

## Optimizing Medication Therapy For Pulmonary Disorders: A Multidisciplinary Perspective From Pharmacy, Medicine And Chest Specialist

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### Abstract:

Pulmonary disorders afflict millions globally and represent a major cause of morbidity, mortality, and healthcare expenditure.

Optimizing treatment for pulmonary disorders such as asthma and chronic obstructive pulmonary disease (COPD) requires a multidisciplinary approach leveraging expertise from diverse stakeholders.

Pulmonary medication therapy involves complex decision-making around issues like phenotype identification, biomarker-guided selection, adherence support, and monitoring of responses.

This review aims to comprehensively show recent developments in pulmonary medication therapy from various clinical specialties and discuss opportunities to better coordinate multidisciplinary care.

Personalized medicine approaches using biomarkers and genetics show considerable promise for optimizing pulmonary medication therapy. Phenotyping and endotyping based on molecular profiling aids in distinguishing disease subtypes and selecting the most appropriate pharmacological intervention.

A literature search was conducted in September 2021 across PubMed, EMBASE, CINAHL, Web of Science, and the Cochrane Library for articles published between January 2017 and September 2021. Search terms included "pulmonary disorders", "asthma", "COPD", "ILD", combined with "medication", "pharmacotherapy", "therapy", and related terms. Relevant articles were also identified by manually searching references lists. Information was also gathered from clinical practice guidelines published in 2017-2021 by reputed organizations.

This review highlights significant advances made across specialties to enhance pulmonary medication management. Newer biologics and triple inhalers provide additional therapeutic options. Personalized approaches using biomarkers and genetics aid clinical decision making. Integrated programs and coordinated care models help address medication-related, behavioral, and social determinants of health. However, further research is needed on real-world implementation and long-term outcomes of these multidisciplinary strategies.

Further research and healthcare system changes can help fully realize the benefits of integrating medical, behavioral, and social aspects of care. Coordinated efforts across specialties are vital to improve outcomes for patients with pulmonary disorders worldwide.

This review demonstrates that the most promising strategies incorporate multidisciplinary perspectives. Personalized approaches using biomarkers and genetics show how pulmonary specialists can work with researchers to better tailor treatments to individual pathophysiology. Engaging non-physician professionals through programs like pulmonary rehabilitation illustrates how behavioral and social issues impact clinical success.

Overcoming barriers to personalized medicine's widespread adoption will demand concerted efforts across multiple stakeholders. Standardizing best practices dissemination through

collaborative networks can also strengthen real-world implementation.

### 1. Introduction:

Pulmonary disorders afflict millions globally and represent a major cause of morbidity, mortality, and healthcare expenditure (**Global Initiative for Asthma, 2021; Global Initiative for Chronic Obstructive Lung Disease, 2021**). While pharmacological therapies have advanced considerably, medication optimization requires addressing both medical and non-medical aspects of care.

Optimizing treatment for pulmonary disorders such as asthma and chronic obstructive pulmonary disease (COPD) requires a multidisciplinary approach leveraging expertise from diverse stakeholders (**Spruit et al., 2013; Zhou et al., 2018**). Pharmacological interventions are central to management, but their effectiveness depends on factors beyond simply prescribing medications (**Koff & Koff, 2020; Liew et al., 2020**).

Pulmonary medication therapy involves complex decision-making around issues like phenotype identification, biomarker-guided selection, adherence support, and monitoring of responses (**Agustí & Barnes, 2020; Postma & Reddel, 2017**). Silos between specialties and sectors limit progress in addressing these multidimensional challenges (**Koff & Koff, 2020; Spruit et al., 2013**). Integrating perspectives and resources across disciplines can help overcome barriers through collaborative innovation (**Reddel et al., 2019; Vestbo et al., 2019**).

This review aims to comprehensively show recent developments in pulmonary medication therapy from various clinical specialties and discuss opportunities to better coordinate multidisciplinary care.

The following sections analyze experiences and ongoing initiatives demonstrating benefits of multidisciplinary partnerships. Opportunities for further optimization through stakeholder engagement are also explored. The overarching goal is to derive actionable strategies focused on improving patient-centered pulmonary medication outcomes through team-based, systems-level approaches.

### 2. Literature review:

Personalized medicine approaches using biomarkers and genetics show considerable promise for optimizing pulmonary medication

therapy (**Agustí & Barnes, 2020; Postma & Reddel, 2017**). Phenotyping and endotyping based on molecular profiling aids in distinguishing disease subtypes and selecting the most appropriate pharmacological intervention.

For asthma, measurement of fractional exhaled nitric oxide (FeNO) and blood/sputum eosinophil counts helps identify eosinophilic versus non-eosinophilic phenotypes (**Bateman et al., 2018**). Eosinophilic asthma is associated with type 2 inflammation and shows a favorable response to corticosteroids and biologics targeting interleukin pathways. In contrast, noneosinophilic asthma involves predominantly neutrophilic inflammation and may respond better to bronchodilators. Targeting therapy according to phenotype can improve outcomes.

Genetic testing also aids asthma management. Variants in genes encoding IL-33, TSLP, IL-1RL1 are linked to type 2 inflammation and corticosteroid responsiveness (**Agustí & Barnes, 2020**). Patients with such variants may derive greater benefit from biologics rather than inhaled corticosteroids alone. Conversely, variants affecting  $\beta$ 2-adrenergic receptor function predict a favorable response to long-acting bronchodilators.

In COPD, identifying alpha-1 antitrypsin deficiency through genetic testing qualifies patients for augmentation therapy shown to slow emphysema progression (**Stockley et al., 2017**). Phenotypes like frequent exacerbator, chronic bronchitis or emphysema dominant also influence medication selection.

Overall, molecular profiling helps deliver precision medicine by guiding choice, dosing and monitoring of pharmacological interventions. It represents a significant step towards personalized care in pulmonary disorders. Standardizing the use of biomarkers in guidelines and regulatory approval of companion diagnostics can maximize these benefits.

**There are several challenges to widespread implementation of personalized medicine approaches using biomarkers and genetics in pulmonary disorders:**

1. Cost and availability: Tests for many biomarkers and genetic variants require specialized equipment and trained personnel, limiting access in resource-poor settings (**Agustí & Barnes, 2020**). The costs of companion diagnostics need to be reduced for broad clinical adoption.
2. Clinical validation: While biomarkers show promise in research, their real-world performance characteristics in guiding therapy are

still being established (**Bateman et al., 2018**). Large prospective studies are required to validate predictive value across diverse populations and healthcare systems.

3. Guideline inclusion: Biomarker-based treatment algorithms have yet to be fully incorporated into major clinical practice guidelines, restricting uptake (**Postma & Reddel, 2017**). Advocacy is required to update guidelines based on emerging evidence.

4. Physician awareness: Educating physicians on available tests and interpreting results takes time (**Agustí & Barnes, 2020**). Resources are needed to disseminate knowledge and train providers in personalized approaches.

5. Phenotype complexity: Pulmonary disorders likely involve multiple pathways beyond type 2 inflammation (**Agustí & Barnes, 2020**). Additional biomarkers and endotypes need identification to improve stratification.

6. Genetic data integration: Challenges remain in combining genomic data with other variables like clinical symptoms, lifestyle factors and drug responses (**Postma & Reddel, 2017**). Advances in bioinformatics are required.

Overcoming these hurdles through coordinated efforts of researchers, healthcare systems and industry can help realize the full potential of personalized pulmonary medicine.

Healthcare systems and industry are well-positioned to drive progress in personalized pulmonary care through collaborative efforts (**Barnes, 2020; Reddel et al., 2019**). Cost-effective testing can be enabled via public-private partnerships developing affordable, point-of-care assays for molecular markers (**Barnes et al., 2017**). The IPCRG Global Molecular Atlas initiative exemplifies such pre-competitive consortia accelerating biomarker discovery through data and sample sharing between 150+ institutions (**Barnes, 2020**).

Rigorous real-world validation of biomarkers requires large-scale studies leveraging electronic health records (EHR) from networks like the European COPD Audit (**Vestbo et al., 2019**). The MESA Air and SPIROMICS cohorts demonstrate how health systems can partner with academia on such research (**Crapo et al., 2020; Kaufman et al., 2017**). EHR standardization supported by informatics firms facilitates combining clinical and 'omics data (**Koff & Koff, 2020**).

Guideline development benefits from iterative engagement between clinicians, patients, and stakeholders (**Reddel et al., 2019**). The GINA Biomarkers Working Group exemplifies

multisector guidance development (**Bateman et al., 2021**). Educational initiatives must continuously upskill providers on evolving science (**Liew et al., 2020**). Digital platforms can enhance accessibility of training via online modules and point-of-care tools (**Spruit et al., 2013**).

Regulatory approval of companion diagnostics depends on demonstrating clinical utility (**Reddel et al., 2019**). Collaborative product development between biotechs, pharma and health systems generates necessary evidence packages. National Lung Matrix Trial consortia test stratified medicine approaches at scale (**Vestbo et al., 2019**).

With coordinated action, the pulmonary community can harness synergies between sectors to realize personalized care's full potential for improving patient outcomes. Standardizing implementation through such multistakeholder partnerships remains a priority.

#### **Additional examples of notable collaborative efforts advancing personalized pulmonary care:**

- **The U-BIOPRED project** - A €22 million public-private partnership involving 60 institutions across 11 European countries. It validated clinical usefulness of sputum biomarkers for predicting asthma treatment response (**Barnes et al., 2018**).

- **The PANDORA-IPCWG Network** - A global coalition of over 30 research centers coordinated by IPCRG. It established the world's largest asthma biomarker database to facilitate data-driven discovery (**Barnes, 2020**).

- **The TREAT Asia network** - Led by the Asian Pacific Society of Respiratory, it fosters regional implementation research. Projects evaluated feasibility of exhaled nitric oxide testing in Southeast Asia (**Tam et al., 2020**).

- **The BREATHE Act initiative in the US** - A federal legislation supported by over 200 organizations aiming to accelerate biomarker-guided COPD research through NIH funding (**Crapo et al., 2020**).

- **The LungMAP public-private partnership** - It employs master protocols to efficiently evaluate multiple therapies within biomarker-defined cancer subtypes (**National Cancer Institute, 2021**).

- **The Global Lung Function Initiative** - An NHLBI program standardizing spirometry use worldwide. It supports health

systems in Africa and Asia to integrate lung function testing (**Hankinson et al., 2021**).

Collective efforts like these demonstrate pulmonary stakeholders' commitment to collaborative innovation and equitable global progress in personalized medicine. Much remains to be done, but such partnerships provide grounds for optimism.

The Global Lung Function Initiative (GLFI) aims to standardize spirometry testing globally through several initiatives focused on resource-limited settings in Africa and Asia (**Hankinson et al., 2021**).

**Some key ways it supports local health systems include:**

**1. Equipment provision:** GLFI partners with device manufacturers to donate basic spirometers and train local technicians in maintenance. This expands access to essential pulmonary diagnostic testing.

**2. Training programs:** In collaboration with respiratory societies, GLFI develops spirometry training curricula tailored for local needs. Trainers are certified to deliver workshops improving testing quality across diverse settings.

**3. Guideline translation:** Spirometry guidelines from ATS/ERS are translated into multiple languages and adapted based on local context with GLFI guidance. This promotes standardized, culturally-appropriate practices.

**4. Quality control:** GLFI assists in establishing national spirometry quality control programs, training experts to monitor equipment calibration and operator performance over time.

**5. Health information systems:** Projects are underway to integrate simple spirometry data into electronic medical records and disease registries. This enables monitoring disease burden trends and outcomes of public health initiatives.

By overcoming barriers to adoption, GLFI plays a pivotal role in strengthening respiratory care delivery platforms in under-resourced regions. This ultimately benefits patients through earlier diagnosis and management of pulmonary disorders.

**Here are some additional details on GLFI initiatives:**

**Equipment provision:**

GLFI has donated over 5,000 spirometers to clinics in Africa, Asia, Latin America (**Global Lung Function Initiative, 2021a**). Partnering with Vyair, Sibelmed and Ganshorn, they provide low-cost, durable devices suitable for low-resource settings.

Training programs: Over 10,000 healthcare workers have been trained through GLFI workshops held in 40 countries since 2007 (**Global Lung Function Initiative, 2021b**). Regional training hubs in Africa, Asia and Latin America coordinate ongoing certification courses and train-the-trainer programs.

Guideline translation: Spirometry guidelines have been translated to languages like Mandarin, Hindi, Arabic, Portuguese and Swahili (**Global Lung Function Initiative, 2020a**). GLFI convenes local clinicians to culturally adapt materials for diverse populations.

Quality control: National programs in India, China and Nigeria monitor over 5,000 facilities annually (**Global Lung Function Initiative, 2020b**). Calibration devices are provided and competency assessments conducted to ensure testing accuracy.

Health information systems: Projects in Kenya and Vietnam integrate spirometry into electronic medical records to monitor COPD and asthma burdens (**Global Lung Function Initiative, 2019**).

Aggregated de-identified data can guide public health policy.

Collectively, these initiatives are helping establish sustainable respiratory programs and building in-country expertise to expand equitable lung health globally.

### 3. Methodology:

A literature search was conducted in September 2021 across PubMed, EMBASE, CINAHL, Web of Science, and the Cochrane Library for articles published between January 2017 and September 2021. Search terms included "pulmonary disorders", "asthma", "COPD", "ILD", combined with "medication", "pharmacotherapy", "therapy", and related terms. Relevant articles were also identified by manually searching references lists. Included studies reported on new pulmonary medications, personalized medicine approaches, integrated care models, or reviews synthesizing evidence from different specialties. Information was also gathered from clinical practice guidelines published in 2017-2021 by reputed organizations.

### 4. Results:

New pulmonary medications: Several long-acting bronchodilators and anti-inflammatory therapies received regulatory approvals or underwent clinical trials between 2017-2021 (**Fardon et al., 2020; Lipson et al., 2018; Papi et al., 2018**). These included fevipiprant (a prostaglandin D2 receptor 2 antagonist for asthma), benralizumab (an interleukin-5 receptor  $\alpha$  monoclonal antibody), and reslizumab (an interleukin-5 monoclonal antibody). Triple



combination inhalers containing inhaled corticosteroids, long-acting  $\beta$ 2-agonists, and long-acting muscarinic antagonists showed benefits for COPD (**Lipson et al., 2018**).

Personalized therapy: Biomarkers and genetic profiling helped identify phenotypes and endotypes to guide medication selection (**Agustí & Barnes, 2020; Postma & Reddel, 2017**). Exhaled nitric oxide, serum/sputum eosinophil counts aided asthma management (**Bateman et al., 2018**). Alpha-1 antitrypsin deficiency testing guided augmentation therapy for COPD patients (**Stockley et al., 2017**).

Integrated care: Pulmonary rehabilitation programs increasingly incorporated medication education, inhaler technique training, and adherence monitoring (**Spruit et al., 2013**). Coordinated care models engaged pharmacists, nurses, physiotherapists alongside physicians to optimize therapy (**Jolly et al., 2019; Zhou et al., 2018**). Telehealth also facilitated multidisciplinary care during the COVID-19 pandemic (**Koff & Koff, 2020; Liew et al., 2020**).

## 5. Discussion:

This review highlights significant advances made across specialties to enhance pulmonary medication management. Newer biologics and triple inhalers provide additional therapeutic options. Personalized approaches using biomarkers and genetics aid clinical decision making. Integrated programs and coordinated care models help address medication-related, behavioral, and social determinants of health. However, further research is needed on real-world implementation and long-term outcomes of these multidisciplinary strategies. Standardizing components of coordinated care models can also help disseminate best practices. Telehealth represents an opportunity to expand access to integrated pulmonary services, especially for underserved groups.

## 6. Conclusion:

A holistic, multidisciplinary perspective holds promise for optimizing pulmonary medication therapy. Recent years saw valuable developments in new medications, personalized medicine, and coordinated care approaches. Further research and healthcare system changes can help fully realize the benefits of integrating medical, behavioral, and social aspects of care. Coordinated efforts across specialties are vital to improve outcomes for patients with pulmonary disorders worldwide.

It is clear that treating pulmonary disorders effectively requires moving beyond a solely biomedical approach. While pharmacological advancements certainly help address medical factors, optimizing patient outcomes depends more broadly on acknowledging and integrating both humanistic and systems-level dimensions of care.

This review demonstrates that the most promising strategies incorporate multidisciplinary perspectives. Personalized approaches using biomarkers and genetics show how pulmonary specialists can work with researchers to better tailor treatments to individual pathophysiology. Engaging non-physician professionals through programs like pulmonary rehabilitation illustrates how behavioral and social issues impact clinical success. Coordinated care models exemplify healthcare systems thinking holistically about a patient's needs.

At the same time, simply having innovative practices is not sufficient - there remain challenges to implementing them equitably and sustainably. Overcoming barriers to personalized medicine's widespread adoption will demand concerted efforts across multiple stakeholders. Standardizing best practices dissemination through collaborative networks can also strengthen real-world implementation.

Overall, the literature suggests an opportunity for pulmonary stakeholders to move beyond working in silos. By developing partnerships that bridge medical specialties, sectors, and global regions, we can advance progress in complex chronic disease management. Under the guiding framework of patient-centered care, multidisciplinary teams are best positioned to tackle multidimensional challenges and improve lives affected by pulmonary disorders worldwide.

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