September 9, 2024

The Honorable Chiquita Brooks-LaSure
Administrator
Centers for Medicare & Medicaid Services
7500 Security Boulevard
Baltimore, MD 21244

RE: Medicare and Medicaid Programs: CY 2025 Payment Policies under the Physician Fee Schedule and Other Changes to Part B Payment and Coverage Policies [CMS-1807-P] AND Medicare and Medicaid Programs: Hospital Outpatient Prospective Payment and Ambulatory Surgical Center Payment Systems [CMS-1809-P]

Dear Administrator Brooks-LaSure:

The undersigned cardiac and pulmonary organizations and patient advocacy groups appreciate the opportunity to provide comments in response to the Centers for Medicare & Medicaid Services (CMS) calendar year (CY) 2025 Medicare Physician Fee Schedule (PFS) proposed rule and CY 2025 Hospital Outpatient Prospective Payment System (OPPS) and Ambulatory Surgical Center (ASC) proposed rule. Our comments address direct supervision of cardiac and pulmonary rehabilitation programs through virtual presence, as well as permanent availability of virtual cardiac and pulmonary rehabilitation services.

Proposal to Extend Definition of "Direct Supervision" to Include Audio-Video Communications Technology through 2025

In 2020, as part of the agency's response to the COVID-19 pandemic, CMS offered the flexibility to meet direct supervision requirements via virtual presence – including for cardiac rehabilitation (CR), intensive cardiac rehabilitation (ICR), and pulmonary rehabilitation (PR) services furnished in physician offices and hospital outpatient departments. The rationale provided by CMS initially was to improve access for patients and reduce burden for providers during the public health emergency (PHE) for COVID-19. In successive rulemaking, CMS has continued to extend this flexibility through CY 2024.

Under this flexibility and subject to the clinical judgment of the supervising physician or non-physician practitioner (NPP), the presence and "immediate availability" of the supervising physician includes virtual presence through audio/video real-time communications technology (excluding audio-only). CMS proposes to extend this flexibility through December 31, 2025, under both the

PFS and OPPS proposed rules, highlighting an interest in uniformity in how regulations are applied to similarly situated providers.

Comments and Recommendations:

CR, ICR, and PR programs are an important part of recovery for those with chronic heart and lung disease and who deal with acute events and exacerbations of their conditions. These vital programs have been shown to reduce rehospitalization and all-cause mortality, as well as improve physical function, quality of life, and lifestyle choices so patients may better self-manage their chronic conditions.

Allowing the direct supervision requirement to be met through the virtual presence of a physician or NPP via audio/video real-time communications technology has been valuable for expanding access to CR, ICR, and PR services safely and effectively since the start of the PHE for COVID-19. This flexibility has been particularly beneficial to beneficiaries living in rural and underserved areas. In contrast, as CMS discusses, elimination of this flexibility would result in barriers to beneficiary access to CR, ICR, and PR programs and the need to restructure practice patterns. We also note serious concerns about beneficiary adherence if this flexibility is not extended.

In the PFS proposed rule, CMS seeks additional information about potential safety and quality of care implications of continuing to allow direct supervision via virtual presence, including in cases where a supervising practitioner would be unable to intervene if complications arise. We believe the risk of patient harm is extremely low for the delivery of CR, ICR, and PR services. Our members and constituents report that the incidence of serious adverse events is rare. Moreover, numerous studies demonstrate that virtual and hybrid delivery of CR and PR services provided by staff are safe, improve health outcomes and adherence, and address barriers to access, as further detailed in Attachment 1 to this letter. Based on the importance of these programs in improving patients' lives and their quality of life, we believe the studies speak for themselves in addressing CMS' request for evidence and in supporting extension of virtual direct supervision policies for CR, ICR, and PR services beyond 2024.

For all of these reasons, we recommend that CMS finalize its proposals to allow direct supervision for CR, ICR, and PR services furnished in physician offices and hospital outpatient departments to be met via audio/video real-time communications technology through the end of CY 2025 at a minimum. We also strongly urge CMS to make this flexibility permanent for CR, ICR, and PR services, with the goal of maintaining ongoing accessibility of these valuable services.

Changes to the Medicare Telehealth Services List and Need for Ongoing Availability of Virtual CR, ICR, and PR Services

CMS received requests to add CR and PR services to the Medicare Telehealth Services List on a permanent basis, including CPT codes 93797, 93798, 94625, and 94626. These services – along with ICR services (HCPCS codes G0422 and G0423) – are currently on the Medicare Telehealth Services List with provisional status. However, CMS declines to update the status of these codes from provisional to permanent for CY 2025, noting that it is not revising the status of any codes from provisional to permanent because it intends to conduct a comprehensive review.

Comments and Recommendations:

As noted above, CR, ICR, and PR programs contribute to reduced morbidity and mortality for patients with chronic heart and lung disease. Despite their effectiveness, CR and PR programs are grossly underutilized: less than 25 percent of Medicare beneficiaries who are eligible for CR attend even one session,[1] and two-fifths of Medicare beneficiaries with chronic obstructive pulmonary disease (COPD) – including eight out of nine such beneficiaries in rural areas – were found to have poor access to PR.[2]

During the PHE for COVID-19, CR, ICR, and PR programs were able to safely and effectively expand their reach through the delivery of virtual services, including as a result of telehealth flexibilities afforded to services furnished by physician offices and virtual care flexibilities granted to hospital-based programs. While the *Consolidated Appropriations Act, 2023* ensured that patients were able to maintain access to virtual CR, ICR, and PR services furnished by physician offices via telehealth through December 31, 2024, virtual delivery of these services by hospital providers ceased to be an option when the PHE expired on May 11, 2023. As a result, only the CR, ICR, and PR programs that furnish services out of physician offices – or less than 5 percent of programs – are able to continue furnishing care virtually.

We again refer CMS to Attachment 1, which summarizes the findings of numerous studies demonstrating the safety of virtual care, as well as the clinical benefits of such care for patients served. Notably, virtual access to these services also benefitted patients facing other barriers to consistent participation in their treatment plans, such as those without transportation or the financial means to regularly travel to in-person program sites.

We believe ongoing availability of virtual CR, ICR, and PR services is critical for maximizing access to these high-value services. To support access for services delivered in physician offices, ***we urge CMS to add these services to the Medicare Telehealth Services List on a permanent basis as expeditiously as possible.*** At the same time, we note that placement of services on the Medicare Telehealth Services List will have limited benefit after 2024 if Congress does not extend existing telehealth flexibilities that temporarily waive statutory geographic restrictions and originating site requirements that apply to the provision of Medicare telehealth services. Furthermore, we highlight the pronounced need to extend availability of virtual CR, ICR, and PR services furnished by hospital outpatient departments.

To address these gaps and needs, we call CMS' attention to *H.R. 1406, the Sustainable Cardiopulmonary Rehabilitation Services in the Home Act,* which was favorably reported out of the House Energy and Commerce Health Subcommittee as amended on May 16, 2024. This bill would improve patient access to CR, ICR, and PR services by permanently allowing Medicare patients to receive these services via virtual telecommunications technology (real-time, audio-visual) in the beneficiary's home, wherever the home is located throughout the country, including when the

[1] Ritchey MD, Maresh S, McNeely J, et al. Tracking cardiac rehabilitation participation and completion among Medicare beneficiaries to inform the efforts of a national initiative. *Cir Cardiovasc Qual Outcomes. 2020; 13:3005902. DOI: 10.1161/CIRCOUTCOMES.119.005902.*

[2] Malla G, Bodduluri S, Sthanam V, Sharma G, Bhatt SP. Access to pulmonary rehabilitation among Medicare beneficiaries with chronic obstructive pulmonary disease. Ann Am Thorac Soc. 2023;20:516–522

services are furnished by hospital outpatient departments. ***We urge CMS to work with Congress to secure enactment of this legislation, which would ensure patients' ongoing access to virtual CR, ICR, and PR services, whether furnished by physician offices or hospital providers. We also encourage CMS to pursue any administrative authorities at its disposal to implement permanent virtual access to CR, ICR, and PR services furnished by hospital outpatient departments.***

* * *

Thank you for your consideration of our comments and recommendations on the CY 2025 Medicare PFS and OPPS proposed rules. If you have any questions, please contact Mollie Corbett, Executive Director of the American Association of Cardiovascular and Pulmonary Rehabilitation, at Advocacy@aacvpr.org.

Sincerely,

American Association of Cardiovascular and Pulmonary Rehabilitation
American Association for Respiratory Care
American College of Chest Physicians
American Thoracic Society
COPD Foundation
Dorney-Koppel Foundation
Heart Failure Society of America
Pulmonary Fibrosis Foundation
The Society of Thoracic Surgeons

ATTACHMENT 1

CARDIAC REHABILITATION (CR): Studies involving virtual and hybrid delivery of CR services demonstrate safety, improved outcomes over usual care, patient acceptance, and adherence.

I. Lear, SA, et al.[1] tested the clinical effectiveness of a virtual cardiac rehabilitation program (vCRP) delivered exclusively using Internet-based technology in response to a call from an American Heart Association Presidential Advisory calling for more robust research in this area.

- 72 participants were recruited and randomized to usual care (UC; n=40) or the vCRP (n=38), with age of the participants at 58.4 in the UC group (52.8, 64.7) and 61.7 (51.3, 65.2) in the intervention group.
- Adherence to the vCRP intervention was based on website usage from the 34 completing vCRP participants.
    - A total of 41% of vCRP participants uploaded ≥32 exercise reports equating to an average of 2 exercise bouts per week.
    - A total of 26% of vCRP participants uploaded the required 8 blood pressure reports.
    - There were 122 one-to-one private chat sessions between the vCRP participants and the nurse, dietitian, or exercise specialist, which averages to 3.6 sessions per participant.
    - The average participant used 2.4, 2.6, and 2.7 hours of nursing, dietitian, and exercise specialist time, respectively.
- **RESULTS:** The vCRP was safe and superior to usual care in reducing cardiovascular disease (CVD) risk and sustaining this reduction delivered exclusively through the Internet to patients in small urban and rural locations.
    - Significant improvements in exercise capacity and dietary quality were reported, with reductions in cholesterol levels. As exercise capacity has a strong association with CVD mortality, the authors noted it is a stronger prognostic indicator than other traditional risk factors.
    - After adjustment for the maximal time on the treadmill at baseline, age, sex, type 2 diabetes mellitus, and Internet use for health information, participants in the vCRP had a greater increase in maximal time on the treadmill by 45.7 (95% confidence interval, 1.04–90.48) seconds compared with the usual care group during the 16 months (*P*=0.045).
    - Of importance is that the benefits of the vCRP were sustained for a 12-month period after removal of the 4-month intervention. This is a key finding because recidivism in CR is commonplace after completion of a program, and the drop-out rates in these programs are as high as 35%.

[1] Lear, SA, et. al., Randomized Trial of a Virtual Cardiac Rehabilitation Program Delivered at a Distance via the Internet. *Circulation: Cardiovascular Quality and Outcomes*. Volume 7, Issue 6, November 2014; Pages 952-959. https://doi.org/10.1161/CIROUTCOMES.114.001230.

II. Heindl B, et al.[2] conducted a review of hybrid CR studies, defined as any combination of supervised center-based and monitored home-based exercise where at least two of the core components are addressed.

- Nine studies were found comparing hybrid CR to 1) traditional center-based CR among coronary artery disease (CAD) patients, (2) usual care among CAD patients, and (3) usual care among heart failure (HF) patients.
- Each study typically began with a center-based component lasting 2-11 weeks and transitioned to a home-based component lasting 10-22 weeks, with 3-5 exercise sessions per week composed of either walking (usually with a treadmill) or cycling for 25-35 minutes at 60-75% maximal heart rate.
    - Patients recorded data from home exercise sessions, via either a digital heart rate monitor or accelerometer, into logbooks which were reviewed by a therapist at specified intervals (often via telephone).
    - Counseling on risk factor management was predominantly provided during the center-based component.
- **RESULTS:** Compared with usual care, in patients with CAD, the studies concluded that "hybrid CR reduced cardiovascular events, and improved lipid profiles, exercise capacity, and [health-related quality of life (HRQoL)]."
    - In patients with HF, compared with usual care, hybrid CR improved physical function, exercise capacity, and HRQoL.
    - Hybrid CR also led to similar short-term outcomes compared to traditional CR in patients with coronary artery disease (CAD), as well as increased adherence and reduced delivery costs.

III. A study by Keteyian SJ, et al.[3] compared exercise training intensity during standard cardiac rehabilitation (S-CR) versus telehealth cardiac rehabilitation (TH-CR) as part of a Hybrid-CR (combined clinic- and remote home-/community-based) program.

- The overall mean exercise training intensities during both the S-CR sessions and the TH-CR sessions from Hybrid-CR were not significantly different at 63±12% and 65±10%, respectively (*P* = .29).
    - While the authors acknowledged the model for Hybrid-CR using telehealth may not be feasible for some due to staff preparedness or limited access technology, it was noted that due to the pandemic, most health care systems are now better prepared to equip and assist CR staff with operationalizing a remote CR model that incorporates virtual telehealth.
- **RESULTS:** There were no serious adverse events or falls that required hospitalization during or within 3 hours after completing a CR session.

[2] Heindl B, Ramirez L, Joseph L, Clarkson S, Thomas R, Bittner V. Hybrid cardiac rehabilitation - The state of the science and the way forward. *Prog Cardiovasc Dis*. 2022 Jan-Feb;70:175-182. doi: 10.1016/j.pcad.2021.12.004. Epub 2021 Dec 24. PMID: 34958846.

[3] Keteyian SJ, Grimshaw C, Clinton A, et al. A comparison of exercise intensity in hybrid versus standard phase two cardiac rehabilitation. *JCRP*. 2021;41:19-22.

IV. Imran HM, et al.[4] undertook a systematic review and meta-analysis of randomized controlled trials (RCTs) to compare functional capacity and health-related quality of life (hr-QOL) outcomes in heart failure for 1) home-based cardiac rehabilitation (HBCR) and usual care, 2) hybrid-CR and usual care, and 3) HBCR and center-based CR (CBCR).

- 31 randomized controlled trials with a total of 1791 heart failure participants were identified.
    - Among 18 studies that compared HBCR and usual care, participants in HBCR had improvement of peak oxygen uptake (2.39 mL/kg per minute; 95% CI, 0.28–4.49) and hr-QOL (16 studies; standardized mean difference: 0.38; 95% CI, 0.19–0.57).
    - Nine RCTs that compared hybrid CR with usual care showed that hybrid CR had greater improvements in peak oxygen uptake (9.72 mL/kg per minute; 95% CI, 5.12–14.33) but not in hr-QOL (2 studies; standardized mean difference: 0.67; 95% CI, −0.20 to 1.54).
    - Five studies comparing HBCR with CBCR showed similar improvements in functional capacity (0.0 mL/kg per minute; 95% CI, −1.93 to 1.92) and hr-QOL (4 studies; standardized mean difference: 0.11; 95% CI, −0.12 to 0.34).
- R**ESULTS**: Both HBCR alone and hybrid CR were at least as safe as CBCR and had the potential to improve clinical outcomes over usual care during short-term follow-up.

V. Ganeshan S. et. al.[5] compared, in CR patients, the association of in-person, hybrid, and virtual CR with change in performance on the 6-minute walk test (6MWT) between enrollment and completion.

- Patients enrolled between October 2019 and May 2021 were categorized into in-person, hybrid, or virtual groups by number of in-person and virtual visits.
    - All patients received individualized exercise training and health behavior counseling.
    - CR was delivered to patients in the hybrid and virtual cohorts using synchronous video exercise and/or asynchronous telephone visits.
    - Measurement at CR enrollment and completion included the 6MWT, blood pressure (BP), depression, anxiety, waist-to-hip ratio, and cardiac self-efficacy.
- **RESULTS:** Hybrid and virtual CR were associated with similar improvements in functional capacity to in-person and have the potential to expand availability without compromising outcomes.
    - Of 187 CR patients 37/97 (38.1%) were in person patients and 58/90 (64.4) were hybrid/virtual patients (P=.001).
    - Improvement in the 6MWT was similar in hybrid (63.4 ± 55.6; *P* = .46) and virtual (63.2 ± 59.6; *P* = .55) patients compared with in-person (51.5 ± 59.4).
    - Hybrid and virtual patients experienced similar improvements in BP control and anxiety.
    - While virtual patients experienced less improvement in depression symptoms, they generally had positive perceptions of hybrid and virtual CR.

---

[4] Imran HM, et. al., Home-Based Cardiac Rehabilitation Alone and Hybrid With Center-Based Cardiac Rehabilitation in Heart Failure: A Systematic Review and Meta-Analysis. *J Am Heart Assoc.* 2019 Aug 20;8(16):e012779. doi: 10.1161/JAHA.119.012779. Epub 2019 Aug 17. PMID: 31423874; PMCID: PMC6759908

[5] Ganeshan, S, et. al., Clinical Outcomes and Qualitative Perceptions of In-person, Hybrid, and Virtual Cardiac Rehabilitation, *Journal of Cardiopulmonary Rehabilitation and Prevention*: April 13, 2022 - Volume - Issue - 10.1097/HCR.0000000000000688. doi: 10.1097/HCR.0000000000000688

- There were no statistically significant changes in waist-to-hip ratio or cardiac self-efficacy.

VI. Jafri SH, et. al.[6] compared outcomes of patients (mean age: 72, 98% male) who were referred and attended a home-based cardiac rehabilitation (HBRC) program versus patients who were referred but did not attend HBCR (Non-HBCR) from 3 to 12 months of the referral date. HBCR consisted of face-to-face entry exam with exercise prescription, weekly phone calls for education and exercise monitoring, with adjustments where applicable, for 12-weeks and an exit exam.

- The primary outcome was a composite of all-cause mortality and hospitalizations with all-cause hospitalization; secondary outcomes were all-cause hospitalization, all-cause mortality, and cardiovascular hospitalizations, separately.
  - Primary outcome occurred in 30 patients (19.1%) in the HBCR group and 30 patients (30%) in the non-HBCR group (adjusted HR=0.56, CI 0.33-0.95, P=.03).
  - All-cause mortality occurred in 6.4% of patients in the HBCR group and 13% patients in the non-HBCR group 3 to 12 months after HBCR referral (adjusted HR=0.43, CI 0.18-1.0, P= .05).
  - There was no difference in cardiovascular hospitalizations (HBCR: 5.7% vs non-HBCR: 10%, adjusted HR 0.57, CI 0.22-1.4, P= .23) or all cause hospitalizations at 3 to 12 months between the groups (HBCR: 12.7% vs non-HBCR: 21%, adjusted HR 0.53, CI 0.28-1.01, P= .05).
- **RESULTS:** The study concluded that "HBCR among referred patients was associated with a lower risk of the combined all-cause mortality and all-cause hospitalizations up to 12 months. Based on the outcomes, HBCR is a reasonable option that can improve access to CR for patients who are not candidates of or cannot attend CBCR."

VII. McDonagh et al.[7] published a Cochrane review of home-based versus center-based cardiac rehabilitation services.

- The review covered 24 randomized clinical trials with a total of 3046 total participants with a history of acute myocardial infarction, coronary revascularization, or heart failure.
- At 12 months, there were no differences between home-based and center-based cardiac rehabilitation in all-cause mortality (RR 1.19, 95% CI 0.65 – 2.16), exercise capacity (standardized mean difference -0.10, 95% CI -0.24 to 0.04), and health-related quality of life.
- **RESULTS:** The authors concluded that home-based cardiac rehabilitation using digital and telehealth platforms are similarly effective as center-based/in-person cardiac rehabilitation in improving clinical outcomes and health-related quality of life in patients with a history of acute myocardial infarction, coronary revascularization, or heart failure.

[6] Jafri SH, et. al. Cardiovascular Outcomes of Patients Referred to Home Based Cardiac Rehabilitation. *Heart Lung.* 2022 Mar-Apr;52:1-7. doi: 10.1016/j.hrtlng.2021.11.005. Epub 2021 Nov 18. PMID: 34801771; PMCID: PMC8600943.

[7] McDonagh et al. Home-based versus supervised centre-based cardiac rehabilitation. *Cochrane Database of Systematic Reviews* 2023, Issue 10. Art. No.: CD007130. DOI: 10.1002/14651858.CD007130.pub5.

VIII. Hilu et. al.[8] conducted an observational study of patients attending remote versus center-based cardiac rehabilitation following an acute coronary syndrome.

- 107 patients participated in remote cardiac rehabilitation, and 198 participated in center-based cardiac rehabilitation.
- Compared to those in the center-based program, those participating in the remote program were more likely to achieve a 10% increase in exercise capacity (69 vs. 55%, *P* = 0.03) and similarly as likely to achieve a 25% increase in exercise capacity (34 vs. 23%, *P* = 0.05).
- Weight reduction and increase in muscle mass was similar between groups, but those in the remote cardiac rehabilitation program had larger fat percent reduction than those in the center based program (2.5 vs. 1.4%, *P* < .005).
- **RESULTS:** The authors concluded that remote cardiac rehabilitation was a safe and effective alternative to center-based cardiac rehabilitation in low to moderate risk patients following an acute coronary syndrome.

[8] Hilu R et al. Effectiveness and Safety of Remote Cardiac Rehabilitation for Patients After Acute Coronary Syndrome. *Am J Cardiol* 2023;207:54-58.

PULMONARY REHABILITION: Studies show that pulmonary rehabilitation programs are safe and yield positive outcomes in a variety of ways.

I. A 2019 study conducted by Knox et al.[9] assessed the feasibility, safety, and effectiveness of a virtual pulmonary rehabilitation program in a real-world setting. The study was conducted in Wales as part of a group of hospitals that covers a semi-rural population of 400,000 people living across a large geographical area.

- The program consisted of a hospital cardiopulmonary center (hub) and a rural village hall and community independent living center (spokes) linked by a real presence video conferencing system with interactive screens.
    - The age of those in the hub (n=24) was 68.6 (12.8); the age in the spoke (n=21) was 70.1 (10.8) with a P-value=0.67 (-8.93-5.79). All participants had moderate to severe COPD, with Medical Research Council (MRC) breathlessness score ≥3, on optimal medications, no exacerbations within 6 weeks, and had varying degrees of airflow obstruction.
- Mean attendance was 11.0 sessions in the hub and 10.5 sessions in the spoke (P=0.65).
    - There was a single (mild) AE (hypoglycemia) in all three hub programs and no AEs in the three spoke programs.
    - Mean COPD Assessment Test scores improved from 25.3 to 21.5 in the hub (*P*<0.001, 95% CI 2.43–5.17) and from 23.4 to 18.8 (*P*<0.001, 2.23–7.02) in the spoke group, with no difference between the groups (*P*=0.51, −3.35–1.70).
    - Mean incremental shuttle walk test scores improved from 142 to 208 m (*P*<0.001, 75–199) in the hub and from 179 to 316 minutes in the spoke (*P*<0.001, 39.3–92.4), with a greater improvement in the spoke (*P*=0.025, 9.31–133).
    - Twenty-one patients saved a total of 8,609.8 miles over the three programs by having the PR in their local spoke, rather than traveling to the usual nearest (hospital) hub.
- **RESULTS:** Video conferencing, which links a local site to a standard PR program is feasible, safe, and demonstrates at least equivalent short-term clinical gains.

II. A 2021 literature review conducted by Rawal, et. al.[10] noted that "less than 3% of eligible candidates for PR attend one or more sessions after hospitalization due to many barriers, including the ongoing COVID-19 pandemic.

- Emerging alternative models of PR delivery such as home-based PR, tele-rehabilitation, web-based PR, or hybrid models can help address these barriers.
- The purpose of the review was to determine if alternative delivery models watered down the effectiveness of PR.
    - Their literature search, using PubMed, CINAHL, and Medline to identify relevant articles through 1 May 2021, identified 26 studies related to pulmonary rehabilitation of which 10 were randomized controlled trials (RCTs), 15 were cohort studies, and 1 was a case series.

[9] Knox L, Dunning M, Davies CA, Mills-Bennet R, Sion TW, Phipps K, Stevenson V, Hurlin C, Lewis K. Safety, feasibility, and effectiveness of virtual pulmonary rehabilitation in the real world. *Int J Chron Obstruct Pulmon Dis.* 2019 Apr 8;14:775-780. doi: 10.2147/COPD.S193827. PMID: 31040656; PMCID: PMC6459142.

[10] Rawal, H.; Cornelison, S.D.; Flynn, S.M.; Ohar, J.A. Will Remotely Based Pulmonary Rehabilitation Water Down Its Effectiveness? Life 2021, 11, 1270. https://doi.org/10.3390/life11111270.

- **RESULTS**: Use of remotely based PR is a feasible and effective option to deliver PR, especially for patients with significant barriers to conventional clinic-based PR. Telerehabilitation was found to be both a feasible and an efficacious option for select patients with lung disease and outcomes across the studies demonstrated similar benefits to traditional PR programs.

NOTE: The studies listed below represent a screen shot of the Tables presented in the Rawal, et al., study. The reference numbers in brackets relate to those in the study and are not accessible as an active hyperlink in these comments.

Table 1. Studies evaluating tele-rehabilitation.

Citation	Study Design/Purpose	Patient Disease/Sample Size	Rehab Site	Intervention	Results	Adverse Events
Tele-Rehabilitation vs. Conventional Pulmonary Rehab						
Layton et al., 2021 [15]	Cohort Study/ Feasibility and efficacy Study	Cystic Fibrosis/ $n = 11$ vs. $n = 8$	Home	Smartphone based application	Increased adherence ($p = 0.03$)	Muscle pain
Hansen et al., 2020 [16]	RCT/ Superiority trial	COPD/ $n = 67$ vs. 67	Home	Real time broadcast by physiotherapist and nurse	No difference in 6MWT between groups. Higher rate of completion in the tele rehabilitation group ($p < 0.01$)	2 AE's in the Conventional PR group.
Rutkowski et al., 2020 [17]	RCT/ Superiority trial	COPD/ $n = 106$ $n = 34$ Conventional PR $n = 38$ Conventional PR +VR $n = 34$ VR	Inpatient	Virtual game system Conventional PR with physiotherapist	PR+VR group was superior to just PR group in Arm curl ($p < 0.003$), chair stand ($p < 0.008$), Up and Go ($p < 0.000$), and 6MWT ($p < 0.011$)VR group superior to PR in Arm curl ($p < 0.000$), chair stand ($p < 0.001$) and 6MWT ($p < 0.031$)	Not mentioned *
Bernocchi et al., 2018 [18]	RCT/Feasibility and efficacy Study	COPD/ $n = 56$ vs. $n = 56$	Home	Physiotherapist weekly phone call	Improvement in 6MWT ($p < 0.0040$)	None reported **
Horton et al., 2018 [19]	RCT/ Non-inferiority trial	COPD/ $n = 145$ vs. $n = 142$	Home	Physiotherapist weekly phone call	No improvement in CRQ dyspnea ($p = 0.18$)	None reported
Vasilopoulou et al., 2017 [20]	RCT/Efficacy Trial	COPD/ $n = 47$ vs. $n = 50$	Home	Recorded session by physiotherapist, exercise scientist	Home based PR and Conventional PR decreased COPD exacerbation and hospitalization when compared to pharmacotherapy ($p < 0.001$)	Not mentioned
Bourne et al., 2017 [21]	RCT/ Non-inferiority trial	COPD/ $n = 64$ vs. $n = 26$	Home	Pre-recorded session by a physiotherapist	Online PR was non-inferior to Conventional PR in 6MWT ($p = 0.098$) and CAT ($p = 0.373$)	Back pain and muscular pain
Chaplin et al., 2017 [22]	RCT/Feasibility and efficacy trial	COPD/ $n = 51$ vs. $n = 52$	Home	Pre-recorded session physiotherapist	No significant difference in the CRQ dyspnea ($p > 0.05$), ESWT ($p > 0.05$)	Not mentioned
Paneroni et al., 2015 [23]	Cohort Study/ Feasibility and Efficacy Study	COPD/ $n = 18$ vs. $n = 18$	Home	Real time video conferencing with the physiotherapist	Improvement in physical activity (steps per day) ($p < 0.0002$) No statistically significant difference in 6MWT, SGRQ or mMRC	None reported
Tabak et al., 2014 [24]	Cohort Study/ Feasibility and Efficacy Study	COPD/ $n = 15$ vs. $n = 14$	Home	Pre-recorded session by physiotherapist	Improvement in mMRC scale ($p < 0.03$)	Not mentioned
Stickland et al., 2011 [25]	Cohort Study/ Efficacy Study	COPD/ $n = 147$ vs. $n = 262$	Satellite Center under super-vision	Real time video conferencing with respiratory therapist	Both telehealth PR and Conventional PR showed improvement in SGRQ ($p < 0.05$)	Not mentioned

Tele-rehabilitation Alone (Pre vs. Post Intervention)						
Lewis et al., 2021 [26]	Cohort Study/ Efficacy and Feasibility Study	COPD/ $n = 17$	Home	Physiotherapist by real time video conferencing	Improvements in 1 min STS ($p = 0.004$), GAD ($p = 0.023$), PHQ-9 ($p = 0.029$), CRQ dyspnea ($p = 0.001$), CRQ fatigue ($p = 0.004$), CRQ emotion ($p = 0.0002$), CRQ mastery ($p = 0.001$)	None reported
Pancroni et al., 2021 [27]	Cohort Study/ Efficacy and Feasibility Study	COVID-19/ $n = 25$	Home	Twice a week call by a physiotherapist	Improvement in STS ($p = 0.003$) and 6MWT ($p = 0.0006$)	None Reported
Wootton et al., 2020 [28]	Case Series	COVID-19/ $n = 3$	Home	Weekly call by physiotherapist	Improvement in 1 min and 5 min STS	Not mentioned
Rassouli et al., 2018 [29]	Cohort Study/Efficacy and Feasibility Study	COPD/$n = 34$	Home	Smartphone application; pre-recorded videos	Improvement in CAT scores ($p = 0.008$) Improvement in CRQ fatigue ($p < 0.001$), mastery ($p < 0.001$) and emotion ($p < 0.001$).	Not mentioned
Zanaboni et al., 2017 [30]	Cohort Study/ Efficacy and Feasibility study	COPD/ $n = 10$	Home	Real time video conferencing with Physiotherapist	Improvement in 6MWT, CAT ($p = 0.022$) scores	Not mentioned
Hoaas et al., 2016 [31]	Cohort Study/ Efficacy and Feasibility Study	COPD/$n = 10$	Home	Pre-recorded session by physiotherapist	Decrease in physical activity (Steps per day) 1 year after a 2-year intervention ($p = 0.039$)	Not mentioned
Marquis et al., 2014 [32]	Cohort Study/ Efficacy and Feasibility Study	COPD/ $n = 26$	Home	Combined Real-time video conferencing by physiotherapists and unsupervised sessions	Improvement in 6MWT ($p < 0.001$), CET ($p = 0.003$) and CRQ ($p < 0.001$) at 8 weeks but not sustained until 24-week follow-up	Not mentioned
Albores et al., 2013 [33]	Cohort Study/ Efficacy and Feasibility Study	COPD/ $n = 25$	Home	Virtual Game system	Improvement in ESWT ($p = 0.005$), arm-lift ($p = 0.03$), sit to stand repetitions ($p = 0.03$) and CRQ emotion scores ($p = 0.02$)	Not mentioned
Holland et al., 2013 [34]	Cohort Study/ Feasibility Study	COPD/ $n = 8$	Home	Real-time videoconferencing with physiotherapist	Improvement in 6MWT, CRQ score	Minor adverse events were desaturation < 88% (n=1) & heart rate >150 BPM(n=1)
Wardini et al., 2013 [35]	Cohort Study/ Feasibility Study	COPD/ $n = 32$	Inpatient conventional + virtual	Virtual game system	Increased enjoyment using VAS Increased adherence	None reported
Tousignant et al., 2012 [36]	Cohort Study/ Feasibility Study	COPD/$n = 3$	Home	Real time videoconferencing with physiotherapist	Improvement in 6MWT for 2 out of 3 participants	Not mentioned
Tele-rehabilitation vs. No Rehabilitation						
Gonzalez-Gerez et al., 2021 [37]	RCT/ Feasibility and Efficacy Trial	COVID-19/ $n = 19$ vs. $n = 19$	Home	Twice weekly calls by physiotherapist	Improvement in 6MWT ($p < 0.001$) and dyspnea perception using Borg scale ($p < 0.001$)	None Reported
Li et al., 2021 [38]	RCT/ Efficacy Trial	COVID-19/ $n = 59$ vs. $n = 61$	Home	Smartphone-based application	Improvement in 6MWT ($p < 0.001$), mMRC ($p < 0.001$), LMS ($p < 0.001$) and SF-12 PCS ($p < 0.001$)	None reported
Bhatt et al., 2019 [39]	Cohort Study/ Feasibility and Efficacy Study	COPD/ $n = 80$ vs. $n = 160$	Home	Physiotherapist by real-time video conferencing	Decreased 30-day all-cause mortality ($p = 0.013$) and readmissions due to AECOPD ($p = 0.04$)	None reported
Tsai, 2017 [40]	RCT/ Efficacy Trial	COPD/ $n = 37$ vs. $n = 37$	Home	Real-time broadcast by physiotherapist	Improvement in ESWT ($p < 0.001$), self-efficacy ($p < 0.007$) and CRQ ($p = 0.07$)	Not mentioned

AE: Adverse Event; AECOPD: Acute Exacerbation of Chronic Obstructive Pulmonary Disease; CAT: COPD Assessment Test; CET: Constant work rate Exercise Test; COPD: Chronic Obstructive Pulmonary Disease; CRQ: Chronic Respiratory Questionnaire; ESWT: Endurance Shuttle Walk Test; EQ-VAS: EuroQol Visual Analog Scale; GAD: Generalized Anxiety Disorder; MRC: Medical Research Council; mMRC: Modified Medical Research Council; LMS: Lower limb muscle Strength; PCS: Physical Component Score; PHQ-9: Primary Health Questionnaire-9; PR: Pulmonary Rehabilitation; RCT: Randomized Control Trial; SF-12: Short Form Health Survey-12; SGRQ: St George's Respiratory Questionnaire; STS: Sit To Stand; VR: Virtual Reality; 6MWT: 6 Minute Walk Test. * Not mentioned—Studies did not look for adverse events. ** None reported: Studies reported the absence of adverse events.