

Artificial Intelligence in Respiratory Medicine: Applications, Methodological Challenges, and Clinical Translation

D. López Padilla; S. Lumbreras Sancho; A. Agustí García-Navarro; J. Jacob; G. Rocco; A. Malhotra; Joan B. Soriano Ortiz

Abstract-

Artificial intelligence (AI) is rapidly transforming respiratory medicine by enabling the integration and analysis of complex multimodal data, including imaging, physiological signals, electronic health records, and patient-generated information. This invited state-of-the-art review synthesizes current evidence on AI applications across chronic airway diseases, lung imaging, thoracic surgery and oncology, and sleep medicine and non-invasive ventilation, with a strong focus on clinically meaningful use cases. We highlight how AI can support earlier and more accurate diagnosis, refined phenotyping and endotyping, improved risk stratification, and more individualized therapeutic strategies. Representative applications include AI-assisted spirometry interpretation, multimodal exacerbation prediction, advanced quantitative imaging, perioperative risk modelling, wearable-based sleep apnoea detection, and AI-assisted respiratory support decision-making. Alongside these opportunities, we discuss cross-cutting challenges that currently limit routine implementation, including data quality and representativeness, insufficient external validation and generalizability, algorithmic bias, limited explainability of complex models, and concerns regarding privacy and data governance. Throughout the review, we argue that AI should be conceived as a tool to augment, rather than replace clinical judgment, embedded within human-in-the-loop frameworks that preserve transparency, fairness, and accountability. We conclude by outlining priorities for future research and policy, such as prospective clinical evaluation, multicenter validation in diverse populations, and closer collaboration between clinicians, data scientists, and regulators, which will be essential to translate the promise of AI into tangible improvements in respiratory outcomes and patient-centered care.

Index Terms- Artificial intelligence; Respiratory tract diseases; Pulmonary medicine; Machine learning; Clinical decision support systems; Translational medical research

Due to copyright restriction we cannot distribute this content on the web. However, clicking on the next link, authors will be able to distribute to you the full version of the paper:

[Request full paper to the authors](#)

If your institution has an electronic subscription to Archivos de Bronconeumología, you can download the paper from the journal website:

Citation:

López-Padilla, D.; Lumbreras, S.; Agustí, A.; Jacob, J.; Rocco, G.; Malhotra, A.; Soriano, Joan B. "Artificial Intelligence in Respiratory Medicine: Applications, Methodological Challenges, and Clinical Translation", Archivos de Bronconeumología, , .