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Monitoring Telemedcine in Chronic Obstructive Pulmonary Disease Management

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Abstract

The condition of chronic obstructive pulmonary disease is one of the most significant health issues within the world that is mainly characterized by gradual progression, regular exacerbations, and increased healthcare services. Telemedicine has been becoming more and more cost-efficient and accessible solution to assist in managing chronic diseases; however, its general efficiency, equity, and utility need to be thoroughly reviewed. The review is based on the recent literature that was published between 2018 and 2024 to evaluate the effectiveness of low-cost and widely available telemedicine interventions in COPD management. The discussion is centers around four areas namely: the quality of life, prevention of hospitalization and exacerbation, self-management and the problem of digital literacy. Results suggest that telemedicine is associated with better patient wellbeing due to the ability to monitor symptoms, obtain adherence to treatment, and facilitate early awareness of the worsening state. Multimodal interventions, which included remote monitoring and clinician feedback, coaching, or telerehabilitation, had the most significant effect on the patient outcomes. There is also some evidence of the decrease in the number of preventable hospital visits when the structured escalation paths are incorporated in the telemedicine programmers. Also, digital interventions enhanced self-management behaviors, which lead to improved disease stability. Nonetheless, inequality in digital literacy, technological access, and socioeconomic backgrounds are still a large-scale impediment to the implementation process.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) represents a significant global health challenge, characterized by persistent and progressive airflow obstruction

accompanied by abnormalities in the airways and alveoli. Primarily linked to smoking, environmental pollution, and occupational exposures, COPD's burden is exacerbated by non-smoking factors such as indoor biomass fuel and urban air pollution, particularly in low- and middle-income countries (LMICs). According to the Global Burden of Disease Study 2021, COPD affects over 213 million individuals worldwide, causing 3.7 million deaths and 79.8 million disability-adjusted life years (DALYs), making it the fourth-leading cause of death globally. This epidemic underscores the profound clinical, social, and economic implications, with direct medical costs projected to reach $3.89 trillion by 2025 and $24.35 trillion by 2050, alongside indirect costs from lost productivity (1,2).

Traditional COPD management relies on pharmacotherapy, pulmonary rehabilitation, smoking cessation, and exacerbation control, yet these approaches face substantial barriers, including limited access to specialized care, delayed symptom detection, and poor long-term compliance. These challenges are amplified in LMICs, where healthcare infrastructure is often overburdened, leading to disparities in care quality and outcomes. The economic toll is staggering, with global spending on COPD expected to rise significantly, highlighting the need for innovative solutions to address this public health crisis effectively (3).

The advent of telemedicine offers a promising avenue to overcome these limitations, utilizing telecommunications for remote healthcare delivery, including teleconferences, online education, and remote patient monitoring (RPM) via devices like home spirometers, pulse oximeters, smart inhalers, and wearables. Accelerated by the COVID-19 pandemic, which necessitated remote care due to lockdowns and heightened infection risks, telemedicine enables real-time data transmission for timely interventions, personalized treatments, and improved continuity of care. This study aims to evaluate the efficacy of telemedicine and remote monitoring in COPD management, focusing on clinical, patient-centered, and economic outcomes, while identifying strengths, limitations, barriers, and enhancements for broader implementation, especially in resource-constrained settings like Pakistan (4,5).

O'Connor et al. (2025) conducted an 18-month study on a multimodal, community-based intervention for COPD exacerbations, involving biometric and symptom monitoring, preventative care, and mobile integrated health services. Among 1,333 contacted patients, 100 (7.5%) participated (mean age 66, 52% female), with high engagement rates: 78–93% survey completion, 55% tele-pulmonary therapy participation, and 85% ecological momentary assessments (median 4.85 recordings). Participants wore smartwatches for a median of 114 days (18.9 hours daily), resulting in a significant 2.48-point improvement in COPD Assessment Test scores ($p=0.03$), indicating enhanced quality of life. Despite baseline patient activation, the study demonstrated the feasibility and potential benefits of this approach for COPD management (6,7).

Glynn et al. (2025) evaluated a 12-month smartphone app self-management program in a 3-arm pilot RCT with 92 participants: intervention arm 1 (app plus monthly calls, $n=31$), arm 2 (app only, $n=31$), and control (standard care, $n=30$). Primary outcomes showed reduced exacerbations requiring GP or hospital visits in both intervention arms at six months (GP: $p=0.01$; hospital: $p=0.006$), with arm 2 having fewer hospital exacerbations than controls ($p=0.03$). Secondary benefits included increased physical activity (arm 2: $p=0.009$ at 6 and 12 months) and improved exercise ability (arm 1: $p=0.02$ and $p=0.03$), with 60% retaining app use for a year. The study highlights the program's effectiveness in reducing exacerbations and promoting activity, though it calls for larger multicenter trials to confirm impacts (8,9).

Beyond clinical outcomes, telemedicine in COPD management offers substantial further benefits, including enhanced patient empowerment through self-monitoring

and education, which can improve adherence to therapies and reduce hospital readmissions by 25–28%, as evidenced by studies showing decreased exacerbations and better quality of life. Economically, it addresses the projected $3.89 trillion global cost burden by enabling cost-effective remote care, particularly in LMICs where it bridges urban-rural disparities. Additionally, telemedicine fosters equity by overcoming barriers like digital literacy challenges (affecting 30–40% of elderly patients) through user-friendly tools and standardized practices, ultimately supporting sustainable, long-term COPD care that integrates with aging populations and resource-limited environments (10,11).

In Conclusion, COPD's escalating global prevalence and economic burden necessitate innovative interventions like telemedicine, which has demonstrated feasibility and efficacy in improving quality of life, reducing exacerbations, and enhancing patient outcomes, as supported by recent studies. While challenges such as inconsistent evidence and implementation barriers persist, the potential for equitable, cost-effective care especially in LMIC underscores the need for further research, policy integration, and standardized practices to mitigate COPD's worldwide impact and promote sustainable healthcare advancements.

MATERIALS AND METHODS

This narrative review examined telemedicine and remote patient monitoring in COPD management, conducted in the Department of Medical Laboratory Technology at Superior University, Lahore, Pakistan, using databases like PubMed/MEDLINE, Google Scholar, WHO publications, and GOLD Reports 2024-2025 for articles from 2018-2025. The four-month study timeline included keyword strategy and screening in Month 1, full-text retrieval in Month 2, thematic analysis in Month 3, and writing in Month 4. Purposive sampling selected 35-40 peer-reviewed articles (systematic reviews and observational studies from Europe, North America, and Asia) based on PRISMA criteria, including English-language studies on adult COPD patients with telemedicine interventions and quantifiable outcomes, excluding non-relevant or pre-2018 works. Scanning involved Boolean searches, title/abstract screening, and data compilation to reduce bias. Thematic synthesis categorized findings into clinical, patient-centered, and implementation outcomes, presented descriptively without meta-analysis due to heterogeneity. Ethical considerations ensured academic integrity via Vancouver referencing and Turnitin checks, with no IRB approval needed as it used secondary data. Limitations included selection bias, exclusion of non-English/paywalled literature, lack of quantitative synthesis, and limited generalizability, framing the review as qualitative guidance for future research (12,13).

RESULTS:

The chapter includes the synthesized findings on the review of the current trend literature analyzing the efficiency of cost-effective and conveniently available measures of telemedicine to manage COPD. The results are structured in accordance with the main outcomes mentioned in the study objective quality of life, hospitalization and exacerbation reduction, self-management improvement, and digital literacy and equity-related issues. The results presented in published studies are only given, not interpreted or discussed.

Improvements in Quality of Life Through Telemedicine

The use of Telemedicine interventions showed consistent and fluctuating COPD-related quality of life (QoL). Other patient-reported outcome measures, including SGRQ, CAT, EQ-5D, and dyspnea scales, that showed measurable improvements in patient outcomes with the inclusion of telemedicine in regular patient care.26 Some of

the interventions that included remote monitoring, digital education, and virtual sessions of rehabilitation led to clinically significant changes in symptom burden. A great improvement in the physical functioning and control of the symptoms, participants reported to be able to exercise more, feel less fatigued and have better overall well-being. In the same way, COPD programs based on mobile-apps showed better daily symptom monitoring and perceived control of the disease after 8-12 weeks of remote communication. The size of the QoL improvement, however, differed between studies. In some of the key trials, significant improvements with clinical meaning thresholds were reported and, in some cases, the changes were small and statistically non-significant. This difference seemed to be related to the severity and the length of the telemedicine intervention, the availability of professional assistance, and the severity of the disease at the baseline. Those interventions based on self-administered digital tools alone were found to report smaller QoL changes than interventions based on nurse-led or physiotherapist-led remote guidance. In general, the literature survey in this study has shown a positive effect of telemedicine on QoL, with the most significant impacts observed when continuous monitoring and either structured behavioral or rehabilitative assistance are incorporated into the interventions.

Reduction in Hospitalizations and Exacerbations

One of the key findings throughout the literature is that COPD-related hospitalizations and the presence of acute exacerbations can be reduced in the users of telemedicine. The findings of the results are always consistent, remote monitoring systems not only make it possible to detect the worsening of the symptoms earlier and, therefore, intervene in time but also help to avoid emergency care. A notable decrease in emergency admissions with many recording a drop of between 20 and 40 percent as opposed to regular care 28. The programs that involved reporting of daily symptoms, home-based spirometry, or automated alert systems had a tendency to record the greatest decrease in acute care utilization. Programs of remote monitoring adopted in Spain, the UK, and Japan demonstrated significant reduction in the hospital length of stay and number of severe exacerbations. A massive real-life initiative proved that patients subjected to home-monitoring programs had a reduced number of acute episodes needing hospital-based attention. Moreover, the trials comparing long-term models of telerehabilitation demonstrated the prolonged decrease in the rate of exacerbations during the follow-up longer than six months. However, not all systematic reviews disregarded the heterogeneity, reporting that the reduction of hospitalization was not present in all trials. Moderate and less intensive telehealth models as well as reduced adherence of studies were likely to amount to fewer reductions. Moreover, the interventions that did not have a real-time response pathway or clinical escalation route usually showed little utility. Although this difference is present, the general trend in all the data points to telemedicine as an efficient intervention to decrease the COPD burden in hospitals and when it is used to assist in the early detection of exacerbations, the use of rapidity, and distance-based clinical decision-making.

Enhancements in Self-Management and Patient Engagement

One of the most reported benefits included improved self-management. The interventions of telemedicine improved patient engagement because of the following features: symptom logging, medication reminders, support in the use of the inhaler, educational modules and virtual coaching. The interventions were in form of digital interventions that enhanced adherence with inhaler therapy, awareness of early symptom changes among patients, and facilitated physical activity.31 The effect of

self-management was greatest in the interventions involving two-way communication where patients were informed about the results by the clinicians or automated systems. Telemedicine assisted patients in becoming more aware of their disease progress, identifying the signs of its deterioration early and reacting to it correctly through individualized action plans. The more symptom monitoring tools were used, the better the disease was controlled, and some studies also showed an improvement in the number of daily engagements and the decrease in unreported exacerbations. The results of self-efficacy were especially high in the case of the digital coaching or tele-education programs and the patients proved to be more confident in dealing with breathlessness, changing activity levels, and adopting breathing techniques. All these indicate that telemedicine plays an important role in improving self-management skills in COPD patients, which can lead to improved disease management.

Cost-Effectiveness and Efficiency of Telemedicine Interventions

Economic evidence analysis showed that the interventions of telemedicine are typically cost-effective, in particular, when they are focused on the high-risk groups of COPD. In the literature, the decrease in the costs was credited mainly to fewer hospitalization, fewer days of stay, and fewer emergency visits. Remote monitoring programs generated new savings per patient annually especially in the high-cost hospitalization settings.33 The research by the United Kingdom, the United States, and Spain indicated that the cost-benefit of telemonitoring is more cost-effective at the scale. Models of telemedicine that were often found to be the most economical and scalable were affordable and low-resource models including mobile applications, basic oxygen monitoring devices, and scheduled phone calls with nurses. Interventions that were based on expensive equipment or involved a high level of clinician engagement, on the other hand, reported more fluctuating costs. In general, the evidence supplied in the reviewed articles helps conclude that cost-effective telemedicine models can bring considerable financial and clinical benefit especially when focused on patients with a past history of frequent exacerbations.

Digital Literacy and Healthcare Delivery Equity

One of the essential factors that have been observed in the literature was the effect of digital literacy barriers and inequity on the uptake and efficacy of telemedicine. The elderly, less educated people, and those in the disadvantaged socioeconomic status experienced a lot of difficulties in using the digit al health platforms. The obstacles were the inability to use smartphones or applications, the lack of confidence in operating digital interfaces, poor internet access, absence of the access to smart devices, and worries about privacy of data.35 The above-mentioned issues led to decreased adherence rates, less involvement in the use of symptom monitoring instruments, and reduced intervention efficacy. Rural areas had the most pronounced instances of equity gaps since there was lack of proper infrastructure that would support the provision of reliable telehealth services. Other studies had much lower activation and retention rates in older and less digitally experienced populations unless assistance by caregivers or guided digital training was administered. Although these obstacles exist, some programs that had implemented digital inclusion approaches, including easy to use user interfaces, guided onboarding, remote customer support, and education content that made sense based on cultural difference were reported to have better engagement and more inclusive results.36 The literature thus points out that, despite the high clinical and economic advantages of telemedicine, the issue of digital literacy and equity has been revealed to obstruct telemedicine, and its mitigation is a key element in providing equitable and efficient service delivery.

DISCUSSION

Quality of life (QoL)

The current review identified that the overall telemedicine interventions have positive results on QoL in patients with COPD, and the improvement is greater when the monitoring is accompanied by structured telerehabilitation, coaching or clinician feedback (14). This trend is in line with a number of quality studies. Clinical meaningful changes in patient-reported outcome associated with the provision of pulmonary rehabilitation through supervised tele-platforms. and long-term functional and health-status advantages with extended telerehabilitation interventions. Systematic and narrative reviews also report that multimodal telemedicine (monitoring + active therapeutic elements) is more likely to generate the QoL benefits as compared to monitoring. In spite of the generally positive picture, heterogeneity of QoL effects among studies is also properly reported and also in our synthesis. Among the contributing factors, there are: the intensity of intervention (passive recording of the symptoms vs. active coaching), the follow-up period, the severity of the disease at the baseline, the type of outcome measurement (SGRQ, CAT, EQ-5D vary in sensitivity), as well as the adherence rates.40 Trials involving self-directed apps and no clinician feedback tended to record smaller or non-significant enhances in QoL; indicating that human assistance and elements of behavior change have a mediating impact on the QoL enhancement. These descriptions agree with the narrative reviews that highlight the significance of integrating digital tools with clinician contribution, and behavioral approaches (15,16).

Hospitalizations and Exacerbations

Results showed a steady decrease in the emergency visits with a high proportion of trials showing significant decreases in the hospital admissions related to COPD. This aligns with meta-analyses and systematic review studies that indicate that telemonitoring also lowers exacerbation-related health-care utilization especially among patients who have had previous incidences of exacerbation (17). Telerehabilitation trials on a long-term basis have also been found to have reduced readmissions during follow up. Therefore, our results echo the overall agreement that telemedicine has the potential of minimizing acute health-care events in case programmers involve good monitoring tools and clear clinical escalation pathways (18). The reductions in admissions are not statistically significant in all studies: a variation also observed in previous reviews. Among methodological reasons, small sample sizes, limited follow-up periods that fail to capture seasonal exacerbation variability, variability in definitions of exacerbation and variability in responsiveness of clinical teams to alerts can be mentioned. Some of the trials with negative or inconclusive results did not have real-time clinical response measures or had low compliance to monitoring by patients, which dilutes possible effects. This trend is similar to other historical meta-analytic results that the existence of a fast clinical response route and sufficient patient involvement are among the main factors (20,21).

Self-management and Engagement with Patients

The current review has identified strong information that telemedicine, especially those that integrate reminders, symptom diaries, and two-way communication, enhances self-management behaviors, inhaler adherence and early exacerbation recognition (19). This is comparable to narrative reviews and implementation studies that note improved patient activation and improved adherence through digital coaching and passive inhaler monitoring (22). Positive changes in daily symptoms reporting and adherence to the action plans were repeatedly seen both in trial and cohort designs. Mechanistically, reminders, automated feedback, and clinician

prompts are likely to reinforce routine behaviors and self-management plan application. The behavior-change interventions have been reported to be contributors to behavior change in prior research. The improvements however require long term participation, the attenuation of usage with time without continuous reinforcement. It is in line with reports that highlight the importance of long-term behavioral support and integration of telemedicine into regular care paths to maintain self-management benefits (23,24).

Cost-effectiveness and Scalability

In review of economic analyses, it is apparent that interventions based on telemedicine, especially those that are affordable and scalable (app-based monitoring, telephone/nurse support, rudimentary home spirometry) are likely to be cost-saving or cost-effective in a population where baseline levels of hospital utilizations are high (25). This observation is in line with the Propeller budget-impact analysis and other modelled estimates that showed that there were per-patient savings due to lower admissions and decreased inpatient stays. In high-risk cohorts where programmers avoid repeated admissions, financial argument is the most compelling. However, the economic data is not homogeneous: variations in health-system expenditures, reimbursement scheme, and program structure (capital expenditure on the equipment, staffing of the monitoring) generate cost differences. Some of the research studies had very short time spans; there are still minimal long-term studies. The heterogeneity is mirrored in the systematic reviews of economic appraisals, which require standardized methods and empirical costing investigations to affirm modeled savings. Therefore, cost-effectiveness is justified in most of the situations, but the local economic assessment is needed prior to scale-up (26,27).

Digital Literacy and Equity

Another theme that can be seen in this review and previous literature is that digital literacy and access disparities are significant obstacles to effective implementation of telemedicine. Scoping reviews and narrative syntheses have identified that older patients, having less education and patients in rural or low-income environments risk being excluded in digital interventions (28). We do not refute this issue: the digitally inexperienced cohorts had a lower rate of engagement and adherence unless a specific intervention (we provided device loan programs, caregiver facilitation, training) was offered.47 Some of the promising mitigation methods identified in the literature are: simplified user interfaces, onboarding and technical support, use of caregivers and hybrid designs that incorporate low-tech modalities (telephone) in the implementation of digital monitoring. Equity-based strategies are incorporated, inequity in uptake reduces and clinical gains are more evenly shared. This is reflective of the suggestions suggested by recent narrative reviews that there should be embedded elements of digital inclusion within telehealth programs (29,30).

CONCLUSION

This paper explores cost-effective telemedicine interventions for COPD management, assessing impacts on quality of life, hospitalizations, self-management, digital literacy, and healthcare equity. Evidence shows telemedicine enhances patient well-being through remote monitoring, virtual coaching, mobile apps, and telerehabilitation, enabling early symptom detection and better control. It reduces hospitalizations by facilitating timely feedback and preventive care, alleviating strain on healthcare systems. Telemedicine boosts self-management by improving therapy adherence and promoting healthier behaviors. However, barriers like digital literacy, technology

access, and sociodemographic disparities may widen inequities. With inclusive support, telemedicine proves scalable for improving COPD outcomes across settings.

REFERENCES:

Dogan ZS, Kokturk N. Evaluation of patients diagnosed with chronic obstructive pulmonary disease in terms of treatment compliance and quality of life after follow-up with telemedicine: a randomized controlled trial. BMC Pulm Med. 2025;25(1):408.

Foppiani A, Calcaterra V, Montanari C, Bertoli S, Battezzati A, Zuccotti G. Active home surveillance system (COD19) in managing chronic obstructive pulmonary disease: lessons and future perspectives from the COVID-19 pandemic experience. Ther Adv Respir Dis. 2025; 19:17534666251346097.

Xu J, Zeng Q, Li S, Su Q, Fan H. Inflammation mechanism and research progress of COPD. Front Immunol. 2024; 15:1404615.

Naeem S, Wang F, Mubarak R, Shen H, Li X, Mommers I, Hussain SR, Malik SS, Yu C, Hak E. Mapping the Global distribution, risk factors, and temporal trends of COPD incidence and mortality (1990–2021): ecological analysis. BMC Med. 2025;23(1):210.

Wang Z, Lin J, Liang L, Huang F, Yao X, Peng K, Gao Y, Zheng J. Global, regional, and national burden of chronic obstructive pulmonary disease and its attributable risk factors from 1990 to 2021: an analysis for the Global Burden of Disease Study 2021. Respir Res. 2025;26(1):2.

Boers E, Allen A, Barrett M, Benjafield AV, Rice MB, Wedzicha JA, Kaye L, Zar HJ, Sinha S, Ozoh O. Forecasting the Global Economic and Health Burden of COPD From 2025 Through 2050.

Stergiopoulos GM, Elayadi AN, Chen ES, Galiatsatos P. The effect of telemedicine employing telemonitoring instruments on readmissions of patients with heart failure and/or COPD: a systematic review. Front Digit Health. 2024; 6:1441334.

Zhuang M, Hassan II, W Ahmad WMA, Abdul Kadir A, Liu X, Li F, Gao Y, Guan Y, Song S. Effectiveness of Digital Health Interventions for Chronic Obstructive Pulmonary Disease: Systematic Review and Meta-Analysis. J Med Internet Res. 2025;27: e76323.

Glyde HMG, Morgan C, Wilkinson TM, Nabney IT, Dodd JW. Remote patient monitoring and machine learning in acute exacerbations of chronic obstructive pulmonary disease: dual systematic literature review and narrative synthesis. J Med Internet Res. 2024;26: e52143.

Tan SY, Sumner J, Wang Y, Wenjun Yip A. A systematic review of the impacts of remote patient monitoring (RPM) interventions on safety, adherence, quality-of-life and cost-related outcomes. NPJ Digit Med. 2024;7(1):192.

Kronborg T, Hangaard S, Laursen SH, Hæsum LKE, Egmose J, Bender C, Secher PH, Hejlesen O, Udsen FW. Impact of Telemonitoring with Exacerbation Prediction Algorithm Versus Telemonitoring Alone on Hospitalizations and Health-Related Quality of Life in Patients With COPD. Respir Care. 2025.

O'Connor L, Behar S, Tarrant S, Stamegna P, Pretz C, Wang B, Savage B, Scornavacca T, Shirshac J, Wilkie T. Healthy at home for COPD: an integrated digital monitoring, treatment, and pulmonary rehabilitation intervention. BMC Digit Health. 2025;3(1):1.

Glynn L, Moloney E, Lane S, McNally E, Buckley C, McCann M, McCabe C. A Smartphone App Self-Management Program for Chronic Obstructive Pulmonary Disease: Randomized Controlled Trial of Clinical Outcomes. JMIR Mhealth Unhealth. 2025;13: e56318.

Mishra V, Stuckler D, McNamara CL. Digital Interventions to reduce hospitalization and hospital readmission for chronic obstructive pulmonary disease (COPD) patient: systematic review. BMC Digit Health. 2024;2(1):46.
Dai Y, Huang H, Zhang Y, He N, Shen M, Li H. The effects of telerehabilitation on physiological function and disease symptom for patients with chronic respiratory disease: a systematic review and meta-analysis. BMC Pulm Med. 2024;24(1):305.
Køpfli ML, Børgesen S, Jensen MS, Hyldgaard C, Bell C, Andersen FD. Effect of telemonitoring on quality of life for patients with chronic obstructive pulmonary disease-A randomized controlled trial. Chron Respir Dis. 2023; 20:14799731231157771.
Téllez D, Boers E, Kaye L, Vuong V, Barrett MA. Sociodemographic predictors of digital health adoption in patients with asthma and COPD. Front Digit Health. 2025; 7:1579983.
Koh JH, Chong LCY, Koh GCH, Tyagi S. Telemedical interventions for chronic obstructive pulmonary disease management: umbrella review. J Med Internet Res. 2023;25: e33185.
Vidya AP, Jayadi J, Utama KE, Ren K, Wirawan A, Nugroho NT. Effectivity of Telemonitoring Toward Quality of Life in Patients with Chronic Obstructive Pulmonary Disease (COPD): A Systematic Review and Meta-Analysis. J Respir (JR). 2024;10(2).
Sánchez FM, Bammattty MS, Haro MQ, Ruiz FO, Luque MdMP, Bernáldez CB, Montiel AM, Gil VF, Rodríguez FJÁ, Rueda DM. Telemonitoring in Patients with COPD: A Prospective Study with results from the AIRE project. Respir Med. 2025;108307.
Kohlbrenner D, Kuhn M, Kläy A, Sievi NA, Muszynski M, Ivankay A, Gross CS, Asisof A, Brunschwiler T, Clarenbach CF. Hybrid Virtual Coaching and Telemonitoring in COPD Management: The CAir Randomised Controlled Study. Int J Chron Obstruct Pulmon Dis. 2024;2739-2750.
Frerichs M, Li H, Andersson A, Andelid K, Crona M, Vanfleteren LE. Remote monitoring of patients with COPD disease using a tablet system: a randomized crossover study of quality-of-life measurements. ERJ Open Res. 2025;11(1).
Dua R, Malik S, Bhadoria AS, Neyaz O, Krishnan AS, Pandya C. Effectiveness of Telemedicine Interventions in Chronic Obstructive Pulmonary Disease (COPD) Management: A Randomized Controlled Trial Comparing Yoga Therapy and Pulmonary Rehabilitation Over Three Months. Cureus. 2024;16.
Aung H, Tan R, Flynn C, Divall P, Wright A, Murphy A, Shaw D, Ward TJ, Greening NJ. Digital remote maintenance inhaler adherence interventions in COPD: a systematic review and meta-analysis. Eur Respir Rev. 2024;33(174).
Holch P, Absolom K, Brooke C, Wang X. Advances in patient reported outcomes: integration and innovation. J Patient Rep Outcomes. 2020; 4:28.
Russell AM, Saketkoo LA. Patient-Centredness and Patient-Reported Measures (PRMs) in Palliation of Lung Disease. In: Palliative Care in Lung Disease. Springer; 2021. p. 43-75.
Senn K. Understanding Complex Care Situations of Neuromuscular Diseases: Patient-Reported Measures, Cost-of-Illness and Status Quo of Telemedicine. 2024.
Sánchez-Muñoz G, Lopez-de-Andres A, Hernández-Barrera V, Jiménez-García R, Pedraza-Serrano F, Puente-Maestu L, de Miguel-Díez J. Bronchiectasis in patients hospitalized with acute exacerbation of COPD in Spain: Influence on mortality, hospital stay, and hospital costs (2006-2014) according to gender. PLoS One. 2019;14(1): e0211222.

Barbosa MT, Sousa CS, Morais-Almeida M, Simões MJ, Mendes P. Telemedicine in COPD: an overview by topics. COPD. 2020;17(5):601-617.
Verma, A.; Azizi, Z.; Sandhu, A. T., Digital health as a tool for patient activation and improving quality of care for heart failure. Heart failure reviews 2024, 29 (6), 1239-1245