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Evaluation of Telephone-Based Cardiac Rehabilitation Services Delivered to Adults 65 and Older During the Early Months of the COVID-19 Pandemic

Nicholas Ownbey[1], Jeff Soukup[2], Elizabeth Fugate-Whitlock[3], and Tina M. K. Newsham[3]

Abstract

This study was performed to evaluate the effectiveness of a hybrid, telephone-based cardiac rehabilitation (TBCR) program implemented early in the COVID-19 pandemic compared with in-person, center-based programming offered prior to the pandemic. The focus was on older adults' engagement and outcomes. Matched groups of hybrid and in-person cardiac rehabilitation (CR) participants were created from existing data and compared using t-tests and repeated measures ANOVAs. Qualitative interviews were conducted with participating CR staff then transcribed, coded, and analyzed for key themes. There were significant differences in body mass index and weight from pre-to post-CR within both hybrid and in-person groups. Despite this, CR staff believed exercise adherence was reduced in the hybrid group when compared to those in the in-person program. In the future, TBCR should be considered as an adjunct to in-person CR. Reluctance to prescribe exercise needs to be addressed through CR staff training.

Keywords

cardiac rehabilitation, telephone-based intervention, COVID-19

What this paper adds

- Reduction of BMI and weight among cardiac rehab (CR) patients age 65 and older did not differ between in-person and telephone-based CR (TBCR) attendees
- CR staff were reluctant to prescribe exercise to older adults without in-person contact with patients indicating that they need additional training on TBCR approaches
- CR staff believed older TBCR patients to be less adherent to prescribed exercise, despite evidence of similar efficacy of approaches, again highlighting the need for additional training related to TBCR and its efficacy

Applications of study findings

- TBCR may serve as a useful adjunct to in-person CR services for older adults, helping to address barriers to access such as transportation/distance while providing practical support at home
- Policies related to billable hours and insurance reimbursement should be revised to include TBCR services for older adults
- Future research on TBCR with older adults should examine patients' perspectives on TBCR

[1]Master of Science in Applied Gerontology Program, University of North Carolina Wilmington, Wilmington, NC, USA
[2]Cardiopulmonary Rehabilitation & Wellness, New Hanover Regional Medical Center (now Novant Health), Wilmington, NC, USA
[3]School of Health and Applied Human Sciences, University of North Carolina Wilmington, Wilmington, NC, USA

Corresponding Author:
Tina M. K. Newsham, School of Health and Applied Human Sciences, University of North Carolina Wilmington, McNeill Hall 2032 5685, Wilmington, NC 28403, USA.
Email: newshamt@uncw.edu

Background

Heart Disease Rates and Risk Factors

In the U.S., cardiovascular disease (CVD) affects about 83.6 million adults, and its most common form, heart disease, is the leading cause of death for those 65 and older (Heron, 2019; Soares-Miranda et al., 2015). Modifiable risk factors that are not often characterized by rapid changes include high blood pressure, hyperlipidemia, diabetes mellitus, obesity, poor diet, sedentary lifestyle, smoking, and stress (Dahlöf, 2010).

Role of Cardiac Rehabilitation in Addressing Heart Disease

Cardiac rehabilitation (CR), is effective for preventing future heart problems, prolonging life, improving health, and reducing medication need through positively influencing modifiable risk factors (National Heart, Lung, and Blood Institute [NHLBI], 2020). CR is particularly beneficial among older populations because of the unique consequences of CVD and multimorbidity that older adults face (Schopfer & Forman, 2016). CR is a safe and effective means of addressing disability, deconditioning, and frailty that some older adults may face (Schopfer & Forman, 2016), yet CR continues to be underutilized within this population**.** **A**mong 267,427 Medicare beneficiaries in 1997, only 13.9% with myocardial infarctions and 31% who had undergone coronary artery bypass grafting surgery participated in CR after hospitalization (Suaya et al., 2007).

CR, performed by interprofessional teams (NHLBI, 2020), combines physical activity, healthy living education, and behavior modification to improve all-around health (Thomas et al., 2019). CR is a cost-effective treatment that improves recovery from and reduces future risk of cardiac events (Giuliano et al., 2017). Cardiovascular health is inversely correlated with all-cause and cardiovascular mortality for all age groups, including older adults (Jin et al., 2017). Despite referral being a Class I recommendation (i.e., a recommendation that applied to most patients most of the time; Smith et al., 2011), only 30–50% of eligible patients are referred to CR by their cardiologist or cardiac specialist, and even fewer complete a program (Giuliano et al., 2017). Older adults are both less likely to receive referrals or to participate in CR (Suaya et al., 2007).

Factors Affecting Uptake of Cardiac Rehabilitation

Multiple barriers, including cognitive, social, and environmental factors, impede adopting appropriate health behaviors, even after surviving a heart attack (Traywick & Schoenberg, 2008). Nakayama et al. (2020) found that the main deterrent to attending CR programs is distance from home to the program location. Further, practical support (e.g., instrumental assistance with tasks or informational assistance such as giving advice) is a crucial component of cardiac patients' ability to manage their health (Hajduk et al., 2018), including attending CR (Molloy et al., 2008). To remove the barrier of having to travel to a CR site while also providing practical support, home-based cardiac rehabilitation (HBCR) programs have been developed.

In HBCR, patients complete rehabilitation activities remotely, typically in their own home, removing distance as a barrier. However, most healthcare providers in the U.S. have little to no experience implementing HBCR, and insurance providers in the U.S. typically will not cover HBCR, unless it is provided as a home health service for patients who are generally limited to their home (Thomas et al., 2019). Researchers have reported slightly higher program adherence and completion of HBCR compared to traditional cardiac rehab programs in other countries (Thomas et al., 2019).

Social distancing requirements during the SARS-CoV-2 (COVID-19) pandemic resulted in medical appointments and interventions, including CR, being limited and resorting to remote delivery (Nakayama et al., 2020). Nakayama et al. (2020) determined remote CR in Japan to be an appropriate replacement for traditional in-person CR during the COVID-19 pandemic, although they did not specifically investigate older adults.

Early in the pandemic, HBCR recommendations were lacking**,** and practitioners were faced with making quick decisions on how to continue to follow existing patients. For some, this resulted in the development of telephone-based communications between patients and staff to provide regular coaching and practical support that would facilitate patients' progress toward their CR goals. As the pandemic continues, guidelines for HBCR were provided and included the utilization of two-way audiovisual communication, with physician supervision that is immediately available through the audiovisual format. Additionally, those providing HBCR must comply with the requirements set forth Centers for Medicare and Medicaid Services (CMS) regarding exercise completion, session duration, and individualized treatment plan (ITP) development and review (American Association of Cardiovascular and Pulmonary Rehabilitation, 2021)**,** which allows the institution to be reimbursed. In contrast, telephone-based cardiac rehabilitation (TBCR) is limited to strictly (two-way) audio communication and does not provide an opportunity for reimbursement. While HBCR was the goal of the program studied here, HBCR was not developed; rather, a TBCR program was utilized.

Under non-pandemic conditions, in-person cardiac rehab at the study site is conducted two or three days per week (MWF or TTh) for 12 weeks, and patients are given the opportunity to complete 36 sessions. Each session consists of about 60 minutes of exercise (aerobic and strength) that is supervised by exercise physiologists and registered nurses. Additional education is offered in a group setting once a week, and patients learn lifestyle modifications to reduce the risk of future cardiac events.

Little information is available concerning physical activity adherence to telephone-based programs with older populations, although telephone-based interventions have been shown to improve medication adherence with older adults (Granger & Bosworth, 2011). To date, no researchers have analyzed TBCR in the U.S. during a public health emergency. Because CR is largely conducted with patients over the age of 65, the purpose of this study was to explore the efficacy of a TBCR program, implemented during the early part of the pandemic, when such in-person services were not feasible, compared to a traditional, in-person program among adults aged 65 and older at a regional hospital in Southeastern North Carolina. We hypothesized that the TBCR program would be equally effective as in-person CR services.

Methods

To explore the efficacy of in-person versus TBCR, the researchers used a mixed methods approach (Johnson & Onwuegbuzie, 2004). The researchers conducted a quantitative analysis of CR patients' outcomes and included qualitative information to understand the perspectives of those who administered the TBCR program. All study procedures were reviewed and approved by the IRB at [blinded for review; IRB protocol #xx-xxxx], and all interview participants provided written consent to participate in a graduate student's research project (CR patients' data was deidentified and did not require consent from the patients to be included, per the IRB determination). We attended to the Consolidated Criteria for Reporting Qualitative Research (COREQ) reporting guidelines (see the supplemental material for completed COREQ checklist; Tong et al., 2007).

Participants

A total of 151 cardiac rehab patients opted into the TBCR program when in-person services were unavailable in 2020. Patients' information was included if they completed all 9 weeks of the TBCR program; reported pre- and post-measures of weight, blood pressure, and exercise; and were at least 65; 15 met all inclusion criteria. All patients whose data were included in the study completed at least an initial in-person evaluation prior to the suspension of in-person group sessions at the study site, although the remaining nine weeks of the program was completed entirely remotely. Thus, these 15 comprised a "hybrid" group—in-person CR patients who opted into TBCR. As a comparison group, 15 patients aged 65 and older who participated in in-person CR at the study site in Spring 2019 were identified and matched by age, gender, diagnosis, and whether they had a myocardial infarction. To supplement understanding of how patients' experiences differed between in-person rehabilitation prior to the pandemic and TBCR during the pandemic, members of the rehabilitation team (exercise physiologists [EPs] and nurses [RNs]) were interviewed.

Procedure

From March 18, 2020, to May 26, 2020, the study site's in-person CR program was suspended, and patients who had completed an initial evaluation and received an exercise prescription were given the option to join a TBCR program. Interaction was limited to phone calls about patients' adherence to exercise, diet, and medications, as well as typical measures within their ITP. Height, weight, blood pressure, exercise type, exercise frequency, exercise duration, diagnoses, interventions, fasting blood glucose, medication compliance, signs/symptoms of cardiac disease, and age were compiled for each patient using the LSI (Life Sciences International, Charlotte NC) telemetry monitoring system. A deidentified dataset was created to allow comparison of outcomes between older adults who participated in in-person and TBCR. For TBCR participants, all vital statistics that were recorded during the TBCR program were self-reported.

One-time, in-person interviews with cardiac team members took place in a private office and were audio recorded once informed consent was gathered. The first author (who identifies as male, was (at the time) a master's student, had completed a graduate-level research methods course, and was supervised by the other authors [all of whom have doctorates]), conducted all interviews. The interviewer had completed a practicum experience at the study site and was known to the CR team. Interviews were transcribed, coded, and deidentified (each participant was assigned a pseudonym). Field notes were not taken.

Measures

Program adherence and exercise data compiled from patient ITPs in Spring 2019 and Spring 2020 were included in the analysis. The qualitative interview guide, which was not piloted, included questions about the development of the TBCR program, its benefits and challenges, and demographics. See the Appendix for the interview guide.

Data Analysis

Quantitative data were analyzed in SPSS version 27 (IBM, Armonk, NY) using independent samples t-tests to compare age, height, weight, and body mass index (BMI). To examine the comparability and efficacy of the TBCR and in-person CR programs, multiple 2x2 (group x time) repeated measures ANOVA's, with post-hoc comparisons adjusted by the Bonferroni test, were used to compare average session duration, exercise frequency by week, total exercise volume, systolic blood pressure (SBP), diastolic blood pressure (DBP), BMI, and weight between the in-person and hybrid groups before and after CR.

Qualitative interviews were coded in Microsoft Word using open coding and close reading in line with the within-site case

study approach described by Creswell and Poth (2017) to evaluate the TBCR program that arose because of the "unusual or unique situation" (p. 74) presented by the pandemic. While doing so, the first author (under the guidance of the co-authors) used constant comparison of data to develop a code book (Creswell & Poth, 2017), and to determine that saturation was reached. The code book was applied to all transcripts and themes were identified by arranging codes hierarchically and logically. Participants were not asked to verify transcripts or provide feedback on the findings.

Results

The in-person and hybrid groups were each comprised of 13 males and 2 females. One individual in each group suffered a MI, 8 received percutaneous coronary interventions, and 2 were classified with chronic stable angina. Additional patient characteristics for each group are provided in Table 1. There were no statistical differences between groups in terms of age, height, weight, or BMI at baseline.

Outcomes of Cardiac Rehabilitation Patients

Patient outcomes after participating in CR can be seen in Table 2. No significant differences were found between or within groups for systolic or diastolic blood pressure, average exercise session duration, exercise frequency per week, or total exercise volume at pre- or post-test. There was a significant decrease in bodyweight and BMI for both groups following CR, but there were no differences in weight or BMI between groups at pre- or post-test.

Table 1. Baseline Demographics by Group.

	IN-PERSON (n = 15)	Hybrid (n = 15)
Age (years)	74.5 ± 5.4	74.9 ± 5.18
Height (cm)	177.0 ± 9.9	172.0 ± 8.6
Weight (kg)	90.9 ± 16.4	88.0 ± 14.8
BMI (kg/m^2)	29.0 ± 4.7	29.8 ± 4.8

Values reported as mean ± standard deviation. BMI, body mass index.

Perceptions of TBCR from the Cardiac Rehabilitation Team Members

All eight members of the CR team who participated in TBCR consented to participate in an interview for this study. Interview lengths ranged from 5.2 to 16.9 minutes (m=11.5 ± 4.3). Of the eight interviewees, seven reported their ages (one reported being "above 40"). Age ranged from 26 to 59 years, with an average of 42.4 ± 12.4 years. One was male, seven were female. All were White/Caucasian. On average, the interviewees had worked for the study site's CR for 12.8 ± 9.1 years, with a range of 2.25–25 years. Six were exercise physiologists and two were registered nurses. Six of the eight stated that TBCR should be continued in the future and five stated they would be willing to be a part of TBCR in the future.

Table 3 includes each participant's pseudonym, position (EP/RN), whether they thought the study site's TBCR should be done in the future (Y/N), and if they would want to participate in TBCR in the future (Y/N).

Development of the TBCR Program

According to Cindy, the study site had *"discussed the possibility of offering [HBCR] as a program before the pandemic, but then once the pandemic hit it kind of forced us to, which was a good thing."* While HBCR was the goal, a TBCR program was put together out of necessity (although participants referred to the program as HBCR in the interviews). The study site's CR gym was closed, as were other gyms that patients could normally utilize. Ann stated, *"it seems like it would be a natural fit to dive into [HBCR] since we were forced to close our doors."* The team researched HBCR and found that at its core, it was still cardiac rehab. This focused the team on home exercise and educational topics, looked to other programs for models, and reported having found valuable

Table 2. Select Patient Outcomes following Cardiac Rehabilitation.

	Pre-Program		Post-Program	
	IN-PERSON (n = 15)	Hybrid (n = 15)	IN-PERSON (n = 15)	Hybrid (n = 15)
Weight (kg)	90.9 ± 16.4	88.0 ± 14.8	89.6 ± 17.2*	84.9 ± 15.1*
BMI (kg/m^2)	29.0 ± 4.7	29.8 ± 4.8	28.5 ± 4.9*	28.7 ± 4.5*
Exercise duration (min)	33.6 ± 9.3	30.0 ± 6.0	31.1 ± 10.2	30.3 ± 7.1
Exercise frequency (sessions/wk)	6.0 ± 2.9	7.2 ± 2.5	7.0 ± 2.2	6.3 ± 1.3
Total exercise volume (min/wk)	208.0 ± 140.1	205.6 ± 65.2	213.3 ± 95.5	188.8 ± 58.7
SBP (mmHg)	122.8 ± 11.3	119.9 ± 11.6	114.3 ± 15.9	121.9 ± 6.5
DBP (mmHg)	71.7 ± 7.2	67.5 ± 9.3	69.8 ± 7.9	68.0 ± 5.3

Values reported as mean ±; standard deviation. BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure. *p<0.05 pre-program vs. post-program.

Table 3. Characteristics and pseudonyms of interview participants.

Position	Years Worked at [Blinded for Review]	Should [Blinded for Review] do TBCR in the Future?	Would you Want to do TBCR in the Future?	Pseudonym
EP2	25	Y	Y	Ann
EP1	16	Y	Y	Pam
EP2	2.25	N	N	Taylor
EP1	10	N	N	Madison
EP2	4.5	Y	Y	Cam
EP1	20	Y	Y	Cindy
RN	3	Y	Y	Mary
RN	22	Y	N	Jamie

information from across the country. The team had a variety of opinions on TBCR; Cam, for instance, believed that *"home-based is better than us not following up or anything."* However, Taylor called TBCR *"not fantastic,"* noting concerns of injuries, falls, and cardiac symptoms without a clinician present to advise or assist the patient. Instead, Taylor would have liked to see an in-person exercise program, possibly with telehealth-based educational opportunities.

COVID-19 forced changes both to the way CR services were delivered by the study site, and how CR was funded. CR is typically paid for by Medicare, Medicaid, and other private healthcare insurers, rather than by the patient. As the study site developed their program, Ann described *"the big challenge"* as *"the reimbursement has not been there from CMS"* for TBCR programs—CMS did not require reimbursement for the individuals supported by Medicare and Medicaid during the gym closure period.

A supportive environment for and within the team contributed to the success in improving patient weight and BMI. The team met multiple times each day to ensure patient needs were met. However, even with the phone interviews, Mary *"wished [the team] did more. Following up on weights, there was no… 'Are you weighing yourself? Are you losing weight? Are you gaining weight?"* Similarly, Jamie observed *"the EP could have been spending…more time with exercising and stress management and that kind of thing."*

Another interesting finding noted by the team was that this older adult population was more technologically capable than team members had expected them to be. Ann revealed, *"we all make generalizations that 'old people don't use technology,' but actually quite a few of our patients have smartphones and use technology."*

Strengths of the TBCR Program

Participants noted several benefits of the telephone-based program. Each interviewee noted a different patient load, ranging from about eight to fifteen patients per day and indicated helping one another with their patient load when needed. Several of the EPs noted feeling *"fine"* about their patient load. Any patient-related issue the EPs could not resolve would be handed off to the nurses to follow-up. Jamie described how nursing staff became a triage for patient concerns outside the scope of practice for EPs, which other team members felt was very beneficial.

Patients asked questions outside of the scope of practice of the EPs and nurses at times; however, the CR team was able to refer the patient to the RD or their physician. Jamie described one goal for the program as ensuring patients had someone to discuss day-to-day symptoms and connect them with the necessary resource. Cam noted the team assisted patients in getting *"the essentials [by giving] them a phone number to call for getting medications or whatever it was or get in touch with the community to help to get food and groceries, then feel comfortable going out."* Cindy asserted that the RD on staff was a pivotal part of the program as patients adopted poorer dietary habits, describing the phone interviews as advantageous for the RD, *"because when she was speaking with them, they were at home [and] she could say 'OK, now go to your pantry, open up, tell me what you have there. Pick up the box, look at the nutrition labels.'"*

TBCR offered the opportunity for CR team members to meet some of the social needs of patients. As many patients lived alone, the pandemic created a great deal of loneliness. Jamie and Pam both noted the social benefit of the calls in alleviating loneliness for (as Jamie said) "*cardiac patients [that] have a lot of issues with stress and anxiety."* The pandemic incited additional fear in many patients to the point they were afraid to go outside to exercise or to the hospital if they needed to. Team members were surprised to find that patients were fearful of exercising outside and reassured patients of their safety in doing so.

Madison and Cindy noted the *"accountability"* and *"encouragement"* patients felt in continuing *"to work on behavior modification."* Despite the fear and anxiety surrounding exercise during the pandemic, the CR team reported that all patients involved were very appreciative of their efforts—every CR team member noted patient appreciation. Cam described how some patients who *"weren't very social"* at in-person CR *"did all the talking [during phone interviews], so it was actually really interesting to see how much the patients appreciated just that phone call."*

Challenges to TBCR

While CR team members noted many benefits of engaging in TBCR during the COVID pandemic, they also noted several challenges. CR includes group education regarding lifestyle changes to improve cardiovascular health, but as in-person lectures could not be held, educational handouts were sent to patients. Cam felt that patients would have benefitted more from in-person education, and while the idea of using video software (Zoom, Skype, etc.) to improve the program was suggested, it did not come to fruition. Several of the CR team members noted a preference of video software over telephone. Madison mentioned they *"could have led them through some exercises while they were at home"* if the CR team and the patients could see one another.

ITPs were the basis of the telephone interviews. While not required by CMS during the pandemic, the CR team chose to continue using and completing ITPs to guide the remote program. Every participant listed the ITPs as a negative, characterizing them as *"intensive," "relentless paperwork that wasn't very productive,"* and *"not in [the CR team members'] scope of practice."* Gathering vitals and weights was another key challenge facing CR team members. While Cindy indicated that the CR team was *"pleased to find out that most of the patients had a blood pressure cuff… scale… [and] glucose monitor at home,"* she also mentioned *"of course we don't know how accurate that is"* (a concern shared by Ann). Obtaining vitals was important to the program, however, not all patients provided them.

Each EP had their own classes prior to COVID, knew the patients in their classes, and could better assist them if they were the one to call the patient. Taylor reported being *"very attentive to my patients, and I don't really like anybody else to have to take care of them. They're mine…"* and that *"I felt like I had to fight to be able to make sure that I was the one calling my people."* Taylor also found when calling another CR team member's patients, being unfamiliar with the patients' health histories made providing care more difficult.

From the view of the CR team, exercise adherence (a focus of any CR program) among TBCR patients was lower than adherence in the in-person program (although the TBCR patients' self-reported data did not differ significantly from the in-person CR comparison group's data). When asked about exercise adherence, CR team members said, *"they probably weren't adhering to actual exercise," "I don't think [TBCR] compares, yeah, at all,"* and *"in regards to actually progressing with exercise, I don't think it was effective."*

Furthermore, without seeing the patient, the EPs felt limited in what they could instruct the patients to do. While all patients included in the TBCR program had been seen in-person by at least one member of the CR team, not all patients were seen by all staff, and there was some reluctance on the part of those who had never seen a patient to prescribe or progress patients' exercise. Taylor discussed the issue of how a patient *"could look great on paper, and you see them in person and you're like, 'Oh my goodness, you look way more sick than you look on paper.'"* Due to the concerns about prescribing exercise, Cam shared her belief that *"people did lose a lot of progress they had made."* Ann, who saw home-based treatment as a natural fit, disagreed with Taylor, who discussed obstacles including gym closures and fall risk.

All team members stated their preference for in-person CR over any sort of telehealth option. Reasons included being *"a hands-on person"* to *"providing more benefit [and] being able to coach patients."* Jamie believed that physical presence provides a different degree of understanding compared to what can be achieved over the phone.

Discussion

In this study, outcomes of pre-pandemic cardiac rehabilitation patients were compared outcomes of patients who participated in TBCR services during the COVID-19 pandemic. Perspectives of CR team members were gathered to explore strengths, weaknesses, opportunities, and challenges of delivering TBCR. Health outcomes were similar across in-person and TBCR patients, yet CR team members reported concerns about TBCR that must be addressed if CR is to be delivered remotely in the future.

While all CR team members indicated a preference for doing CR in person, in line with other healthcare providers' preference that provision of this type of remote care be temporary (Franzosa et al., 2021), five out of eight were willing to do TBCR in the future, particularly for addressing the non-exercise-related components of CR. Despite this preference, all participants recognized that TBCR was preferable to no program at all. Furthermore, the lack of significant differences in patient outcomes between hybrid and in-person patients indicates that TBCR is a viable and valuable addition to in-person CR. These findings are consistent with others who have found no difference in modifiable cardiovascular risk factors and functional capacity between TBCR and in-person CR (Wakefield et al., 2014; Rawston et al., 2016). Utilizing a TBCR program to engage patients on days they are not physically in CR or following the completion of an in-person program could be a viable adjunct, potentially enhancing patient outcomes or improving sustainability.

A challenge to TBCR was the reluctance to prescribe exercise without seeing a patient during the CR program. Without an in-person evaluation to assess physiologic responses, metabolic and orthopedic considerations, and other exercise limitations, reluctance on the part of the EPs to prescribe exercise would likely reduce long-term TBCR efficacy. However, remote exercise can be performed safely and effectively when proper eligibility screening is performed, established exercise prescription guidelines are followed, and proper education is provided (Wakefield et al., 2014). Reluctance of the staff to prescribe exercise may have been due to the inability to adequately screen for eligibility

and provide education prior to initiation of the TBCR program. Wakefield and colleagues provided participants with instruction on proper exercise equipment use, blood pressure and heart rate monitoring, and emergency medical service contact prior to the onset of their home-exercise training. In addition, providers were contacted prior to participant inclusion (Wakefield et al., 2014).

In this study, all patients had been physically evaluated and provided an exercise prescription for center-based CR prior to the suspension of in-person programming; however, eligibility for TBCR was not conducted nor was education specific to the home-exercise plans. The suddenness of the pandemic onset and subsequent closure of center-based CR did not allow for program planning in advance. Each patient was able to continue with their initial prescription or perform a similar routine if they chose to do so, although progression of the exercise prescription is pivotal to much of the improvement CR patients may hope to see.

All CR team members noted issues with the ITPs. This suggests that while in-person CR may be performed well with the current ITP format, TBCR may be better performed with a different ITP format and entirely new data entry process.

Finally, as most CR patients are older adults, it is important to examine the potential impact of ageist ideas CR team members may hold. While only one participant specifically indicated holding ageist ideas (i.e., they assumed that older CR patients would struggle with technology), there is a common assumption that older adults are not comfortable with technology. Despite this assumption, older adults' use of technology in medical care is consistently on the rise (Onyeaka et al., 2021), and the greatest barriers to accessing telehealth options appear to be socioeconomic (access to adequate devices and internet) rather than age-related (Choi et al., 2022). This ageist belief may impede CR providers from offering telephone-based services when, in fact, many potential patients might be interested in and capable of engaging in technology-driven HBCR.

The information obtained in this study may provide great value for the study site and other CR sites wishing to extend the CR services they offer to patients who may struggle to attend in-person CR. These insights should help CR programs identify opportunities for providing telephone-based services and staff training to reduce ageism, enhance patient outcomes, and increase the sustainability of benefits received during in-person CR. Provision of such practical support as can be offered through TBCR may enhance adherence to appropriate health behaviors for those who have experienced a cardiac event (Hajduk et al., 2018), and increase adherence to CR (Molloy et al., 2008).

Limitations

While this study is the first examination of TBCR program efficacy and CR team members' perspectives of TBCR during the early phase of the COVID-19 h, it is not without limitations. Within the hybrid group, baseline values were assessed in the CR facility, while post-CR values were self-reported by patients, and there may have been self-reporting bias or instrumentation error. Regardless, TBCR patients' weight and BMI changes were comparable to that of in-person CR patients, thus, it is unlikely their measurement tools were significantly out of calibration or that patients intentionally misrepresented their numbers.

The data were drawn from a very small sample size (15 individuals per group) over a short timeframe (9 weeks). With such a limited sample, results may not generalize to the larger population. Follow-up studies should be performed with standardized measures and equipment, greater patient accountability, a longer duration, and a larger sample.

Finally, although HBCR served as a model for the TBCR program that was implemented, as two-way audiovisual communication was not used in this program, key elements of HBCR were missing (Thomas et al., 2019). Except in rare circumstances, such as the COVID-19 pandemic, such TBCR programming might not be reimbursable (American Association of Cardiovascular and Pulmonary Rehabilitation, 2021). As we suggest TBCR to be a useful adjunct to in-person cardiac rehab, in the future researchers should focus on identifying which elements of HBCR are vital to the success of such programs so that modified versions (including telephone-based components) can be offered. For patients who struggle with adherence because of distance to CR facilities (Nakayama et al., 2020) or lack of access to high-speed internet and other tools for two-way audiovisual communication (Choi et al., 2022; challenges that residents of rural communities [Conley & Whitacre, 2020] and older adults [Marra et al., 2020] are particularly likely to face), among other barriers, TBCR may be a particularly useful adjunct to in-person or HBCR services.

Conclusion

The findings from this study support and extend the work of previous efforts and should inform future programming and research efforts related to HBCR. Future researchers examining HBCR should include interventions that provide patients with scales, BP cuffs, glucose monitors, and accelerometers to maintain standardization and enhance objectivity. Providers should also consider offering blended programs so patients may receive the benefits of in-person CR and accountability provided by TBCR. Finally, future researchers should examine patient perspectives of home- and telephone-based cardiac rehabilitation as the current study only included patient outcomes and provider perspectives.

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ORCID iD

Tina M. K. Newsham https://orcid.org/0000-0003-2567-3837

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