoping review of medication adherence strategies for BP control identified four recent studies using trained personnel, such as CHWs and health coaches, demonstrating improved medication adherence and BP reductions among participants.<sup>27</sup> However, these trials were pre-post design and lacked a comparison group, and none included South Asians. A recent CHW-led RCT for South Asians in primary care clinics in New York City, similarly demonstrated significant BP reductions; treatment group participants had 3.7 [95% CI, 2.1–6.5] times the odds of achieving BP control at follow-up compared with the control group.<sup>28</sup> Our study, which also adds a telehealth component, is consistent with these findings.

It was difficult to collect HbA1c measures, especially among the group recruited through the community. However, we were able to collect diabetes medication use via self-report and found that medication and insulin use increased over time among the control group, while the treatment group saw little change. Among individuals completing the follow-up survey in the treatment group, diabetes medication only increased from 59 to 60%, insulin only decreased from 4 to 3%, and both medication and insulin decreased from 8 to 4%. Among individuals completing the follow-up survey in the control group, diabetes medication only increased from 66 to 81%, insulin only increased from 8 to 14%, and both medication and insulin decreased from 12 to 0%. Because this is by self-report, we do not know the reason why medication use changed over time. However, treatment group participants were more likely to self-report using physical activity and diet control to manage their diabetes.

Findings also support that a telehealth platform is feasible and intervention engagement can be achieved with high participant retention. Previous work in Bangladeshi communities has demonstrated that first generation immigrants like those who participated in our intervention, often face signification barriers to accessing health care such as limited English proficiency and difficulties navigating the health system.<sup>29</sup> This community also is at high risk for low digital literacy;<sup>30</sup> however, participants in our study reported that

with support from their CHW, skills were gained in their use of Zoom, communicating with a doctor or other health professional via email or the internet, and using a device such as a computer, smartphone, or tablet. The use of telehealth allowed the CHW team flexibility by offering sessions at multiple times. Participants often stayed after a session to ask questions, and the telehealth format allowed the CHWs and participants to remain in the space. Telehealth also allowed participants to save travel time that would have otherwise been a barrier to offering multiple sessions and would require engagement of family members to transport older participants. This helped maintain high levels of retention in the intervention.<sup>30</sup>

The DREAM Atlanta study adds to the growing body of literature that supports to use of CHWs to provide linguistically and culturally tailored chronic disease management education. Moreover, this study addresses the comorbid burden of DMII and HTN, thus addressing multiple CVD risk factors as advised by most expert organizations, including the American Heart Association and the American Diabetes Association.<sup>14, 31</sup> Our study also demonstrates that telehealth models are feasible and may improve the reach and retention of programs by addressing known barriers in immigrant communities like transportation and irregular schedules.

Our study has several limitations of note. First, because the intervention occurred during the COVID-19 pandemic, there was incomplete follow-up data for face-to-face clinical outcomes, namely HbA1c and lipids; HbA1c was collected for a small group, but lipids could not be obtained. Second, randomization was conducted by age, sex, and CHW placement, but no other factors; however, no significant differences by intervention group were noted for clinical measures at baseline. Third, family members were included in the study, and participation in the intervention with family may be a motivating factor and influence study outcomes. Fourth, many measures were collected by self-report; for BP and weight, accuracy was enhanced by providing a standardized scales and BP monitors and obtaining measurements while video conferencing with the CHW. However, only one BP reading was taken by participants at baseline and end of study. Validated scales were used for diet and physical activity, similar to previous studies.<sup>32</sup> Fifth, hypertension medication data was not collected, which may be associated with BP control. Sixth, a majority of study participants were of Bangladeshi origin, thus the results may not be generalizable to all South Asians. Lastly, the follow-up time period was short, limited to six months. Thus, the extent to which findings are sustained over extended periods of time is unknown. However, this is consistent with most published literature of diabetes group visits.<sup>33</sup>

DREAM Atlanta demonstrates the feasibility and efficacy of a CHW model to deliver a telehealth lifestyle intervention to address DMII and BP control among South Asians. CHWs in our study were uniquely well-qualified to address

cultural, linguistic, and digital barriers to care for South Asians. Moreover, the telehealth model played a key role in the reach and retention of the intervention. Future studies are warranted to evaluate the implementation of CHW-led telehealth models, with longer follow up periods to assess sustainability.

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**Data Availability** The data sets generated and analyzed during this study will be available from the corresponding author on reasonable request.

## Declarations

**Conflict of Interest** The authors declare that they do not have a conflict of interest.

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