



ERS | *monograph*

COPD in the 21st Century

Edited by Jadwiga A. Wedzicha,
James P. Allinson and
Peter M.A. Calverley

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Editor in Chief
Peter M.A. Calverley

This book is one in a series of *ERS Monographs*. Each individual issue provides a comprehensive overview of one specific clinical area of respiratory health, communicating information about the most advanced techniques and systems required for its investigation. It provides factual and useful scientific detail, drawing on specific case studies and looking into the diagnosis and management of individual patients. Previously published titles in this series are listed at the back of this *Monograph*.

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Preface

Christian B. Laursen 

Since the term COPD was introduced in the mid-20th century, the efforts of researchers, clinicians and patients have combined to significantly increase the awareness, understanding, prevention and treatment options of the disease. Despite these advances, COPD remains a major cause of ill health, disability, healthcare costs and premature mortality on a global scale. Prejudice, inequality and lack of awareness of COPD at a societal level remain important factors that need to be addressed in many countries.



The primary aim of this *Monograph* is to provide the reader with a concise overview of the current knowledge and understanding of COPD. As such, it will certainly be of interest to readers with less experience of COPD who wish to gain a broad yet concise overview of COPD. But as the Guest Editors have carefully selected a team of authors with expertise at the highest international level, readers who consider themselves specialists in the field will also find many useful pearls of wisdom in each of the individual chapters.

The first chapter of the *Monograph* addresses the patient's perspective on living with COPD and their priorities for future research and care. This chapter is an excellent example of why we as healthcare workers and researchers need to ensure and actively encourage patient involvement in healthcare and research. Viewed from one angle, the chapter is a sobering reminder of the areas in which we have so far failed in our effort to help and support our patients. Yet, if used as a beacon for progress, the chapter provides a strategic road map to ensuring the further improvement of the current healthcare system and research, to the benefit of patients in the future.

As the Deputy Chief Editor of the *ERS Monograph*, it has been a real pleasure to act as chief editor for the Guest Editors Jadwiga A. Wedzicha, James P. Allinson and Peter M.A. Calverley, who I think have done a brilliant job. My sincere thanks and appreciation to them and all the involved authors for producing this excellent and much-needed *Monograph*. An additional thank you to all the

“nameless” expert peer reviewers involved in the process, who provided feedback for each chapter, thereby ensuring the *Monograph* is of highest possible quality.

I sincerely hope that you enjoy reading this *Monograph* and, more importantly, use the many insights provided to ensure better patient care in this field.

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Guest Editors

Jadwiga A. Wedzicha

Jadwiga A. Wedzicha is Professor of Respiratory Medicine, Head of the Respiratory Division at the National Heart and Lung Institute (Imperial College London, London, UK), Consul at Imperial College and Honorary Consultant at the Royal Brompton and Harefield Hospitals (London, UK). She qualified from Somerville College (Oxford University, Oxford, UK) and St Bartholomew's Hospital Medical College (University of London, London, UK). She was elected as Fellow of the Academy of Medical Sciences (FMedSci) and is a fellow both of the American Thoracic Society (ATS) and the European Respiratory Society (ERS). She received the Helmholtz International Fellow Award in 2014.



Professor Wedzicha has a major interest in the causes, mechanisms, impact and prevention of COPD exacerbations, and in the role of bacterial and viral infection in COPD exacerbations. She directs an active research group specialising in COPD exacerbations, and has published extensively on this topic. She also directs the British Lung Foundation Early COPD Cohort.

Professor Wedzicha was Editor-in-Chief of *Thorax* from 2002 to 2010, and until March 2022 she was Editor-in-Chief of the *American Journal of Respiratory and Critical Care Medicine*. She was the *Lancet* Ombudsman until 2014, Publications Director for the ERS and has also previously been ERS Guidelines Director. She is a member of the GOLD Scientific Committee.

James P. Allinson

James P. Allinson is Consultant Respiratory Physician at the Royal Brompton Hospital (London, UK) and an honorary Senior Clinical Lecturer at the National Heart and Lung Institute (Imperial College London, London, UK).

Dr Allinson graduated from the University of Oxford (Oxford, UK) in 2005. He trained in respiratory and general medicine in London and was awarded a PhD from Imperial College London in 2018.



Dr Allinson leads research exploring how COPD and lung health develop across the life course, aiming to find ways to improve the

treatment of those with established disease. Clinically, he subspecialises in the fields of advanced COPD and respiratory failure.

Peter M.A. Calverley



Peter M.A. Calverley is Emeritus Professor of Respiratory Medicine at the University of Liverpool (Liverpool, UK) and continues to work in the Institute of Life Courses and Medical Science (University of Liverpool). His research interests focus on the pathophysiology and management of COPD, and he has published over 500 papers and several textbooks, as well as lecturing widely on these topics.

Professor Calverley has been an Associate Editor of the *European Respiratory Journal*, *Thorax* and the *American Journal of Respiratory and Critical Care Medicine*. He is currently Chief Editor of the *ERS Monograph*. Professor Calverley has chaired the scientific committee of the British Lung Foundation, the British Sleep Society and the Clinical Physiology Assembly of the European Respiratory Society (ERS) and was a member of the ERS Executive Committee. He was a founder member of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) and chaired its Dissemination Committee and Scientific Committee. He was President of the British Thoracic Society (BTS) in 2006, co-chaired the External Reference Group advising Ministers on the content of the COPD Clinical Service Strategy, and chaired the Respiratory Specialty groups of the UK Comprehensive Clinical Research Network until 2015. He currently Chairs the UK BEACON study (British Early COPD Network), researching the origins of COPD in young adults.

Professor Calverley is a Fellow of both the London and Edinburgh Colleges of Physicians and of the Academy of Medical Sciences, ERS and the American Thoracic Society. In 2023, he received the BTS medal for outstanding contributions to respiratory medicine.

Introduction

Jadwiga A. Wedzicha^{1,2}, James P. Allinson^{1,2} and Peter M.A. Calverley ³

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COPD still causes substantial morbidity and mortality in millions of people around the world. This Monograph outlines our growing understanding of COPD and highlights the cutting edge of research and care for this common illness. <https://bit.ly/ERSM103intro>

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COPD remains a major cause of ill health, disability, healthcare costs and premature mortality. This is not due to lack of effort on the part of clinicians and scientists. In 1950, 76 new papers were published that used the term chronic obstructive pulmonary disease, 76 that used the term emphysema and 13 that used the term chronic bronchitis. By 1980, the numbers had risen to 350, 255 and 32, respectively. In 2020, 6024 papers were published using the now preferred term, COPD. Even allowing for duplicate publication in different languages, this represents a significant effort across many countries to understand this important respiratory disease and it has yielded positive results. As we reach the “other side” of the COVID-19 pandemic and old concerns begin to reassert themselves in our clinical practice, it feels like an appropriate time to take stock of where we are in the long struggle against COPD and consider what the future might bring.

That is what we have tried to do in this issue of the *ERS Monograph*. We begin at the heart of the matter, with the patient’s perspective on COPD [1]. This may make for uncomfortable reading as it is clear that despite our best efforts, we are still falling short of our patients’ rightful expectations. Next we survey our progress up to the time just before the pandemic began, considering how our understanding of COPD has evolved and how it has been driven by prevailing medical concepts. The tools available to interrogate the illness and insight provided by the results of therapeutic trials, which were not always successful, are also considered [2].

Defining COPD has been a recurring problem, which has limited our understanding considerably. This topic is addressed in detail in chapter 3 [3]. A particular challenge for both patients with COPD and their carers is the long and variable time-course of this condition. With the advent of large datasets, in which spirometry data have been collected in population samples, multiple disease trajectories have been identified. This complex but important topic is reviewed in chapter 4 [4]. Changes in the incidence and prevalence of COPD, perhaps reflecting its multifactorial origins, are reviewed in chapter 5 [5]. Clinical COPD is characteristically accompanied by multimorbidity, with some conditions sharing common mechanistic pathways with COPD. One of the most frequent and important of these is cardiac disease, and this is the topic of chapter 6 [6].

The next chapters look at the mechanisms that underlie the lung damage that is present at all stages of COPD, examining new approaches to using simple biomarkers to understand the impact of the disease and identify endotypes that might respond to specific treatment. The cellular and signalling mechanisms that operate in COPD-related inflammation are addressed in chapter 7 [7]. New insights into the importance of the microbiome in COPD are offered in chapter 8 [8], while the recent studies that have led us to reappraise the importance of chronic bronchitis in the natural history of COPD are considered in chapter 9 [9]. The role of the eosinophil, a marker of T-helper cell 2-mediated inflammation, is reviewed in chapter 10 [10]. Chapter 11 addresses the rapidly changing role of imaging as a way to understand, stratify and identify COPD, not only when advanced disease is present but at a stage before spirometric abnormality is present [11]. Finally, advances in computing and bioengineering have led to the development of new tools that can evaluate lung mechanics and gas exchange noninvasively during tidal breathing. The potential of this approach as a diagnostic and descriptive tool is the topic of chapter 12 [12].

As knowledge about COPD and its management has grown, so too has the need to evaluate and understand this growing body of evidence. Of the resulting treatment strategies, the most influential has been the Global initiative for Chronic Obstructive Lung Disease (GOLD). In chapter 13, two of the leaders of this process review how this group operates and its priorities in decision-making [13]. In chapter 14, the evidence that underpins the use of bronchodilators and ICS in COPD is reviewed in detail [14], while in chapter 15 the possibility of new transformative therapies is considered [15]. COPD care is multimodal and there is abundant evidence that improving physical fitness and mental well-being allows patients with COPD to live better lives. The changing face of pulmonary rehabilitation and its application in different economic settings across the world is the topic of chapter 16 [16].

Exacerbations of COPD are crucial drivers of worse health status and deterioration in lung function. Our knowledge of these events has grown steadily in the last two decades. The latest understanding of the nature of these episodes and their impact on the patient is reviewed in chapter 17 [17], while their acute management is addressed in chapter 18 [18]. Patients with advanced COPD face severe difficulties but in selected cases, these can be alleviated by the use of noninvasive mechanical ventilation, the topic of chapter 19 [19]. For others, medical lung volume reduction using a variety of endoscopic approaches can improve their lung function and health status considerably. This exciting field is the focus of chapter 20 [20].

Our final chapter considers the topics not already addressed that we believe will be important research areas in the future, together with new trends that are likely to be important in the way we approach this condition [21].

We hope that taken together the chapters in this issue of the *Monograph* provide an up-to-date overview of what is happening in the wide field of COPD research, both at a basic and clinical level. We are very grateful to our many distinguished contributors for their help in creating what we hope you will find to be a useful addition to the *Monograph* series.

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List of abbreviations

AECOPD	acute exacerbation of COPD
BAL	bronchoalveolar lavage
COVID-19	coronavirus disease 2019
CRP	C-reactive protein
CT	computed tomography
DPI	dry-powder inhaler
FEV₁	forced expiratory volume in 1 s
FVC	forced vital capacity
ICS	inhaled corticosteroid
ICU	intensive care unit
Ig	immunoglobulin
IL	interleukin
LABA	long-acting β -agonist
LAMA	long-acting muscarinic antagonist
LLN	lower limit of normal
LMICs	low- and middle-income countries
MDI	metered-dose inhaler
RCT	randomised controlled trial
RV	residual volume
SABA	short-acting β -agonist
SAMA	short-acting muscarinic antagonist
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
TLC	total lung capacity