Editorial: Emerging advances in exploiting pulmonary administration for treatment of thoracic diseases

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Editorial on the Research Topic
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Introduction

Thoracic diseases represent some of the major healthcare challenges worldwide. This field has witnessed remarkable advancements in recent years, with demonstrated efficacy in managing respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), and cystic fibrosis (Bhatt et al., 2023; Woodward and Fromen, 2024). Encouragingly, emerging applications extend to respiratory infections, pulmonary oncology, and even systemic disorders including diabetes, revealing broader therapeutic potential (Li et al., 2022). Despite these advances, still some challenges remain to attract wide attention from academic and industrial circles. This Research Topic, titled "Emerging Advances in Exploiting Pulmonary Administration for Treatment of Thoracic Diseases," aimed to address the latest research in this field, including clinical trials, formulations, biosafety, Artificial Intelligence (AI) applications et al., through pulmonary administration by compiling cutting-edge research.

Scope and contributions

In this Research Topic, we solicit submissions reporting recent progress on pulmonary administration. Related topics include but were not limited to the following: Clinical trials on new drugs delivered through the pulmonary route. Investigating nanoparticle or genetic formulations given through pulmonary administration. Advanced aerosol, nebulization, instillation, or inhalation therapies. Safety and pharmacokinetics-related studies. Mechanisms of imaging and therapy. Intratracheal or pulmonary delivery instrument, device, or medical facilities. Delivery-associated complications. Bronchoscope applications

SCHEME 1
The solicited submissions scope of this Research Topic (This image is generated by Biorender).
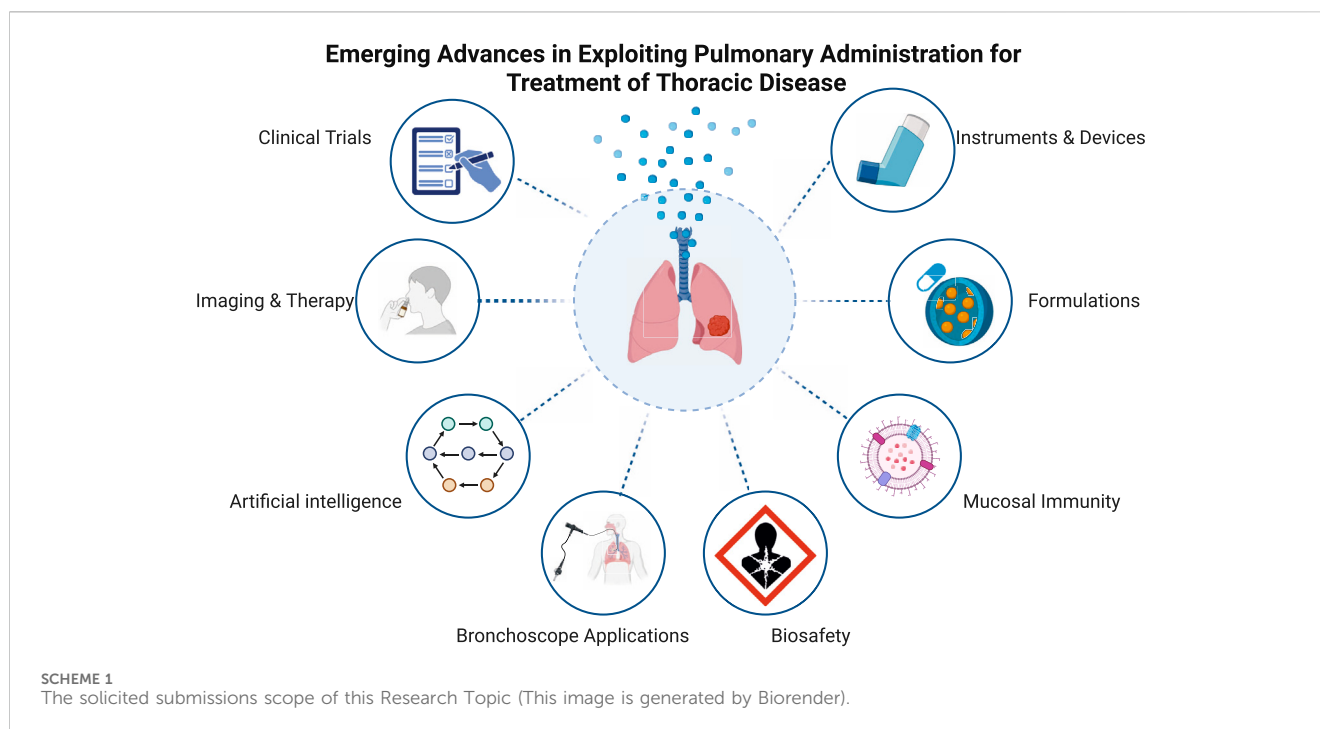
in the context of thoracic disease treatment. Artificial Intelligence applications in precision detection of thoracic diseases and challenges in the pulmonary delivery of therapeutics, Scheme 1.

Focusing on these subjects, this Research Topic received 15 submissions, of which 4 were accepted (27% acceptance rate). Key contributions include: A kind of dual-modality MRI/fluorescence ultrasmall iron oxide nanoprobe was successfully synthesized that can effectively assess and dynamically monitor atherosclerotic plaques, showing potential for clinical translation (Zhang et al.). A retrospective study on the characteristics of respiratory muscle function and influencing factors in patients with dyspnea and normal or mildly abnormal lung function (Yang et al.). A novel method for precise implantation of a tracheal Y-shaped stent (Ding et al.) and a review report on the development of clinical trials for non-small cell lung cancer drugs in China from 2005 to 2023 (Jia et al.).

Future perspectives

The field of pulmonary administration is evolving rapidly, particularly in the treatment of localized lung diseases, driven by the innovations in nanotechnology, advanced aerosol systems, and gene therapy (Wang et al., 2023). Nevertheless, critical challenges still need to be addressed to translate promising preclinical innovations into successful clinical application. Key priorities include improving alveolar targeting precision to minimize proximal airway drug loss and overcoming bioavailability limitations linked to pulmonary deposition variability and metabolic clearance (Wang et al., 2024; Yang et al., 2022). Ensuring nanocarrier safety and developing scalable production methods for complex systems (e.g., lipid nanoparticles, exosomes) remain vital for clinical adoption. Interdisciplinary approaches—such as AI-optimized carrier design, patient-tailored therapies based on anatomical and biomarker data, and strategies to bypass pulmonary barriers (e.g., mucus clearance, epithelial junctions) (Li et al., 2025; Liu et al., 2024; Ren et al., 2025). It can be anticipated that targeted pulmonary therapies will continue to serve as pivotal contributors to global respiratory disease management, driven by rapid interdisciplinary advancements in precision medicine.

Author contributions

LW: Writing – review and editing, Writing – original draft. GL: Writing – review and editing. JX: Writing – review and editing. DP: Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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