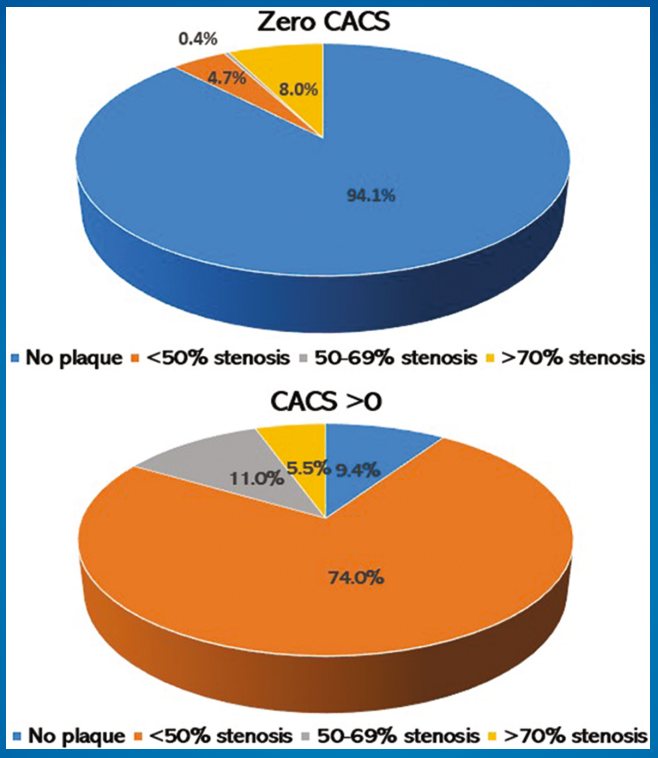
ISSN 2250-3528

Journal of Clinical and Preventive Cardiology

Full text online at www.jcpconline.org

Volume 11 • Issue 2 • April-June 2022



See pages 44-49

Contents :

EDITOR'S PAGE

Editor's Page April 2022.....29

ORIGINAL ARTICLES

Impact of COVID-19 Pandemic Induced Lockdown on Management of Myocardial Infarction: An Indian Survey Report from the Experiences by 1083 Cardiologists.....30

Effectiveness of a Home-Based Cardiovascular Disease Prevention Program during the COVID-19 Pandemic.....37

Diagnostic Accuracy of Coronary Artery Calcium Score for Excluding Obstructive Coronary Artery Disease.....44

Evaluation of Clinical and Biochemical Parameters of Trinidadian Patients with Coronary Artery Disease for Predicting the Revascularization Strategy.....50

CASE REPORT

Moderator Band Calcification Masquerading Infrahisian Conduction System Disease.....56

Left Atrial Myxoma in a Patient with Hypertrophic Obstructive Cardiomyopathy.....60

Academic Partner : South Asian Society of Atherosclerosis and Thrombosis

Wolters Kluwer

Medknow

Original Article

Effectiveness of a Home-Based Cardiovascular Disease Prevention Program during the COVID-19 Pandemic

Priya Chockalingam[1], PhD; Vaishnav Natarajan[1], MPT; Tharani Sekar[1], MSc; Rajaram Anantharaman[2], FRCP; Meeranghani Mohamed Yusuf[3], FRCS; Sengottuvelu Gunasekaran[3], FRCP; Pradeep G. Nayar[4], FACC; V. Chockalingam[5], FACC

[1]Department of Preventive Cardiology, Cardiac Wellness Institute, [2]Department of Cardiology, ACCiST Centre, Kauvery Hospital, [3]Department of Cardiothoracic Surgery, Apollo Main Hospitals, [4]Department of Cardiology, Fortis Malar Hospital, [5]Department of Cardiology, Dr. MGR Medical University, Chennai, Tamil Nadu, India

Abstract

Purpose: Home-based cardiovascular disease (CVD) primary prevention (HBPP) and cardiac rehabilitation (HBCR) programs which occupied a small proportion of the overall Preventive Cardiology work in the past have become mainstream during the COVID-19 pandemic. This study aims to analyze the effectiveness of a home-based CVD prevention program implemented during the pandemic in India. **Methods:** A retrospective study was conducted on prepandemic and pandemic enrollees. Health behavior, CVD risk factors, physical and mental component score (PCS, MCS) from SF-12 questionnaire, body mass index (BMI), 6-min walk distance (6MWD), and clinical and biochemical parameters were assessed. A multidisciplinary team consisting of Physician, Physiotherapist, Dietician, and Counseling Psychologist provided the program using telehealth platforms. **Results:** Of the 66 subjects (55 ± 13 years, 73% male), 17 (26%) enrolled prepandemic and 49 (74%) enrolled during pandemic, 28 (42%) were HBPP, and 38 (58%) were HBCR participants. Majority of the subjects (n = 51, 77%) with significantly more HBCR than HBPP participants harbored 4 or more risk factors (P = 0.04). In the 60 (91%) program completers, BMI, 6MWD, PCS, and MCS had improved significantly. Systolic blood pressure, diastolic blood pressure, left ventricular ejection fraction, glycosylated hemoglobin, total cholesterol, and low-density lipoproteins had improved significantly in affected subjects. Completely home-based participants (n = 44, 67%) who never had any in-person contact with the team during the program also showed significant improvement. No adverse events were reported. **Conclusions:** Comprehensive home-based CVD prevention programs are effective in improving anthropometric, clinical, biochemical, and psychosocial parameters, are a safe alternative to conventional programs, and could potentially become the standard-of-care in the postpandemic era.

Keywords: *Cardiac rehabilitation, cardiovascular diseases, primary prevention, risk factors for cardiovascular diseases, telerehabilitation*

Received: 27-10-2021
Accepted: 09-12-2021
Published: 24-06-2022

Funding Sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

The field of Preventive Cardiology encompasses the cumulative efforts at reducing the cardiovascular disease (CVD) burden through primordial, primary, secondary, and tertiary prevention programs. A multidisciplinary team approach that focuses on public awareness, patient education, health behavior modification, and exercise training is at the core of Preventive Cardiology work globally.[1] While conventional primary and secondary prevention programs consist of center-based, in-person sessions for at-risk individuals and patients, the COVID-19 pandemic has catapulted the need for adopting alternative models of care such as home-based programs.[2]

Access this article online

Quick Response Code:

Website: www.jcpconline.org

DOI: 10.4103/jcpc.jcpc_53_21

Comprehensive home-based primary prevention (HBPP) and secondary prevention or home-based cardiac rehabilitation (HBCR) programs delivered using telehealth platforms have been proven effective in improving clinical and health-related quality of life (HRQoL) outcomes in participants.[3,4] HBCR had previously been deemed a reasonable option for selected clinically stable low to moderate risk patients eligible for cardiac rehab but unable to attend a center-based program.[5] However, completely

Address for correspondence: Dr. Priya Chockalingam, MBBS, MRCPCH, PhD, Cardiac Wellness Institute, No. 21, 5th Avenue, Besant Nagar, Chennai - 600 090, Tamil Nadu, India.
E-mail: priya.chockalingam@gmail.com

How to cite this article: Chockalingam P, Natarajan V, Sekar T, Anantharaman R, Yusuf MM, Gunasekaran S, *et al.* Effectiveness of a home-based cardiovascular disease prevention program during the COVID-19 pandemic. J Clin Prev Cardiol 2022;11:37-43.

home-based (CHB) programs were in a stage of infancy before the pandemic.

In the face of the pandemic-led unprecedented closure of rehab centers, home-based programs have become pivotal in maintaining continuity in cardiovascular risk mitigation efforts across the globe.[6-11] Having developed a working multidisciplinary model for the prevention of CVD in India and despite being a predominantly center-based service in the prepandemic period,[12,13] our unit successfully rolled out a CHB telehealth program with the start of the government enforced lockdown in March 2020. The aim of this study is to analyze the effectiveness of a home-based CVD prevention program implemented during the COVID-19 pandemic in India.

Methods

Subjects

All patients who had participated in the HBPP and HBCR programs provided by our team from November 2016 to March 2020 (prepandemic period) and from April 2020 to July 2021 (pandemic period) were included in this retrospective study. HBPP was provided for individuals with one or more cardiovascular risk factors but without an established cardiac diagnosis. HBCR was provided for cardiac patients. High-risk patients, such as those with uncontrolled heart failure, unstable angina, or critical coronary occlusions awaiting revascularization, were not offered HBCR but were advised to consult their cardiologist for optimization of medical management and/or revascularization. The procedures followed were in accordance with the ethical standards of the Indian Council of Medical Research and with the Declaration of Helsinki. Written informed consent was obtained from all patients at the time of enrolment. Ethical committee approval was not sought due to the retrospective nature of the study.

Evaluation and outcomes

Intake evaluation consisted of an in-person or telephone/video consultation with the physician and review of medical records, followed by risk-stratification, documentation of demographic details, health behavior assessment using an internally validated questionnaire, HRQoL assessment using the physical component score (PCS), and mental component score (MCS) derived from the SF-12 questionnaire, nutritional assessment using 24-h diet recall and body mass index (BMI), and functional capacity assessment using the 6-min walk distance (6MWD) derived from the 6-min walk test (6MWT) or the number of steps from the 2-min step test (2MST).

CVD risk factors were assessed at the time of intake evaluation as follows: previously diagnosed with Type 2 diabetes mellitus (T2DM) or newly diagnosed with (pre) T2DM, hypertension and hypercholesterolemia, overweight and obesity (BMI ≥25 kg/m^2), inadequate exercise (<150 min/week of aerobic exercise), inadequate fiber intake (<400 g/day of fruit and vegetable consumption and noninclusion of whole-grain products everyday), tobacco use (ex-or current-user of any form of tobacco), alcohol use (binge or habitual consumption of alcohol, or occasional use of small amounts of alcohol), and presence of psychosocial factors (self-reported chronic stress, anxiety or depression). Verbal questioning and questionnaires were used to assess health behavior. Goal setting was used to help patients achieve the desired health behavior.

Vitals such as heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP) were documented in patients who came for in-person sessions or had a home monitor. All HBCR participants and HBPP participants with known hypertension were recommended to possess a home BP monitor before commencing the program. Individuals with resting SBP ≥140 mmHg and/or DBP ≥90 mmHg at intake evaluation were monitored closely during the sessions and medication modified if necessary. Patients with a left ventricular ejection fraction (LVEF) ≤40% and LVEF 41%–49% termed as heart failure with reduced ejection fraction (HFrEF) and heart failure with mid-range ejection fraction (HFmEF), respectively were monitored closely for heart failure symptoms, were provided special education and counseling pertaining to heart failure, and were followed-up for postprogram repeat echocardiogram if available.

The 6MWT was conducted remotely after providing the participants relevant information about the test and giving them sufficient time to pick a suitable test space in their house. All assessments were repeated at the end of the stipulated program and at regular intervals thereafter if they re-enrolled for the maintenance program.

Program outcomes were analyzed in all program completers. In addition, changes in SBP, DBP, and LVEF were documented in those with hypertension and heart failure at enrolment, respectively. Changes in fasting blood sugar (FBS) and glycosylated hemoglobin (HbA1c), and total cholesterol (TC), low-density lipoproteins (LDL), and triglycerides (TGL) were documented in subjects with T2DM and dyslipidemia, respectively. While all participants were advised to repeat their relevant investigations postprogram, it was not easily executable given the pandemic situation.

Intervention

Before the pandemic, a CHB program was provided only to participants residing outside Chennai or overseas. A partially home-based (PHB) program with some in-person and some telehealth sessions was provided to participants living in other parts of India and willing to visit us a few times during the program. Each in-person session lasted about 60–90 min as it included an exercise and an education/counseling component and each telehealth session lasted about 30–45 min, as it was either an exercise or an education/counseling session. All telehealth sessions were provided using online communication platforms such as Google Meet/WhatsApp/Zoom or through telephone. Educational materials including demonstration videos were shared through E-mail and WhatsApp.

A multidisciplinary health-care team consisting of a Physician, Physiotherapist, Dietician, and Counseling Psychologist provided 1–2 sessions per week. The core components of the program were exercise training, nutritional counseling, goal-setting to promote behavior modification, psychosocial counseling, and education about relevant topics such as risk

factors, medication adherence, resuming normal activities, and returning to work. The education/counseling sessions were small group sessions with an audiovisual presentation followed by interaction. Family members of participants were encouraged to attend all sessions, particularly the education/counseling sessions.

The Physiotherapist virtually demonstrated and the participant performed the exercises. The exercise prescription included nonequipment based exercises such as terrace or indoor walking, stair climbing, spot marching, modified squats, modified lunges and wall pushups. Resistance training with dumbbells (1 kg or 2 kg) or water bottles (0.5 or 1 l), and abdominal and core muscle strengthening exercises such as normal curls, side curls, alternate leg raise, modified prone and side planks, and pelvic bridging was also included. Special attention was paid to the posture and breathing pattern during exercise. All participants were advised to monitor their rate of perceived exertion using Borg scale and for any exercise-related symptoms. Participants with a home monitor were instructed to document their heart rate and blood pressure before and after exercise on a periodic basis.

Upon completion of the intensive program, patients were provided with a program summary, requested to fill a feedback form, and encouraged to re-enroll in a maintenance program with fortnightly or monthly follow-up sessions as appropriate. Referring physicians were able to track their patients' progress in real-time during the program through an interactive online tracker. All information pertaining to their sessions, complaints if any and adherence in terms of exercise performance and dietary intake on the non-session days were documented in this tracker.

Statistics

Categorical data are expressed as numbers (n) and percentages (%) and continuous data as mean and standard deviation. Data were tested for normality and parametric and nonparametric statistics applied accordingly. Chi-square and unpaired *t*-test or Mann–Whitney test were used to compare categorical and continuous variables of the HBPP and HBCR groups at baseline, respectively. Baseline and end-of-program characteristics were compared using paired *t*-test or Wilcoxon signed-rank test for normally distributed and non-normally distributed data, respectively. A $P < 0.05$ was considered significant.

Results

Of the 66 subjects included in the study, 10 (15%) had completed the program in the prepandemic period, 7 (11%) had enrolled in the prepandemic period and continued into the pandemic period, and 49 (74%) had enrolled in the pandemic period. Five (8%) subjects had contracted COVID-19 infection before enrolling; 4 (6%) had been infected after completion of program and had recovered.

The age of the study subjects was 55 ± 13 years (range 35–83 years) and 48 (73%) were male; 28 (42%) were enrolled in the HBPP program and 38 (58%) in the HBCR program. Table 1 provides the baseline characteristics of the subjects. There were significantly more males, smokers, and occasional alcohol users in the HBCR group; all other parameters were comparable. All individuals who had a history of smoking reported having quit in the past or at the time of being diagnosed with CVD. However, they were educated about the role of smoking in the causation of CVD and counseled about the importance of complete and total smoking cessation.

Figure 1 shows the geographic distribution of the participants. While the majority was from Tamil Nadu, participants also hailed from Pondicherry, Karnataka, West Bengal, and Uttar Pradesh. Overseas participants were from Singapore, Kuwait, Germany, and Canada. All subjects were Indians. Of the 5 couples that had enrolled, 3 couples were in the HBPP program and 2 couples were split between the programs with the wife in the HBPP and the husband in the HBCR program. Forty (61%) subjects were employed or were managing their own business at the time of enrolment; the others were retired or were homemakers. Return to work counseling, with a special focus on maintaining physical and mental wellbeing during work from home, was provided when applicable.

Figure 2 depicts the proportion of subjects with multiple CVD risk factors. Majority of the subjects (n = 51, 77%), with significantly more HBCR participants than HBPP participants, harbored 4 or more risk factors (P = 0.04).

The underlying diagnosis in the HBCR group was coronary artery disease in 36 (95%) subjects of which 19 (53%) had presented with acute coronary syndrome (ACS) in the pandemic period. Hypertrophic cardiomyopathy and dilated cardiomyopathy were present in 1 (2.5%) subject each. All subjects in the HBCR group were receiving optimal medical therapy and had good medication adherence. Figure 3 shows the distribution of coronary revascularization procedures performed before and during the pandemic.

The total number of sessions attended was 13 (interquartile range [IQR]: 10–24) sessions over a period of 3.3 (IQR 2.5–4.6) months. The HBCR participants attended significantly more sessions (18.5, IQR 8–24) than the HBPP participants (12, IQR 8–13.5, P = 0.0005). Family member

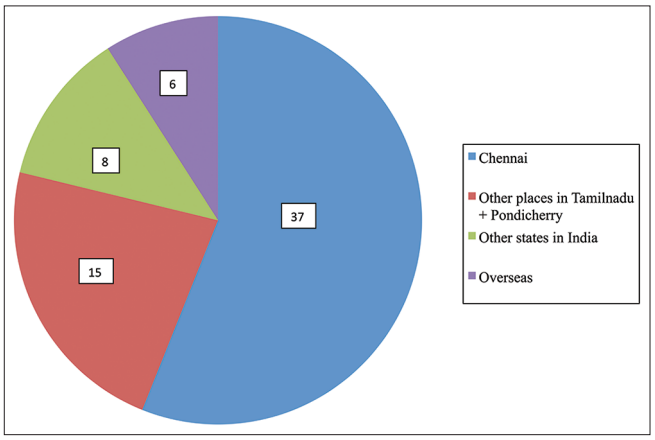


Figure 1: Geographic distribution of participants

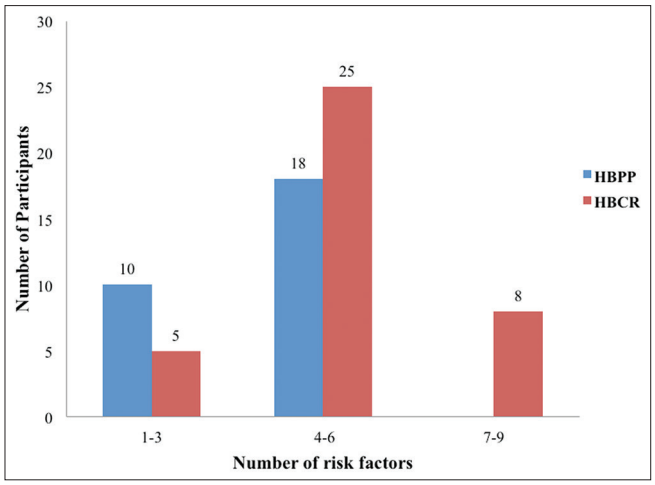


Figure 2: Proportion of participants with multiple cardiovascular disease risk factors

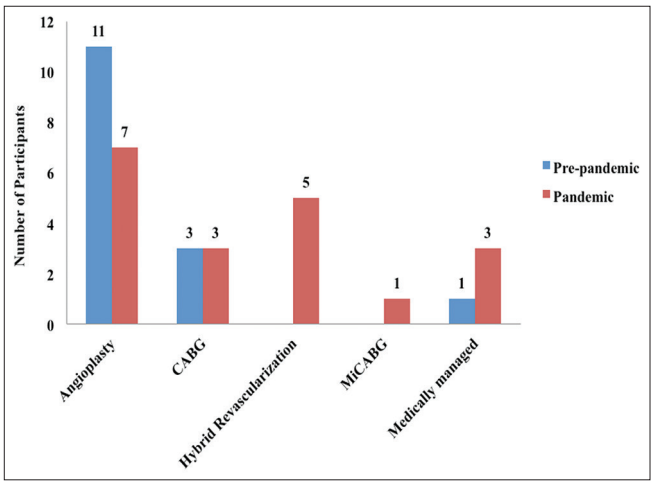


Figure 3: Management of acute coronary syndrome prepandemic and during the pandemic CABG – coronary artery bypass graft; MiCABG – minimally invasive coronary artery bypass graft

participation was significantly higher in the HBCR than in the HBPP group (92% vs. 11%, $P = 0.0001$). Sixty subjects (91%) completed their intensive home-based program in the stipulated time. Two (3%) subjects had been advised by their treating physician to withhold their exercise sessions in the middle of the program; one of them had persisting mild anterior chest wall pain unrelated to exercise 3 months after open-heart coronary artery bypass graft surgery with all investigations being normal; the other patient experienced occasional palpitations while exercising 3 months after his COVID-19 infection and his 24-h Holter and other investigations were unremarkable; both patients had completed their mid-program evaluation, were attending education/counseling sessions as planned and were included in the outcome analysis. Four (6%) subjects, 2 each in the HBPP and HBCR groups, dropped out of the program due to a noncardiac illness in the participant ($n = 1$) or family member ($n = 1$), demanding work schedule ($n = 1$) and unknown reason ($n = 1$).

Health behavior in terms of fiber intake, avoidance of unhealthy foods and inclusion of healthy foods, and adherence to exercise and stress management techniques had improved in all subjects. Table 2 shows the outcomes in subjects who had pre and post program values. BMI and 6MWD had improved significantly in all subjects and in the HBPP and HBCR groups. PCS and MCS had improved significantly in all subjects and in the HBCR group. SBP and DBP had improved significantly in subjects with resting BP ≥140/90 mmHg. LVEF had improved significantly in subjects with HFrEF and HFmEF. HbA1c had improved significantly in those with (pre) T2DM while FBS had improved non-significantly from 115 to 104 mg/dl. The group ($n = 22$) with newly diagnosed (pre) T2DM showed improved blood sugar control after the program and were reassured that antidiabetic drugs will not be needed if they continued to adhere to the lifestyle changes. Subjects with hypercholesterolemia showed significant improvement in their TC and LDL levels and a non-significant reduction in their TGL levels.

CHB and PHB programs were provided to 44 (67%) and 22 (33%) subjects, respectively. Table 3 shows that there was a significant improvement in BMI, 6MWD, and PCS in both subgroups while MCS improved significantly in the CHB subgroup.

Fifteen (25%) subjects re-enrolled in the maintenance program with more HBCR ($n = 12$, 32%) than HBPP ($n = 3$, 11%) participants re-enrolling. Participants attended a median of 9 (IQR 3–13) sessions over a period of 6.8 (IQR 3.8–17.5) months in the maintenance program, and 11 (73%) subjects were still in the maintenance program at the time of study submission.

No adverse events were reported. Participants' feedback on the program was uniformly positive. The referring physicians were satisfied with the continuity of communication maintained by the rehab team and they found it useful that they were able to track their patients' progress in real-time using the online tracker.

Discussion

To the best of our knowledge, this is the first study to report the effectiveness of comprehensive home-based CVD primary prevention and cardiac rehabilitation programs during the COVID-19 pandemic. With ~75% of all cardiac rehab services being suspended globally during the pandemic and the remaining adopting technology-based solutions to provide services, we have successfully adopted a telehealth platform to continue serving the CVD patients and the at-risk population.[14] The fact that our home-based program has significantly improved anthropometric, functional, psychosocial, and clinical outcomes underscores the importance of such services and puts it on par with conventional center-based programs in the management of CVD.

A recent randomized controlled trial by Pogosova *et al*. has shown that the addition of telehealth strategies using remote support by phone calls over a period of 3 months resulted in small but significant improvements in cardiovascular risk factors, body composition, anxiety, and depression in

Table 1: Baseline characteristics of the subjects

Variable	All subjects (*n*=66)	HBPP (*n*=28)	HBCR (*n*=38)	*P*
Demographic details				
Age, year[a]	55±13	54±12	56±14	0.5488
Male[b]	48 (73)	14 (50)	34 (92)	0.0010
Residing outside Chennai[b]	29 (44)	13 (46)	16 (42)	0.5481
CVD risk profile				
Hypertension[b]	38 (58)	15 (53)	23 (61)	0.7542
Known diabetes[b]	24 (36)	11 (17)	13 (20)	0.8692
Newly diagnosed (pre) diabetes[b]	22 (33)	6 (9)	16 (24)	0.1344
Hypercholesterolemia[b]	40 (62)	19 (66)	21 (55)	0.4354
Overweight/obesity[b]	40 (61)	19 (66)	21 (57)	0.4354
Tobacco use[b]	15 (23)	0	15 (42)	0.0005
Alcohol use[b,c]	17 (25)	2 (5)	15 (42)	0.0073
Inadequate exercise[b]	50 (75)	21 (73)	29 (78)	0.9019
Inadequate fiber intake[b]	64 (98)	27 (96)	37 (97)	0.8772
Psychosocial risk[b]	55 (83)	22 (78)	33 (87)	0.5776
Comorbid conditions				
Depression[b]	2 (3)	1 (4)	1 (3)	1
Sleep apnea[b]	2 (3)	2 (7)	0	0.1762
Heart failure[b]	12	0	12 (32)	0.003
On medication[b]	55 (83)	17 (61)	38 (100)	0.0001
Clinical profile				
BMI, kg/m^2[a]	26±6	28±7	25±4	0.0767
Heart rate, bpm[a]	77±16 (*n*=55)	78±16 (*n*=17)	76±16	0.6701
SBP, mmHg[a]	123±15 (*n*=55)	122±16 (*n*=17)	124±15	0.6562
DBP, mmHg[a]	77±8 (*n*=55)	77±7 (*n*=17)	77±10	1.0000
6MWD, meters[a]	398±86 (*n*=52)	416±91 (*n*=16)	391±88 (*n*=36)	0.3539
2MST steps, n[a]	66±16 (*n*=12)	66±16 (*n*=12)	NA	NA
HRQoL				
SF-12 PCS[a]	41±10 (*n*=64)	44±10 (*n*=27)	38±11 (*n*=37)	0.1175
SF-12 MCS[a]	48±11 (*n*=64)	49±11 (*n*=27)	48±11 (*n*=37)	0.4503

[a]Mean±SD, [b]*n* (%), [c]Occasional use of alcohol. 2MST=2 min step test, 6MWD=6 min walk distance, BMI=Body mass index, CVD=Cardiovascular disease, DBP=Diastolic blood pressure, HBCR=Home-based cardiac rehabilitation, HBPP=Home-based prevention program, HRQoL=Health-related quality of life, MCS=Mental component score, NA=Not applicable, PCS=Physical component score, SBP=Systolic blood pressure, SD=Standard deviation

patients at high and very high cardiovascular risk.[3] A recent review by Battineni *et al*.[15] including 19 telemedicine programs from developed countries has shown that such programs lead to significant improvement in the prevention of dyslipidemia, hypertension, and obesity among patients at high risk for CVD, are effective in promoting a healthy lifestyle to reduce cardiovascular risk, significantly reduce cardiac-related emergency department visits in patients after ACS, help in monitoring and following up patients with heart failure to reduce re-hospitalization and mortality rate and improve medication adherence, and are effective in reducing the recurring healthcare costs of cardiac patients. The present study, being comprehensive in nature and providing all the core components of conventional CVD prevention programs, has shown improvement in health behavior as well as in hypertension, T2DM, and lipid management in patients with high cardiovascular risk.

The management choices for patients presenting with ACS during the pandemic reflected the need for balancing appropriate revascularization with minimal hospital stay. In heart failure patients, Nakayama *et al*. have shown that remote cardiac rehabilitation was effective in reducing the emergency readmission rate and in improving HRQoL during the pandemic in Japan.[9] While the TELEREH-HF study had shown improvements in functional and quality-of-life outcomes after 9 weeks of hybrid comprehensive telerehabilitation,[16] an earlier meta-analysis had shown that moderate-intensity continuous exercise training significantly increased LVEF in HFrEF patients.[17] Our program had also shown significant improvement in LVEF in HFrEF and HFmEF patients.

The recent call for action paper by Scherrenberg *et al*. has provided an overview of comprehensive telerehabilitation interventions in EAPC accredited cardiac rehab centers during the pandemic.[18] It is interesting to note that several interventions included in their recommendation such as patient assessment, remote 6MWT, goal-setting, psychosocial counseling and stress management training, educational audiovisual presentations using video conferencing facility, nutritional counseling

Table 2: Outcomes in subjects who completed the program

	All subjects (*n*=66)			HBPP (*n*=28)			HBCR (*n*=38)		
	Pre	Post	*P*	Pre	Post	*P*	Pre	Post	*P*
BMI, kg/m^2 [a]	26.3±6	25.7±5	0.0002*	27.7±7	26.9±7	0.0044* (*n*=22)	25.3±4	24.7±4	0.0036* (*n*=35)
HR, bpm[a]	74±12	76±12	0.5357 (*n*=45)	76±11	80±16	0.5209 (*n*=14)	75±16	74±10	0.7121 (*n*=33)
SBP, mmHg[a]	123±14	125±16	0.6695 (*n*=45)	120±13	115±10	0.2719 (*n*=14)	125±15	122±16	0.4171 (*n*=33)
DBP, mmHg[a]	78±9	75±9	0.1812 (*n*=45)	77±7	76±9	0.7697 (*n*=14)	77±10	74±10	0.1520 (*n*=33)
6MWD, meters [a]	406±82	486±82	<0.0001* (*n*=47)	427±89	490±85	0.0005* (*n*=14)	394±91	475±84	0.0003* (*n*=33)
2MST[#], steps[a]	66±16	64±12	0.7314 (*n*=6)	67±11	68±6	0.8868 (*n*=5)	NA	NA	NA
PCS[a]	40±11	48±8	0.0001* (*n*=34)	42±11	49±5	0.0692 (*n*=12)	38±11	47±8	0.0037* (*n*=22)
MCS[a]	51±9	55±6	0.0177* (*n*=34)	50±9	55±6	0.1775 (*n*=12)	51±10	55±7	0.0358* (*n*=22)
Subjects with BP ≥140/90 mmHg (n=9)									
SBP, mmHg[a]	141±10	126±9	0.0038* (*n*=8)						
DBP, mmHg[a]	85±9	75±8	0.0014* (*n*=8)						
Subjects with T2DM (n=46)									
FBS, mg/dl, median (IQR)	115 (98-186)	104 (96-132)	0.08 (*n*=19)						
HbA1c, %, median (IQR)	6.8 (6-8.1)	6.5 (5.8-7.3)	0.0019* (*n*=19)						
Subjects with hypercholesterolemia (n=40)									
TC, mg/dL[a]	172±61	137±35	0.0195* (*n*=19)						
LDL, mg/dL[a]	103±47	76±33	0.0308* (*n*=19)						
TGL, mg/dL[a]	157±63	134±66	0.0894 (*n*=19)						
Subjects with HFrEF and HFmEF (n=12)									
LVEF, %[a]	40±7	54±11	0.0165* (*n*=9)						

[a]Mean±SD, *P<0.05, [#]2MST was performed in 1 HBCR participant as she did not possess a home BP monitor, 2MST - 2 minute step test, 6MWD - 6 minute walk distance, BMI - body mass index, BP - blood pressure, DBP - Diastolic blood pressure, FBS - Fasting blood sugar, HbA1c - Glycated hemoglobin, HBCR - Home-based cardiac rehabilitation, HBPP - Home-based prevention program, HFmEF - Heart failure with mid range ejection fraction, HFrEF - Heart failure with reduced ejection fraction, HR - Heart rate, LDL - Low density lipoprotein, LVEF - Left ventricular ejection fraction, MCS - Mental component summary, NA - not applicable, PCS - Physical component summary, SBP - Systolic blood pressure, T2DM - Type 2 diabetes mellitus, TC - Total Cholesterol, TGL - Triglycerides

Table 3: Outcomes of interest in subjects attending the completely home-based and partially home-based programs

	CHB (*n*=44)			PHB (*n*=22)		
	Pre	Post	*P*	Pre	Post	*P*
BMI, kg/m^2[a]	24.8±5	24.3±5	0.0095* (*n*=37)	28.9±5	28.0±5	0.0005* (*n*=19)
6MWD, meters[a]	400±105	481±97	0.0001* (*n*=29)	410±53	477±54	<0.0001* (*n*=18)
PCS[a]	42±12	49±7	0.0018* (*n*=22)	36±9	46±8	0.0127* (*n*=12)
MCS[a]	50±10	55±7	0.0267* (*n*=22)	50±7	53±4	0.1996 (*n*=12)

[a]Mean±SD, *P<0.05, 6MWD - 6 minute walk distance, BMI - Body mass index, CHB - Completely home-based, MCS - Mental component score, PCS - Physical component score, PHB - Partially home-based

and weight management, smoking cessation, and return to work counseling and guideline-directed medical therapy in coordination with the treating physician were all featured in our home-based program despite this being a developing country and a low-resource setting. Significant improvement in both the physical and mental component scores in our study population is a clear indicator of better HRQoL achieved with the home-based program in spite of the enormous psychosocial impact of the prevailing pandemic situation on the participants.

The main limitations of the present study are the small sample size and the lack of complete data, being attributable to the low referral rates and the pandemic-related poor accessibility to laboratory services, respectively. However, this is a first of its kind study from India showing promising outcomes in the prevention of CVD and with a potential to be utilized in the postpandemic period as well. Large multicenter studies have to be undertaken to better understand the uptake and the cost-effectiveness of such programs in developing countries.

Conclusions

Comprehensive home-based telehealth programs are an effective and safe alternative to conventional CVD prevention and rehabilitation programs during the pandemic. There is potential to expand these services post-pandemic to all patients

and thereby improve the reach of such multidisciplinary programs to positively impact the growing mortality and morbidity due to CVD globally.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Shapiro MD, Fazio S. Preventive cardiology as a dedicated clinical service: The past, the present, and the (Magnificent) future. Am J Prev Cardiol 2020;1:100011.
2. Clark RA, Conway A, Poulsen V, Keech W, Tirimacco R, Tideman P. Alternative models of cardiac rehabilitation: A systematic review. Eur J Prev Cardiol 2015;22:35-74.
3. Pogosova N, Yufereva Y, Sokolova O, Yusubova A, Suvorov A, Saner H. Telemedicine intervention to improve long-term risk factor control and body composition in persons with high cardiovascular risk: Results from a randomized trial: Telehealth strategies may offer an advantage over standard institutional based interventions for improvement of cardiovascular risk in high-risk patients long-term. Glob Heart 2021;16:21.
4. Anderson L, Sharp GA, Norton RJ, Dalal H, Dean SG, Jolly K, *et al.* Home-based versus centre-based cardiac rehabilitation. Cochrane Database Syst Rev 2017;6:CD007130.
5. Thomas RJ, Beatty AL, Beckie TM, Brewer LC, Brown TM, Forman DE, *et al*. Home-Based Cardiac Rehabilitation: A Scientific Statement From the American Association of Cardiovascular and Pulmonary Rehabilitation, the American Heart Association, and the American College of Cardiology. Circulation. 2019;140:e69-e89..
6. Duffy EY, Cainzos-Achirica M, Michos ED. Primary and secondary prevention of cardiovascular disease in the era of the coronavirus pandemic. Circulation 2020;141:1943-5.
7. Vishwanath V, Beckman AL, Kazi DS. Reimagining cardiac rehabilitation in the era of coronavirus disease 2019. JAMA Health Forum 2020;1:e201346.
8. Babu AS, Arena R, Ozemek C, Lavie CJ. COVID-19: A time for alternate models in cardiac rehabilitation to take centre stage. Can J Cardiol 2020;36:792-4.
9. Nakayama A, Takayama N, Kobayashi M, Hyodo K, Maeshima N, Takayuki F, *et al.* Remote cardiac rehabilitation is a good alternative of outpatient cardiac rehabilitation in the COVID-19 era. Environ Health Prev Med 2020;25:48.
10. O'Doherty AF, Humphreys H, Dawkes S, Cowie A, Hinton S, Brubaker PH, *et al.* How has technology been used to deliver cardiac rehabilitation during the COVID-19 pandemic? An international cross-sectional survey of healthcare professionals conducted by the BACPR. BMJ Open 2021;11:e046051.
11. Moulson N, Bewick D, Selway T, Harris J, Suskin N, Oh P, *et al.* Cardiac rehabilitation during the COVID-19 Era: Guidance on implementing virtual care. Can J Cardiol 2020;36:1317-21.
12. Chockalingam P, Sakthi Vinayagam N, Ezhil Vani N, Chockalingam V. Outcomes of a multidisciplinary coronary heart disease prevention programme in southern India. Heart Asia 2016;8:39-44.
13. Chockalingam P, Rajaram A, Maiya A, Contractor A. A multicentre retrospective study on quality and outcomes of cardiac rehabilitation programs in India. Indian Heart J 2020;72:55-7.
14. Ghisi GL, Xu Z, Liu X, Mola A, Gallagher R, Babu AS, *et al.* Impacts of the COVID-19 pandemic on cardiac rehabilitation delivery around the world. Glob Heart 2021;16:43.
15. Battineni G, Sagaro GG, Chintalapudi N, Amenta F. The benefits of telemedicine in personalized prevention of cardiovascular diseases (CVD): A systematic review. J Pers Med 2021;11:658.
16. Piotrowicz E, Pencina MJ, Opolski G, Zareba W, Banach M, Kowalik I, *et al.* Effects of a 9-week hybrid comprehensive telerehabilitation program on long-term outcomes in patients with heart failure: The telerehabilitation in heart failure patients (TELEREH-HF) randomized clinical trial. JAMA Cardiol 2020;5:300-8.
17. Tucker WJ, Beaudry RI, Liang Y, Clark AM, Tomczak CR, Nelson MD, *et al.* Meta-analysis of exercise training on left ventricular ejection fraction in heart failure with reduced ejection fraction: A 10-year update. Prog Cardiovasc Dis 2019;62:163-71.
18. Scherrenberg M, Wilhelm M, Hansen D, Völler H, Cornelissen V, Frederix I, *et al.* The future is now: A call for action for cardiac telerehabilitation in the COVID-19 pandemic from the secondary prevention and rehabilitation section of the European Association of Preventive Cardiology. Eur J Prev Cardiol 2020. doi: 10.1177/2047487320939671.