

Tele-Rehabilitation in the Smartphone Era: Empowering Lung Transplant Recipients to Breathe Easier at Home

Reza Abdollahi

Student Research Committee, Urmia University of Medical Sciences, Urmia, Iran.

E-mail: rezaabdollahi97@yahoo.com **Doi:** 10.22038/psj.2026.93516.1517

Dear Editor,

Lung transplantation is a life-saving intervention for individuals with end-stage pulmonary diseases. However, the post-transplant period requires rigorous rehabilitation to restore physical function and reduce risks such as infection or graft rejection. Traditional center-based rehabilitation can be burdensome due to travel demands, costs, and infection exposure risks for immunocompromised patients. Tele-rehabilitation hereafter referred to as tele-rehabilitation leverages smartphone technology to deliver remote, personalized care via apps, wearables, and virtual consultations. This approach has the potential to shift rehabilitative care to the home, empowering recipients in their recovery (1). Post-lung transplant recipients often experience muscle weakness and reduced exercise capacity. Regular physical activity is essential, yet adherence to in-person programs can be suboptimal due to logistical barriers. Preliminary evidence from lung transplant-specific studies, including pilot work and trial designs, suggests that smartphone-based tele-rehabilitation using step-counters, activity trackers, and coaching apps may enhance adherence and engagement through personalized goal-setting and remote progress monitoring (2,3). In broader chronic respiratory populations (e.g., COPD), similar digital interventions have shown benefits in these areas, providing supportive extrapolated evidence (3,4). The potential benefits of tele-rehabilitation are multifactorial. It improves accessibility by reducing travel burden and infection risk a key advantage for immunosuppressed patients. Hybrid models combining virtual and in-person sessions add

flexibility. Preliminary data from lung transplant-specific programs, such as the Lung Transplant Go (LTGO) pilot study and its subsequent randomized controlled trial design (5,6), along with evidence extrapolated from pulmonary rehabilitation in other chronic lung diseases, suggest potential improvements in functional capacity (e.g., six-minute walk distance) and patient-reported outcomes like motivation and self-efficacy (3,4). Remote monitoring may also offer cost-saving potential by reducing acute healthcare utilization.

However, challenges must be addressed to fully realize tele-rehabilitation's potential. Technological access and digital literacy vary, risking a "digital divide" that could exacerbate inequities. Data privacy and security for transmitted health information raise important ethical and governance concerns. Clinically, the lack of direct supervision necessitates robust remote monitoring protocols, including defined thresholds for parameters like oxygen saturation and clear escalation pathways, to ensure patient safety particularly for detecting exercise-induced desaturation. While app-based behavioral features can support motivation, the absence of in-person social support may impact long-term engagement. Although evidence from COPD and related conditions is encouraging, rigorous lung transplant-specific randomized controlled trials remain limited, and more are needed to confirm efficacy and safety in this population (7,8). Implementation of tele-rehabilitation requires careful ethical and governance frameworks, including informed consent for data use, strategies to promote equitable access and bridge the digital divide, and clear clinical accountability for remote

monitoring. Addressing these is essential for responsible scale-up. Looking ahead, advances such as AI-driven analytics and enhanced wearable integration could refine remote care. Future policy and research should prioritize standardized, equitable protocols and high-quality, transplant-specific evidence (6). In conclusion, tele-rehabilitation offers a transformative opportunity for accessible, patient-centered support of lung transplant recipients. While preliminary evidence particularly from related fields and early transplant-specific studies is promising, overcoming technological, clinical, and ethical challenges is critical. Thoughtful integration of this technology can empower patients to manage their health and breathe easier in their post-transplant lives.

References

1. Wijsenbeek MS, Moor CC, Johannson KA, et al. Home monitoring in interstitial lung diseases. *The Lancet Respiratory Medicine*. 2023; 11(1): 97-110.
2. Wang R, Peng F, Guo S, et al. Elements of Post-Transplant Recovery in Lung Transplant Recipients: A Scoping Review. *Clinical Nursing Research*. 2024;33(6):481-92.
3. Pimenta S, Hansen H, Demeyer H, et al. Role of digital health in pulmonary rehabilitation and beyond: shaping the future. *ERJ Open Research*. 2023;9(2).
4. Rochester CL, Vogiatzis I, Holland AE, et al. An official American Thoracic Society/ European Respiratory Society policy statement: enhancing implementation, use, and delivery of pulmonary rehabilitation. *American Journal of Respiratory and Critical Care Medicine*. 2015;192(11):1373-86.
5. Debette-Thellier E, et al. Delivering an In-Home Exercise Program via Telerehabilitation: A Pilot Study of Lung Transplant Go (LTGO). *International Journal of Telerehabilitation*. 2016; 8(2): 31-42.
6. Vendetti ML, et al. Design of Lung Transplant Go (LTGO): A randomized controlled trial evaluating the efficacy of a telerehabilitation behavioral exercise intervention... *Contemporary Clinical Trials Communications*.
7. Rawal H, Cornelison SD, Flynn SM, Ohar JA. Will remotely based pulmonary rehabilitation water down its effectiveness? *Life*. 2021;11(11):1270.
8. Jacinto T, Smith E, Diciolla NS, et al. ERS International Congress 2023: highlights from the Allied Respiratory Professionals Assembly. *ERJ Open Research*. 2024;10(2).