Cardiopulmonary Telerehabilitation

Dixie Aragaki, MD[a,b,*], Jerry Luo, MD[c], Elizabeth Weiner, MD[c], Grace Zhang, MD[c], Babak Darvish, MD[d]

KEYWORDS

• Telehealth • Telerehabilitation • Cardiac rehabilitation • Pulmonary rehabilitation
• Home-based rehabilitation

KEY POINTS

- Comprehensive cardiopulmonary telerehabilitation programs can include remote monitoring, health coaching, virtual education tools, and social networking to enhance interest and motivation.
- Cardiac and pulmonary telerehabilitation programs have been shown to be safe and effective alternatives to center-based rehabilitation programs.
- The optimization of various telemedicine platforms and tools (for remote cardiorespiratory monitoring and therapy interventions) continues to grow and enhance care.
- A thoughtful team-oriented patient-centered approach can ensure higher-risk patients are triaged to the most appropriate care setting.

INTRODUCTION

Chronic heart failure (CHF) and chronic obstructive pulmonary disease (COPD) frequently coexist in older frail adults because of common risk factors. These conditions are associated with frequent exacerbations leading to vicious cycles of dyspnea, reduced activity, impaired function, and social isolation, and are ultimately leading causes of mortality.[1] The prevalence of CHF in patients with COPD is more than 20% and that of COPD in patients with CHF ranges from 10% to 40%.[2] More urgent

[a] Department of Medicine, Division of Physical Medicine and Rehabilitation, David Geffen School of Medicine at UCLA, Los Angeles, CA USA; [b] Physical Medicine and Rehabilitation Service, VA Greater Los Angeles Healthcare System, 11301 Wilshire Boulevard (117), Los Angeles, CA 90073, USA; [c] Physical Medicine and Rehabilitation Residency (PGY-2), Greater Los Angeles VA Healthcare System, West Los Angeles VA Medical Center, 11301 Wilshire Boulevard (117), Los Angeles, CA 90073, USA; [d] Cardiopulmonary Telehealth Service, Physical Medicine and Rehabilitation Service, Greater Los Angeles Healthcare System, West Los Angeles VA Medical Center, 11301 Wilshire Boulevard (117), Los Angeles, CA 90073, USA
* Corresponding author. Physical Medicine and Rehabilitation Service, VA Greater Los Angeles Healthcare System, 11301 Wilshire Boulevard (117), Los Angeles, CA 90073, USA
E-mail address: Dixie.aragaki@va.gov

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than ever is the call to help patients with cardiovascular and pulmonary disease safely and effectively access comprehensive rehabilitative programs that can improve quality of life.

Telerehabilitation enables virtual care by facilitating remote interactions between patients and providers using information and communication technology. It can use videoconferencing, telephone, email, secure messaging, smartphones, personal computers, wearable sensors, and other electronic gadgetry to engage participants of various levels of technological proficiency. Despite the virtual nature, cardiopulmonary telerehabilitation programs deliver real results for patients, families, caregivers, and an allied health care team.

Cardiac rehabilitation (CR) is a class IA recommendation for secondary prevention of cardiovascular disease (CVD)[3] yet remains poorly used, with studies reporting enrollment rates of only 25% to 30% of eligible patients in the United States.[4,5] Contributing factors to low participation include clinical provider awareness and referral patterns; facility or community resources; logistic impediments (eg, transportation, distance, schedule conflicts, caregiver responsibilities); and patient-dependent factors, such as motivation and health status. Telerehabilitation programs offer the advantage of reducing some logistical barriers while achieving comparable safety and efficacy to center-based care models for low-to-moderate-risk patients.[5–7] However, virtual CR faces separate challenges including a paucity of specific recommended protocols for patients with high complexity and cardiovascular risk. Although the Centers for Medicare and Medicaid Services expanded reimbursement for telehealth during the SARS-CoV-2 (COVID-19) pandemic to facilitate the path for clinicians to reach patients sequestered in their homes, no similar reimbursement allowance was arranged for home-based CR as of 2020.[8] In the setting of the COVID-19 global pandemic with public health recommendations emphasizing social distancing and imposing periodic or partial closures of outpatient services and gyms, virtual CR programs have emerged as necessary alternatives to facility-based care. Home-based cardiac telerehabilitation programs can help select appropriate patients, avoid delays in treatment, improve participation in secondary prevention programs, preserve delivery of care in a cost-effective and convenient manner, and mitigate risk of infections and preventable hospitalizations.[8]

Before the COVID-19 pandemic, concerns about limited access to hospital- or community-based pulmonary rehabilitation (PR) programs were expressed worldwide. For instance, only 0.5% to 2.0% of eligible patients in Portugal were reported to have access to a PR program.[9] Despite the well-supported benefits of PR, including improvement in functional capacity, limb muscle function, dyspnea, and psychosocial outcome measures, such as quality of life and self-efficacy, it is troubling that overall use of PR programs has been low.[10,11] One analysis revealed that only 3% of Medicare beneficiaries with COPD participate in traditional PR programs in the United States.[12] Given the recent rise in public acceptance of telehealth care options, there is likely an even lower use of pulmonary telerehabilitation programs. Insufficient funding, resources, reimbursement, awareness, and additional patient-related barriers to enrollment are cited as contributors to the gap in delivery of PR programs to patients who could benefit.[11,13]

Since the COVID-19 global outbreak, stakeholders have been pressed to expand access to the proven physiologic and psychosocial benefits of PR for patients with preexisting chronic pulmonary disease and newly acquired infectious respiratory illness. The closures of many community gyms and outpatient clinics have prompted technological solutions to overcome hindrances imposed by social distancing and lack of physical treatment spaces. The multidisciplinary nature of traditional PR

programs involves a team of skilled providers to provide key components of medical clearance, exercise training, health coaching, and behavior modification to optimize respiratory fitness. However, lack of official endorsement for a standardized virtual care version of a multidisciplinary PR approach by leading professional organizations, such as the American Thoracic Society or the European Respiratory Society, leaves challenges in telehealth care planning, coordination, and implementation. Despite these challenges, studies have demonstrated effectiveness of home-based programs comparable with facility-based programs, including decreased acute COPD exacerbations and hospitalizations with superior reduction in emergency department visits.[14]

Cardiac and pulmonary telerehabilitation programs should be considered safe and effective components of a sustainable solution to meet the needs of patients with acute or chronic, preexisting or newly acquired, cardiopulmonary diseases. This review highlights clinical considerations, current evidence, global context, potential barriers, advantages, recommendations, and future directions of cardiopulmonary telerehabilitation.

NATURE OF THE PROBLEM/CONSIDERATIONS

Given the poor referral patterns, enrollment levels, and completion rates for traditional center-based CR programs, society has needed alternative strategies to deliver care in a convenient flexible manner.[7] With the emergence of the COVID-19 pandemic in early 2020, the global ability to offer care was further challenged. Home-based CR has increasingly been proposed because patients of all age groups show a growing ability to use information and communication technology to connect with their care providers.[15] A Pew Research Center survey in 2016 revealed that 80% of US adults ages 65 and older owned a cellphone and 42% had smartphones (up from 18% in 2013). Access to the Internet, tablets, computers, and social media is correlated with age, household income, and educational level.[16] It is important to take these patient-centered factors into consideration when trying to implement virtual CR programs. Additional challenges include limited facility and staff resources, paucity of standardized virtual CR protocols, lack of reimbursement, and underdeveloped virtual care infrastructure to meet privacy policy and documentation standards.

Part of the solution requires bridging the digital divide so people of broader ages, socioeconomic backgrounds, and technological familiarity can use communication technology. The Veterans Affairs system offers a good example of meeting this need through its recent creation of a national “digital divide” consultation that offers technical assistance and loaner tablets or smartphones to facilitate telehealth (eg, VA Video Connect, “my HealtheVet”).

Another consideration is how to reach eligible patients in a fluctuating period of care-delivery restrictions and physical distancing recommendations. Changes in staffing, referral practices, early discharge emphasis, and intermittent closures of outpatient services can result in losing touch with patients in need of continuity of care. The Italian Association of Clinical Cardiology published a position paper describing frequently observed clinical scenarios. Delayed presentation and treatment were common themes in the postsurgery and postacute coronary syndrome patient population for fear of nosocomial infections. Observed direct effects of COVID-19 infection include acute cardiac injury presenting as elevated cardiac troponins, cardiomyopathy, and heart failure.[17] Indirect effects include quarantine-induced stress with restricted physical activities, reduced adherence to prescribed therapy, limited access to follow-up visits, social isolation, depression, behavioral addictive disorders, weight

gain, and a cascade of sequelae from unsuccessful implementation of secondary prevention strategies.[17]

Patients with preexisting CVD are at increased risk of severe illness and worse outcome from COVID-19 infection given profound impacts on the pulmonary system and association with multiorgan failure, acute hypoxic myocardial injury, myocarditis, and arterial and venous thromboembolism.[18] Vascular complications, such as pulmonary embolism, deep vein thrombosis, disseminated intravascular coagulation, acute coronary syndrome, ischemic stroke, and arterial and capillary embolism, have been reported in approximately 20% of patients with COVID-19.[19] Therefore, residual impacts, such as deconditioning, focal neurologic deficits, risks of extended anticoagulation therapy, and possible development of post-phlebitic syndrome are contextual factors to consider because therapeutic and educational programs should be tailored to meet specific needs.

To maximize success, virtual cardiopulmonary rehabilitation programs should prioritize basic, safe, and timely care options over comprehensive or complex approaches.[5] Considering the status in resources and limitations of the health care recipients and providers is crucial to bridging the digital divide and implementing feasible solutions.

CURRENT EVIDENCE

There exists strong evidence for health benefits of PR, yet implementation is low with only 3% to 16% of appropriate patients with COPD being referred to PR and only 1% to 2% gaining access.[20] Transportation has been reported as the most common barrier to PR participation.[21] Therefore, pulmonary telerehabilitation has gained support. Health counseling via telephone was reported by patients with moderate to severe COPD to result in behavioral changes (eg, increased physical activity, smoking cessation) and increased motivation to maintain a healthier lifestyle.[22] There is moderate evidence that virtual PR can increase quality of life, reduce hospital admissions and emergency department visits, and reduce health care costs in patients with chronic pulmonary disease.[23]

In support of sustained PR outcomes, a 2-year pilot study showed full completion rate and improvement in 6-minute-walk distance with maintained physical performance, health status, and quality of life.[24] Most telehealth PR programs use regular telephone calls (eg, weekly calls for 8 weeks followed by transition to monthly telephone calls for up to a year) with reinforcement, feedback, and support provided via Web sites, mobile phone text messages, or live video-calls. A meta-analysis investigating effects of telehealth in patients with COPD found improvements in physical activity level,[25] which is importantly the strongest predictor for mortality in patients with COPD.[26]

In a study of elderly patients with combined COPD and CHF, a 4-month telerehabilitation program was deemed feasible, safe, and effective demonstrating improvements in walking distance, quality of life, dyspnea, physical activity profile, disability, and time-to-event (defined as hospitalization or death) compared with a control group[1] receiving standard care. The intervention group patients were followed via structured telephone calls with individualized exercise programs using mini-ergometer, callisthenic exercises, and pedometer-based walking and monitoring was done with pulse oximeter, portable one-lead electrocardiograph, and use of the Borg Rating of Perceived Exertion scale.[1]

Similar to PR, CR also suffers from low enrollment rates.[27] Multiple randomized controlled trials and meta-analyses have found cardiac telerehabilitation to be as

effective as traditional center-based rehabilitation for patients with history of coronary atherosclerotic disease, myocardial infarction, revascularization, or heart failure.[28–30] Patients are remotely monitored using devices (eg, video, pulse oximeters, pedometers) to collect health data, such as daily physical activity and heart rate, to provide feedback.[31] Benefits of cardiac telerehabilitation include cost, convenience, increased participation, decreased transport needs, and empowerment of patients engaged in their rehabilitation experience through education by professionals and self-monitoring at home.[32,33]

In a randomized controlled study consisting of patients with documented coronary artery disease or previous myocardial infarction completing a 12-week CR program, peak oxygen uptake significantly increased in home-based and center-based groups, but the center-based group reported more sedentary time (quantified as <1.5 metabolic equivalent tasks [METs]).[31] Another randomized controlled trial supported these findings in heart failure patients. Their results showed no significant difference between home-based telerehabilitation and traditional center-based programs in gains in 6-minute-walk distance.[34]

In a systematic review and meta-analysis of 17 randomized trials by Buckingham and colleagues,[35] there was no difference in adverse events or all-cause mortality noted at 1-year follow-up, nor was any difference observed in the number of cardiac events, including coronary revascularization, recurrent myocardial infarctions, or heart failure–related admissions between home- and center-based groups. In one 6-year follow-up study,[36] general hospitalizations were greater for the center-based group compared with the home-based group and home-based programs seemed to confer higher adherence. Ultimately, there was no significant difference in secondary outcomes, including exercise capacity, modifiable risk factors, quality of life, and cardiac events when comparing home-based with center-based rehabilitation, suggesting that home-based programs are an adequate alternative to center-based programs.[35]

Cost of telerehabilitation programs is another important factor to consider with far-reaching consequences on access to care and future policies. Currently, the best conducted cost-analysis studies of cardiac telerehabilitation are based in Europe and New Zealand. The Telerehab III trial, conducted in Belgium, was a multicenter randomized controlled trial originally designed to assess the long-term efficacy of cardiac telerehabilitation compared with usual care. Frederix and colleagues[37] collected data from this study and performed a cost analysis, primarily focusing on incremental cost-effectiveness and number of lost workdays. Within the 1-year follow-up period, there was a statistically significant lower incremental cost per patient and significantly fewer days lost because of cardiovascular rehospitalizations compared with the control group.[37] A long-term follow-up study to the Telerehab III trial was conducted to gauge the cost impact of an additional 6-month cardiac telerehabilitation regimen at 2-year follow-up and still showed cost-savings and overall efficacy in the Internet-based therapy group.[38]

In a more recent New Zealand study,[33] similar cost reductions were found for virtual CR involving a 12-week smartphone and chest-worn wearable sensor-based platform compared with a supervised control group. Delivery of the telerehabilitation protocol was found to be substantially less expensive. Similarly, a Netherlands comparison trial found evidence that telerehabilitation had a 75% to 95% probability of being more cost-effective.[39]

The cost and efficiency at which cardiac telerehabilitation can be delivered help determine if it is a suitable option. Although further studies need to be conducted within the United States to conclusively determine the cost-effectiveness of cardiopulmonary telerehabilitation, current evidence is optimistic.

CLINICAL RELEVANCE

CR can have life-saving benefits, because just a 1-MET improvement in functional capacity bestows a 17% to 30% reduction in all-cause mortality.[40] One study examining a large pool of Medicare beneficiaries with coronary artery disease found a 21% to 34% lower mortality rate in those who completed CR compared with those who did not.[41] It also seems that reductions in mortality rates are dose-dependent. A study of greater than 30,000 Medicare beneficiaries participating in CR showed reduction in morbidity at 4 years was better if patients attended greater than 11 sessions out of a full 36 sessions offered. When mortality risk of those who attended all 36 sessions was compared with the risk of patients who attended fewer sessions, they observed that each additional six sessions was associated with a 6% reduction in mortality.[42] This underscores the importance of encouraging patients to not only initiate a CR program but to also choose a program they are most likely to complete in full.

Benefits of CR reach beyond those with typical CVD. Cancer survivors have a 1.3- to 3.6-fold increase in mortality risk and a 1.7- to 18.5-fold increase in incidence of CVD risk factors compared with people without a cancer history.[43] A comprehensive CR program focused on nutrition, physical activity, and appropriate management of cardiotoxic oncologic therapies is useful. Exercise has been shown to improve cardiorespiratory fitness after completion of cancer treatment, indicating lower mortality, less symptom burden, and lower treatment-related toxicities in this population. The connection between CVD risk factors and outcomes among cancer survivors clearly identifies a need for accessibility and feasibility of rehabilitation.[43] Patients undergoing treatment of cancer or recovering from illness are also particularly vulnerable to COVID-19, and careful consideration must be taken when determining if a face-to-face evaluation is justifiable. This presents another opportunity for telerehabilitation to protect frailer patients from potential exposure to a public health threat.

Not only does the presence of CVD increase COVID-19 fatality rates up to 10-fold, the pandemic-strained health care system has delayed routine care for many patients with CVD, leading to a greater risk of future cardiovascular events and death.[44] Many beneficial, but elective, interventions, such as coronary angiograms, pacemaker, or implantable cardioverter defibrillator device placement, and cardiac surgeries have been postponed. Even patients who experience an acute coronary event fear going to the hospital, and admissions to cardiac intensive care units have been reduced and follow-up care appointments are fewer than usual because of concerns of COVID-19 exposure.[45] This can result in a cycle of patients being untreated or undertreated for existing cardiovascular conditions and potentially suffering adverse outcomes.

Cardiac telerehabilitation will become more important following the resolution of the COVID-19 pandemic. Some long-term sequelae for those recovering from the virus include cardiac injury, coagulation disorders, stroke, and critical illness myopathy and polyneuropathy.[46] Home-based rehabilitation allows for initiation of therapy and education while keeping these patients safely isolated from others early in the recovery phase.

APPLICATION

Center-based CR has a class IA recommendation by the American Heart Association, the American College of Cardiology, and the European Society of Cardiology for secondary prevention after an acute coronary syndrome, coronary revascularization, or in the setting of stable angina or symptomatic peripheral arterial disease. CR is also

recommended after heart valve surgery, cardiac transplantation, and CHF with reduced ejection fraction.[7,15]

During the COVID-19 global pandemic, some inpatient CR units have been closed or converted to emergency COVID units and the medical staff detailed to fulfill other hospital operation duties. Phase I inpatient CR programs noted reduced referrals for patients with nonemergent cardiothoracic surgeries and procedures that were deferred because of fear of nosocomial infections.[45] Because of the higher COVID-19 mortality rates of elderly patients with preexisting cardiopulmonary disease,[47] health care systems have emphasized the importance of reducing unnecessary hospital visits. Traditional phase II outpatient CR programs have largely been postponed but core elements are effectively delivered through telemedicine.[5]

Fig. 1 presents the generally accepted three-phase model of CR programs with additional components of telehealth to augment the outpatient phase II and longer-term maintenance phase III after completion of the inpatient phase I. The major components of an outpatient cardiopulmonary telerehabilitation program are shown in Fig. 2.

COMPLICATIONS/CONCERNS

During a global health crisis, such as the COVID-19 pandemic, providers face the challenge of performing a risk-benefit analysis to triage patients to either in-person evaluation or virtual care. It can feel like a high-stakes gamble where the risks of offering a virtual CR program without the typical face-to-face clearance evaluation must be balanced with the benefits of initiating valuable elements of CR while preventing unnecessary infectious disease exposure.

Leading organizations consider a symptom-limited graded exercise test (GXT) to be the gold standard for exercise prescription formulation and risk stratification. However, because of the predominant droplet and probable airborne mode of SARS-CoV-2 virus transmission, face-to-face encounters and nonemergent aerosol-generating

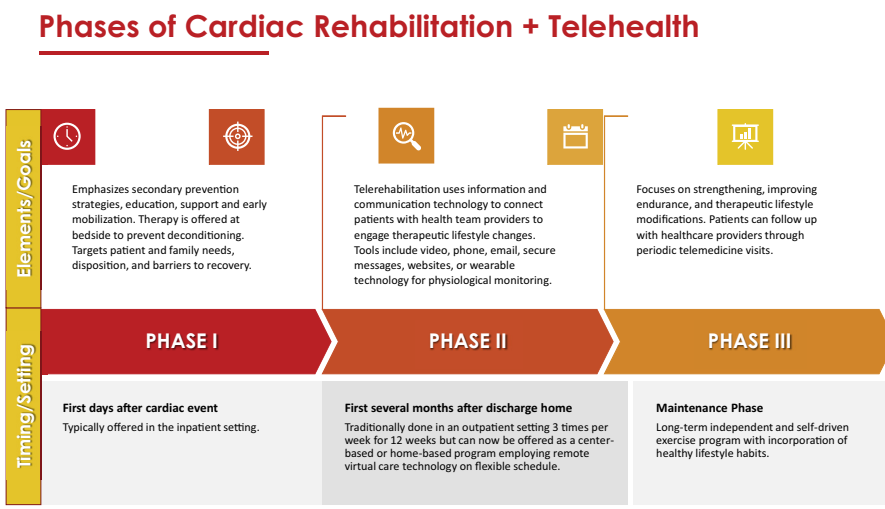

Fig. 1. Scheme of the three-phase model of cardiac rehabilitation with additional telehealth components to augment the outpatient intervention period (phases II and III) after completion of the traditional early inpatient treatment period (phase I).

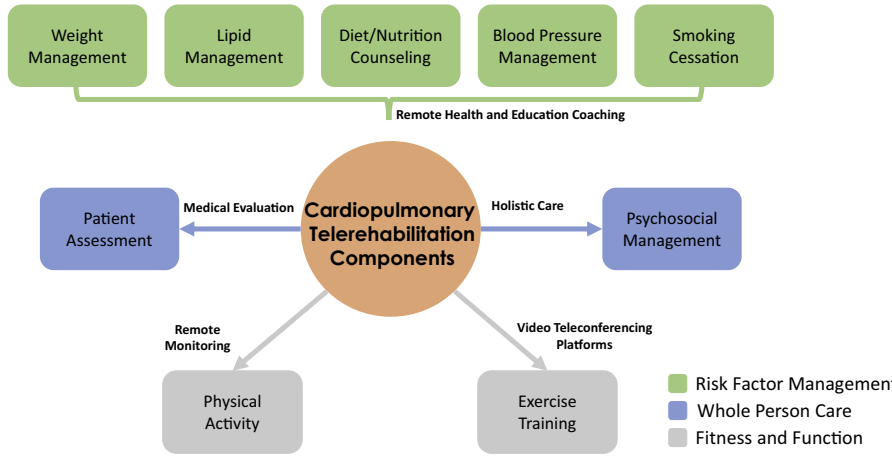

Fig. 2. Key components of cardiopulmonary rehabilitation are vital to center-based and home-based programs. These secondary prevention strategies incorporate elements from risk factor management to whole person care to fitness and function. These interventions are achieved remotely through use of information and communication technology.

procedures, such as a GXT, have been largely discouraged.[47] Nonetheless, a GXT should be performed under safest conditions possible (eg, preprocedure COVID-19 testing and proper personal protective equipment) if clinically indicated for particularly higher risk patients (eg, active cardiopulmonary symptoms, exercise-related arrhythmias, or significantly reduced ejection fraction). If a GXT is not available or deemed necessary, a careful decision-making process can permit alternative methods of assessing functional capacity (eg, Duke Activity Status Index, self-administered 6-minute-walk test). Home-based exercise prescriptions should be conservative, slowly titrated, and monitored via wearable heart-rate monitors/sensors or exertion level estimates (eg, the "talk test" or Borg Rating of Perceived Exertion).[5] Before the COVID-19 pandemic, surveys done by US[48] and Dutch clinics[49] reported that up to 70% of CR programs did not perform a baseline GXT before initiating CR and used other methods to create exercise prescriptions.[40] Therefore, a cautious prescription for physical activity is arguably better than the alternative of withholding CR completely.

Moderate-intensity exercise programs are guided by parameters, such as the Karvonen formula (eg, 40%–60% of the heart rate reserve plus resting heart rate), 55% to 70% peak heart rate, 4 to 6 METs, or the "speech rule" (ie, respiratory rate allows conversation).[50] In the absence of a baseline GXT, commonly used techniques for prescribing exercise include using the Borg rating of perceived exertion in a range of 11 to 14 or creating a conservative target pulse range based on resting heart rate plus 20 to 30 beats per minute.[40] The rating of perceived exertion is closely related to physiologic responses to exercise, such as lactate threshold, even in patients with coronary artery disease.[51]

Also of importance is the blood pressure and blood glucose response to exercise in patients with hypertension and diabetes mellitus, especially when on multiple medications with variable food and fluid intake. Blood pressure should be measured before and intermittently during exercise to detect possible hypertensive or hypotensive response to exercise. A systolic blood pressure greater than 200 mm Hg or a diastolic blood pressure greater than 100 mm Hg is used as a relative indication to terminate exercise.[50] A decrease in systolic blood pressure greater than 10 mm Hg less than

baseline while exercising is also a reason for holding activity and seeking evaluation for cardiac ischemia before continuing a telerehabilitation program. For patients with diabetes, initial exercise workload should be cautious to prevent hypoglycemic events possibly triggered by skeletal muscle consumption in proportion to exercise intensity. Patients should be advised to check their blood glucose levels before and after the first few exercise sessions if they do not have a recent history of being physically active. A small snack (with ~15 g of carbohydrate) is given if blood sugar levels are low (<70 mg/dL) and repeated if still low on a recheck 15 minutes later. Exercise progression are gradually and safely achieved through routine remote telerehabilitation program participation.

Patients with CHF are considered to be at higher risk for an exercise-related event and warrant telehealth screening for warning signs, such as active cardiopulmonary symptoms, vital sign abnormalities, weight trends (eg, sudden increase can signal fluid retention), and absence or even reversal of expected progress. If a CR team member suspects worsening exercise intolerance or significant ischemia at low work rates (<2 METs), exercise should be terminated, and the patient directed for appropriate reassessment.[52]

Serious adverse CVD events are estimated to occur in about 1 per every 50,000 patient-hours during center-based CR, but the incidence of adverse events experienced during cardiac telerehabilitation is not well established.[4] Cardiopulmonary arrests, arrhythmias, angina, syncope, and ST-segment changes on electrocardiogram are typically categorized as true adverse events.[53] The incidence of such events during cardiac telerehabilitation should ideally occur at comparable or lower rates than traditional center-based CR to be suitable. Fortunately, there are some promising studies in support of telerehabilitation safety.

There have been several reviews demonstrating optimistic findings in favor of telerehabilitation. A European multinational randomized clinical trial demonstrated that there was no significant increase in adverse events between participation in cardiac telerehabilitation compared with no rehabilitation at all. Snoek and colleagues[54] concluded that based on these findings, telerehabilitation may safely offer improved physical fitness and activity to elderly patients that decline traditional center-based CR. Frederix and colleagues reviewed 37 publications using a variety of telemedicine formats including telephone, Internet-based, and videoconferencing interventions. Seven of these 37 publications evaluated safety and after pooled analysis, the telerehabilitation format was found to be favored in terms of adverse events and rehospitalizations because of cardiovascular reasons (odds ratio, 1.30; 95% confidence interval, 1.13–1.50).[55] Two additional systematic reviews corroborated these findings, reporting a negligible difference in adverse events attributed to participation in telerehabilitation.[28,56] Although many prior studies have been statistically underpowered and conducted in a non-US population, cardiac telerehabilitation seems to be a suitable alternative to center-based rehabilitation provided patients are adequately risk-stratified (low-to-moderate-risk cardiac patients) before engaging in therapies.[4]

FUTURE DIRECTIONS/SUMMARY

Further studies investigating the safety and efficacy of cardiopulmonary telerehabilitation will help set standardized guidelines, especially in light of the recent pandemic, which has left many COVID-19 survivors in need of care.[57] In fact, among patients that required intensive care unit hospitalization, many develop long-lasting cardiac consequences, including venous thromboembolisms, myocarditis, or myocardial ischemic injury.[57] In a study performed in Switzerland among COVID-19 survivors,

Table 1
Seven tips for starting a cardiopulmonary telerehabilitation program

Make it simple	Use existing staff and resources with the mantra, "Use what works and work with what you got." A telephone is effective if your patient or team does not have secure videoconferencing or smartphone technology available.
Make it timely	Do not delay care if you can start even just a hybrid model or partial aspect of the multidisciplinary program safely.
Make it focused	Target your dedicated telehealth virtual sessions on core elements, such as medical advice, physical therapeutic activities, psychological counseling, dietary education, smoking cessation, and other topics.
Make it practical	Consider helpful tools that are easy to use and may be available at your facility, such as blood pressure cuffs, pedometers, pulse oximeters, pedal exercise machines, loaner tablets or smartphones, and illustrated exercise pamphlet materials.
Make it social	To reduce feelings of social isolation, introduce patient group sessions for dietician, psychologist, physiologist, and other multidisciplinary team members.
Make it better	Keep assessing and seeking ways to improve the program based on feedback from patients, providers, and other stakeholders. Provide updates to colleagues, department and facility leadership, and funding resources when positive outcomes and milestones are achieved to share success stories.
Make it last	Strengthen and reinforce your team and resources. Even after COVID-19 or another public health threat, plan for cardiopulmonary telerehabilitation programs to continue offering a safe and effective alternative to center-based care.

some of whom required mechanical ventilation, 2 to 4 weeks of acute inpatient cardiopulmonary rehabilitation improved exercise capacity measured by the 6-minute-walk test.[57] A need for an alternative to acute inpatient rehabilitation for those who cannot feasibly access these health services has arisen. Furthermore, those who pose a high risk for reinfection may find it safer to participate in rehabilitation in a socially distanced manner. When remotely guided physical exercise and multidisciplinary secondary prevention measures are used in conjunction, these interventions have been shown to reduce future adverse events and help patients manage risk factors.[44]

Moving forward, cardiopulmonary telerehabilitation should be made widely accessible and incorporate new lessons learned from the COVID-19 pandemic and harness the power of information and communication technology to provide evidence-based patient-centered care. **Table 1** lists recommendations to facilities or health care groups seeking to develop a cardiopulmonary telerehabilitation program.

CLINICS CARE POINTS

- Cardiac and pulmonary telerehabilitation are safe, convenient, and cost-effective alternatives to traditional center-based rehabilitation programs and facilitate patient participation by reducing logistical and financial barriers.
- Comprehensive telerehabilitation programs can include remote monitoring, health coaching, virtual education tools, and social networking to enhance interest and motivation.
- Potential limitations of cardiopulmonary telerehabilitation include willingness and ability of enrolled patients to engage in telehealth technologies in addition to limitations on resources, reimbursement, and policies within health care organizations.

- Because of the increased health risks faced by patients with cardiopulmonary disease, telemedicine offers the benefit of a remote visit type during an ongoing pandemic (especially when the infectious disease impacts cardiac and respiratory systems).

DISCLOSURE

The authors have nothing to disclose.

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