Invited review

ERS International Congress 2023: highlights from the Respiratory Infections Assembly


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ERS International Congress 2023: highlights from the Respiratory Infections Assembly

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Take home message

This highlights article provides valuable insight into the latest scientific data and updates in clinical practice from Assembly 10 at the ERS 2023 Congress

Abstract

This year’s European Respiratory Society Annual Congress 2023 took place on a hybrid platform, with participants joining online and in-person, in Milan, Italy. The congress welcomed over 20,000 attendees, bringing together exciting updates in respiratory science and medicine from around the world. In this article, Early Career Members of the Respiratory Infections Assembly 10 summarise a selection of sessions across a broad range of topics, including presentations on bronchiectasis, nontuberculosis mycobacteria, tuberculosis, cystic fibrosis and COVID-19.

Introduction

The European Respiratory Society International Congress took place in Milan, Italy, in September 2023. The congress welcomed over 20,000 attendees on a hybrid platform, bringing together exciting updates in respiratory science and medicine from all over the globe. Following each congress, Early Career Members of the Respiratory Infections Assembly produce a highlights article, summarizing interesting sessions from Assembly 10 (1-3). This year’s article features sessions across a broad range of topics, including presentations on pneumonia, COVID-19, bronchiectasis, nontuberculous mycobacteria (NTM), tuberculosis (TB) and cystic fibrosis.

Group 10.01: Respiratory infections and bronchiectasis

State of the Art session. Management of respiratory infections: the future and the present

Paul G. Thomas (USA) opened the session by discussing the fundamental role of lung fibroblasts in maintaining extracellular matrix (ECM) integrity against the recruitment of immune cells (4). Distinct fibroblast activation states include the ECM-synthesising, damage-responsive and interferon-responsive types. Persistent activity and differentiation to myofibroblasts at late stages of viral infection predispose to chronic inflammation and fibrosis, mediated by ADAMTS4 matrix proteinase (5). Detected in lower respiratory tract samples, ADAMTS4 indicates unfavourable outcomes in healthy individuals with influenza or SARS-CoV-2, promoting inflammation and matrix degradation. Its downregulation potentially improves outcomes without impeding viral clearance. ADAMTS4 exerts protective activity against Streptococcus pneumoniae-induced acute airway inflammation, allowing prompt neutrophil migration in bacterial infections. Development of adjunctive fibroblast-targeted agents may enhance respiratory infections management.

Sanjay Haresh Chotirmall (Singapore) explored the lung microbiome as part of a holistic approach to chronic respiratory disease endo-phenotyping (6). Dysbiosis of the microbiome (7-11) and disrupted lung-gut axis driven by the presence of Pseudomonas (12) in the lungs are associated with disease severity and poor outcomes in stable disease. Neisseria subflava, although previously considered commensal, is pathobiont in bronchiectasis (13), while air-fungal sensitisation correlates with worse COPD outcomes (14), outlining the impact of environmental exposure (15). Microbiome identity
profiles remain stable during exacerbations, comprising a conserved “core” part and an ancillary part of exacerbation-related pathogens which alter functional composition (16, 17). Antimicrobial resistance patterns constitute distinct “resistotypes” (18), which are modifiable by antimicrobials. Future antimicrobial clinical trials may warrant stratification by microbiomes to detect key outcomes.

Christophe Carnoy (France) introduced the European FAIR project inaugurating an adjunctive immunomodulatory approach to antimicrobial-resistant bacterial pneumonia, based on flagellin (19, 20). Refined by simulation platforms, preclinical experiments were confirmatory against different pathogens and yielded relevant biomarkers (multiomics). Aerosol delivery of the FLAMOD product minimises the systemic impact and required dose. The project is currently conducting toxicology studies in non-human primates, showing homogeneous airway deposition and good tolerance. Scheduled in 2024, a randomized controlled phase 1 dose-escalating trial will assess safety and determine the lowest dose in healthy volunteers. Stratification markers will disclose the target pneumonia population (BIO-PNEU clinical study), while both a patient and clinician cohort exhibit promising prospective acceptability.

Jessica Rademacher (Germany) encouraged vaccination in children and adults to prevent S. pneumoniae severe infections and related COPD and asthma exacerbations. Covering more serotypes, a single-dose PCV20 vaccine suffices in adults (21), but sequential PCV15-PPSV23 vaccination is also recommended as per the latest Advisory Committee on Immunization Practices (ACIP). Patients with COPD should receive both pneumococcal and influenza vaccination (22), but commonly refrain due in part to a lack of recommendation by physicians (23). Apart from the seasonal pandemic and exacerbations of chronic diseases, influenza vaccination also prevents acute cardiovascular events (24). The adjuvanted MF59 (25) and high dose hemagglutinin (60mcg) (26) vaccines have established effectiveness. To date, two protein-based vaccines against respiratory syncytial virus (RSV) are licensed. A single dose may be administered in adults ≥60 years based on shared clinical decision-making and in individuals at increased risk for severe disease (ACIP). We anticipate the upcoming follow-up results from RSVPreF3 OA phase 3 trial, along with novel vaccines (27, 28).

Acute Respiratory Infections: What’s New? Respiratory medicine meets other disciplines

This oral session was a joint ERS/European Scientific Working Group on Influenza (ESWI) collaboration. The session aimed to provide an update about the latest data on the evolution, epidemiology, pathogenesis, prevention and treatment of influenza, COVID-19 and other respiratory viral infections; to discuss the disease pathogenesis with a focus on systemic and mucosal biomarkers; and to discuss strategies to prevent infection by vaccination and management of viral infections.

The session started with Collin Russell (Netherlands) showing evidence that seasonal respiratory virus epidemics have returned as major public health burden, after a significant reduction during COVID-19 pandemic. Data reveals that influenza and SARS-CoV-2 have both evolved during the last three years (29). Results from RSV in healthy term-born infants demonstrated that RSV leads to the
hospitalisation of one in every 56 healthy infants and that immunisation of pregnant woman is a key step to reduce the health-care burden (30).

Peter Openshaw (United Kingdom) focused his talk on the mucosal immune response against these respiratory viruses (31). The comparison between the systemic immunity, induced by intramuscular vaccines, and the mucosal immunity, induced by nasal vaccines, demonstrated the compartmentalization of the immunity. The studies presented during this talk, such as ISARIC 4C and PHOSPH-COVID, provided unique insights into the need for monitoring local mucosal immunity by using nasosorption devices (32).

Regarding prevention, Hanna Nohynek (Finland) discussed the latest updates on the vaccines against respiratory infections, including COVID-19, invasive pneumococcal disease (IPD), influenza and RSV. Very few respiratory infections were diagnosed during COVID-19 pandemic, but they are now returning and efforts are needed to work on vaccine prevention. For COVID-19, the long-term aim is to develop a broadly protective coronavirus vaccine (33). For IPD, influenza and RSV new vaccines are in development using the newest technology and with different target indication, especially for IPD (pediatric, maternal or elderly) (34). In conclusion, countries need to make a decision on the vaccine implementation and to speed up several key steps that participate in the vaccine approval. Therefore, although progress is underway, more work is still needed.

Finally, the session finished with the talk of Maxime Patout (France) focused on new insights for the management of non-COVID-19 respiratory infections. The clinical benefits for three different types of treatments, such as prone positioning, continuous positive airway pressure (CPAP) and steroids were reviewed (35-37). Data suggested that there is not enough evidence to support their use in non-severe COVID-19 patients. Therefore, more randomized control trials are needed to elucidate their use and personalized medicine may help in the management of respiratory infections.

A general overview of the concept of preconception origins of respiratory disease: what is the epidemiological evidence so far?

This session consisted of four talks, showcased the paradigm that respiratory health and disease influenced by factors acting before conception (38).

Cecilie Svanes (Norway) summarized the main epidemiological findings in different human cohorts and gave an overview of the main factors associated with respiratory disease in the future child. Based on data from the multigenerational RHINESSA study, the prospective children of boys who started to smoke before the age of 15 have a higher risk of asthma and lower lung function (39). Potential underlying mechanisms were answered by the RHINESSA cohort on the effect of a father’s preconception smoking, in which Svanes et al. found that overall 19 DNAm changes were detected across 14 genes in children of pubertal onset smokers, associated with offspring outcomes in asthma, wheezing, and BMI (40). Mothers’ exposure to cleaning agents long before conception are risk factors for offspring wheezing and asthma (41). From both the maternal and paternal sides, tuberculosis or helminths increase the risk of respiratory disease, relating to both epigenetic and cell immunity changes (42). The main factors leading to altered phenotypes in the offspring are summarized in Figure 1.
William Horsnell (United Kingdom) described murine models used to establish the long-term effects of maternal vaccination, the mechanisms that may support these effects, and the influence of the maternal immunity transfer to offsprings. Offsprings of unvaccinated (MU) or PCV-13 vaccinated (MV) H2Dd/H2Kb female mice were infected with S. pneumoniae strains. Offsprings of MV mothers had lower bacterial burden and a high level of maternal protection associated with raised levels of vaccine-specific antibodies. In line with the theory of fetomaternal microchimerism (43), WT offsprings born to MV IL-4R−/− mother did not acquire maternal B cells and had impaired antibody protection. Briefly, the data suggests that maternal vaccination causes long-lasting antibody-mediated immunity and via B cell maternal microchimerism cell immunity transferred to the offspring can be a determining factor in future immune responses.

Anthony J. Hannan (Australia) presented a brief overview of transgenerational epigenetic factors that influence future offsprings’ disease susceptibility. In a murine model paternal stress and elevated glucocorticoid exposure induced changes in the miRNA profile of paternal sperm, triggering anxiety in male offsprings, and small RNA analysis of sperm showed elevated levels of small noncoding RNAs related to growth factors (44). The epigenetic state of the sperm can drive transcription of the embryos and transfer intergenerational information (45). The epigenetic inheritance can be altered by DNA methylation at imprinted genes, sperm small non-coding RNAs, and long-coding RNAs, all can influence offspring phenotypes. A mice model with Toxoplasma gondii provided evidence that paternal infection can cause changes in sperm’s small RNA profile and demonstrated behavioural changes via intergenerational inheritance (46).
Finally, Maria Lerm (Sweden) provided insights into the main methods in the investigations of DNA methylation and her research in connection with tuberculosis and COVID-19 exposures. Bacillus Calmette Guérin (BCG) – vaccinated subjects showed epigenetic reprogramming, altered DNA methylation of immune cells, resulting in enhanced anti-mycobacterial immunity (47). Moreover, SARS-CoV-2 can bring about long-standing favourable changes in DNA methylation patterns, associated with better recovery and antiviral immunity (48). Protection against infections can be transferred across generations, but data about the future DNA methylation pattern in the offspring is lacking (49). Professor Lerm investigated the PBMCs of babies whose mothers had COVID-19 and unveiled that various genes have epigenetic modifications. Preliminary results suggest that epigenetic rewiring can be a decisive factor in the protection against infections in the offspring.

War, climate change, migration and respiratory infections

This oral session discussed some of the urgent interconnected problems influencing respiratory medicine all over the world.

Giovanni Battista Migliori (Italy) started the discussion with a report about the acute respiratory infections in crisis affected populations. In a number of recent wars and natural disasters, the death toll can be driven by “indirect” factors. This can include the increased risk of disease and case-fatality brought about by conditions such as displacement into overcrowded camps, food insecurity and breakdown of public health services rather than the direct effects of the crisis. The majority of acute respiratory infection (ARIs) deaths are driven by acute lower respiratory infections (ARLI), mainly pneumonia. Nearly all severe ARLI episodes occur in children under 5 years, the elderly and the immunocompromised. In children, viral aetiology accounts for 25-50% of pneumonia cases, predominantly driven by RSV, parainfluenza and influenza viruses. Approximately 50% of cases include either a primary or secondary bacterial infection (50). At the same time overcrowded conditions in refugee centers contributed to increase ARI incidence rate, measles transmission and tuberculosis detection. This is due in part to the destruction of health care services, exposure to high pathogen densities, aggravating weather conditions, regional disease endemicity and low vaccination coverage (51). Migliori highlighted the effects of war on the transmission of tuberculosis, using a World War I transmission model; war lead to a two-fold risk of developing tuberculosis, longer infections cycles and increased multidrug resistance. It is estimated that worldwide, in 2019 there were 272 million migrants out of a global population of 7.7 billion – 1 in every 30 people (52).

ERS President, Carlos Robalo Cordeiro (Portugal), continued the session with a speech about climate change and respiratory infections, showing that air pollution and climate change are ranked as the World Health Organisation’s number one threat to global health (53). Cordeiro highlighted that air pollution and climate change as well as vaccine hesitancy (54) contribute to the development of respiratory disease. Climate change can lead to health impacts directly, through factors such as heat stress and flood damage, indirectly, through disease vectors, and also through economic and social disruption. These factors are associated with increases in mortality, hospital and ICU admission and visits to general practice. Recently published evidence suggests that climate change can have a direct impact on the sustainability and susceptibility of viral infections, through reductions in anti-viral response, changes to cell surface receptor expression and viral entry, and disruption to epithelial barrier function (55). On the topic of air pollution, a recent joint workshop report from the ERS,
International Society for Environmental Epidemiology, Health Effects Institute and World Health Organisation found that long term exposure to outdoor air pollution can increase the risk of infection and death from COVID-19 (56). Finally, Cordeiro concluded with the ERS commitment to sustainability, outlining the work that the ERS has committed to sustainable practices and climate protection projects.

Marijike Proesmans (Belgium) considered effect of climate changes and migration on infection in the pediatric population by epigenetic modifications, placental effects, endocrine and immunological changes, and particulate matter transplacental translocation. Maternal exposure to indoor pollution showed long term outcome effects, including reductions in FEV₁ and increased wheeze over 5 years (57). She also mentioned positive correlation between ambient extreme heat and pediatric morbidity due to pediatric infections and asthma (58).

Finally, Denniz Falzon (Switzerland) named COVID-19 a principal point of strong connection between health injury and increased in migration. He showed that the major factors that drive the health of refugees and migrants were: leadership and governance, financing, service delivery, access to medical products, vaccines and technologies, health information systems, health workforce (59).

**Bronchiectasis**

The session on Bronchiectasis began with a late-breaking abstract of a multicenter study presented by Lianjun Lin (China). Lin demonstrated the potential for bronchoalveolar lavage fluid amylase levels as a highly sensitive and specific clinical biomarker for the diagnosis of aspiration, a known bronchiectasis aetiology which is notoriously difficult to diagnose (60).

The session included a wide array of cutting-edge data stemming from the EMBARC registry. Amelia Shoemark (United Kingdom) presented exciting translational data from the EMBARC-BRIDGE study highlighting distinct metabolomic differences in the neutrophils of bronchiectasis patients versus healthy, age-matched controls, and that metabolomic profiles change according to disease severity. Jennifer Pollock (United Kingdom) presented EMBARC registry data showing that inhaled corticosteroids (ICS) significantly reduce exacerbations and hospitalisations in bronchiectasis patients with a blood eosinophil count >300 cells/µL, with no obvious relationship with mortality, a finding which may advance the development of clinical trials of ICS in this eosinophilic sub-group. Letizia Traversi (Spain) also presented registry data identifying the significant over/misdiagnosis of COPD in bronchiectasis patients and that the ROSE criteria (61) is a reliable and robust tool for diagnosing COPD-bronchiectasis overlap, a clinically-meaningful population shown here to be more clinically severe.

Further advocating for tools for more robust diagnostics, Alejandro A Diaz (USA) presented interesting data advocating for the inclusion of artificial intelligence (AI)-based lung imaging in identifying bronchiectasis in those with COPD, and that COPD individuals with suspected bronchiectasis had increased all-cause mortality, further reinforcing the clinical severity of the COPD-bronchiectasis overlap.

As well as the EMBARC registry, data from the UK Bronchiectasis registry was also shared. Jennifer Pollock (United Kingdom) gave a second presentation drawing attention to the prevalence and
clinical impact of psychological morbidity in those with bronchiectasis, where anxiety and depression were common and associated with clinical severity and poor outcomes, and the importance of psychological screening in bronchiectasis care.

Impressive results using clinical samples from two key bronchiectasis clinical trials were also shared. Using samples from the Phase II WILLOW trial of Brensocatib (62), Lidia Perea (Spain) showed that Brensocatib significantly increases airway levels of Secretory Leukocyte Protease Inhibitor (SLPI), an anti-protease which may dampen the inflammatory response seen in those with bronchiectasis. In addition, using samples from the iBEST trial of inhaled tobramycin (63), Michael Tunney (United Kingdom) confirmed that qPCR can effectively detect specific pathogens, such as *P. aeruginosa*, within clinical samples and has potential as an effective clinical trial endpoint in investigations concerning antimicrobials.

Rebecca Hull (United Kingdom) went on to highlight the extreme heterogeneity of *P. aeruginosa* clones isolated from bronchiectasis patients and that specific variants within these clones are associated with increased biofilm formation or, alternatively, reduced growth *in vitro*, findings with potential implications for future anti-pseudomonal therapies.

Rounding off the session, Ivan Barone (Italy) gave an excellent overview of the impact of cardiovascular events in those with bronchiectasis, emphasizing a strong association between both conditions and a prominent need for screening and a multidisciplinary care approach in bronchiectasis.

**Group 10.02: tuberculous and nontuberculous mycobacterial disease**

**Advances in the epidemiology, diagnosis and treatment of tuberculosis and non-tuberculous mycobacterial disease**

In this oral session, 9 presenters each gave a 5-minute presentation about their work on TB and NTM.

Ole Skouvig Pedersen (Denmark), presented a meta-analysis on global treatment outcomes of extensively drug resistant (XDR)-TB (64). In an analysis of 94 studies with 10223 patients recruited from 2005 to 2023, the authors reported a pooled success of 44.2%, with a slight improvement after 2013. Management of multi-drug resistant (MDR)-TB was discussed by Nana Kiria (Georgia), reporting safety and efficacy of the BPaL (65) regimen in Georgia in a retrospective study of 16 patients who all achieved sputum conversion after a mean of 33 days, with only 4 patients experiencing adverse effects.

Karen Wolmarans (South Africa) gave preliminary data on lung function and PET/CT findings in a cohort of 106 patients with clinical response to TB treatment and a negative sputum culture for TB after 16 weeks of treatment. They found that patients with persistent lung inflammation, defined as SUV >50 with PET/CT scans, had a statistically relevant lower diffusing capacity, FEV1 and FVC. Lung function tests as a mean of addressing post TB lung disease (66) were also the subject of a meta-analysis from Sharena Ratnakumar (United Kingdom). Data from 13 studies reporting on 62932 patients showed that TB survivors have significantly decreased lung function compared to healthy controls, with FEV1 more affected than FVC.
A case series from Jee Wang Kim (United Kingdom) showed outcomes following PET-CT and targeted invasive sampling in four asymptomatic immunocompetent household pulmonary TB contacts with normal chest x-rays. The study found metabolically active culturable TB infection, prior to features of subclinical disease becoming evident with clinical screening.

Mirae Park (United Kingdom) analysed the diagnostic accuracy of TB PCR testing for the detection of mycobacterium tuberculosis in BAL samples in culture positive pulmonary TB cases and found it more accurate than smear microscopy.

Dong Nguyen Van (Viet Nam) presented a meta-analysis of two- versus three-drug regimens in the treatment of mycobacterium avium (67). Seven RTCs were examined comparing efficacy of the two treatments regarding bacteriological responses, mortality, and acquired macrolide resistance, and no statistically relevant differences were found. Yann-Yuan Wang (Taiwan) explored in a prospective multicentre study the application of electronic nose, a breathomics analyser (68), in the clinical assessment of patients with confirmed NTM colonisation. Accuracy of eNose in confirming NTM pulmonary disease, measured as area under curve, was similar to that of an expert panel. Ying Na Ho (Singapore) presented a study of longitudinal 7 years follow-up of lung functions in patients affected by mycobacterium abscessus pulmonary disease (MAPD) (67). Patients with MAPD had a significant rate of decline of FEV1 compared to idiopathic bronchiectasis. MAPD patients had lower BMI and were younger than patients with idiopathic bronchiectasis.

Clinical problems in tuberculosis and other respiratory infections

During the poster session about clinical problems in TB and other respiratory infections, the presenters discussed the impact that pulmonary contagious diseases still have on society, ranging from TB to SARS-CoV-2 pneumonia.

Igor Ivanes (Republic of Moldova) explored different characteristics of tuberculosis in Moldova, including reduction in the diagnosis of tuberculosis in children under the conditions of the COVID-19 pandemic, to the impact of the disease on the evolution of pregnancy, delivery and perinatal outcomes. Despite the efforts made to improve the management of tuberculosis in Algeria, there are still fatal forms of tuberculosis. Nadia Fettal (Algeria) showed the data of a retrospective cohort with a mortality rate of 4%. Sofia El Hanafi (Morocco) presented a case series of 38 patients with pseudotumor tuberculosis characterized by clinical, radiological and endoscopic features which can mimic a bronchogenic carcinoma. Selsabil Daboussi (Tunisia) showed how tuberculosis relapse are a public health problem in Tunisia, with a high risk of developing MDR tuberculosis.

In a multicenter retrospective study at four South Korean hospitals, Hyonsoo Joo (Republic of Korea) studied the correlation between COPD development and TB infection. Similar to results found by Stolz D. et al (69), suggesting that pulmonary infections are a cause of COPD, in this study the authors found that 13.6% of the patients developed COPD with a strong correlation with the severity of TB sequelae.

“Tripledemic” was a word coined by Usman Kahara (United Kingdom) to describe the inpatient burden of winter respiratory viral illness in a district general respiratory unit in 2022: Flu, respiratory
syncytial virus (RSV) and COVID-19. The study showed that, surprisingly, having 2 concurrent viruses during the COVID pandemic did not worsen patient outcomes.

Hounda Rouis (Tunisia) explored the correlation between imaging in non-cystic fibrosis bronchiectasis and prognosis scores finding that extensive lesions on high resolution chest x-ray are associated with a higher FACED score (70) without significant correlation with BSI score (71).

Final, the poster session included a number of posters relating to the COVID-19 pandemic: post-COVID-19 pulmonary complications in the chest clinic of Oran, Algeria, were described by Abdelmajid Snouber (Algeria). Prognostic information 90 days after diagnosis of COVID-19 was reviewed for 158 patient that underwent invasive mechanical ventilation by Masamichi Mineshita (Japan), who found that factors such as age, comorbidities, low lymphocyte count and renal impairment were all associated with poor prognosis. From Ukraine, Natalia Habshydez (Ukraine) studied COVID-19 as endothelial dysfunction trigger finding that patients with low saturation and high CRP during the acute phase of the disease had higher endothelin-1 (used as endothelial dysfunction marker) levels following infection. The effectiveness of efferent therapy based on nanoparticle silica in treatment of SARS-CoV-2 pneumonia was evaluated by Oksana Vilsaniuk (Ukraine) with evidence of a reduced time of hospitalization, number of complications and mortality. Nathalie De Vos (Belgium) proposed a theragnostic approach to guide therapeutic decisions in COVID-19 aiming to diminish sequels. Data that highlighted the need for pro-active healthcare after a hospital admission to diagnose and manage newly acquired long term conditions 1 year after Sars-Cov-2 pneumonia were presented by Rachael Evans (United Kingdom).

**Group 10.03: Adults cystic fibrosis**

*Cystic fibrosis in adults*

Multiple studies examined the changes in the elexacaftor-tezacaftor-ivacaftor (ETI) era. Shahid Sheikh (USA) evaluated CT scans modifications after 1 year of therapy, revealing a decrease in mucous plugging and, to a lesser extent, in hyperinflation (72). Federica Bellino (Italy) conducted an analysis to assess the variability in the response to ETI, finding significant heterogeneity in terms of ppFEV1, BMI, sweat chloride concentration and Cystic Fibrosis Questionnaire-Revised score changes after 6 months, with a moderate correlation between BMI and ppFEV1. Inbal Golan-Tripto (Israel) analyzed the sputum of 15 cystic fibrosis patients with previous isolation of NTM, discovering a 60% decrease of NTM isolation after 1 year of ETI (73).

Even in the era of cystic fibrosis transmembrane conductance regulators (CFTR) modulators, *P. aeruginosa* infection remains one of the main challenges in people with cystic fibrosis (pwCF) (74)[3]. In light of this issue, Urania Rappo (USA) presented a phase 1b/2a trial to evaluate phage therapy with BX004-A for chronic *P. aeruginosa* pulmonary infection in stable cystic fibrosis patients. The study drug was well-tolerated, with a reduction of *P. aeruginosa* colony forming units at 15 days and no emerging resistance to BX004-A.
Claire Houston (United Kingdom) investigated the factors underlying increased pulmonary exacerbations in patients with cystic fibrosis, finding lower levels of innate host defense proteins (antiprotease, antimicrobials and immunomodulatory proteins) in the sputum of frequent exacerbators.

In non-cystic fibrosis bronchiectasis, treatment with Brensocatib was found effective in prolonging time to first exacerbation (62). Ariel Teper (USA) conducted a study on pharmacokinetics and safety of Brensocatib in patients with cystic fibrosis, showing results comparable to those described for healthy subjects and bronchiectasis patients, regardless of concomitant therapy with CFTR modulators.

The use of inhaled antibiotics remains pivotal in the therapy of cystic fibrosis. Nicholas Simmonds (United Kingdom) reported interim findings from a post-marketing safety study in cystic fibrosis treated with levofloxacin inhalation solution (LIS) in Germany and in the UK, whose primary aim was to evaluate the occurrence of haemoptysis, hepatotoxicity and tendon rupture. The analysis revealed no differences in liver disease between the LIS and the non-LIS cohort. The incidence of tendon rupture was very low. In the UK registry, haemoptysis was minimal in the LIS cohort, with higher but non-significant rates in Germany, consistent with phase III trial reports (75).

Astrid Vermaut (Belgium) presented a study on the cellular immune landscape in end-stage cystic fibrosis lungs, showing that the end-stage cystic fibrosis inflammatory profile involves the adaptive immune system (mostly B cells and CD8 T cells), with a heterogeneity among different end stage cystic fibrosis lungs.

Moving on to the new challenges and opportunities for cystic fibrosis patients, Paola Iacotucci (Italy) showed how the use of e-health technologies could reduce costs. Finally, Almudena Felipe Montiel (Spain) reported that, as age increases, patients with cystic fibrosis develop comorbidities that need to be assessed, such as psychiatric, haematologic, renal, rheumatic, cardiac and immunological disorders, but also malignancies, neurological and thyroid issues.

**Conclusion**

As one of the largest ERS assemblies, assembly 10 encompasses a broad range of clinical and scientific topics in areas including bronchiectasis, NTM, cystic fibrosis, COVID-19 and TB. Here, we have presented a selection of presentations from numerous high-quality respiratory infection sessions at the 2023 ERS Congress. We hope this offers the reader the chance to be informed of some of the latest developments from Assembly 10 and encourage future participation in the ERS Congress.
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Francesco Bindo reports no conflicts of interest.
Giovanni Fumagalli reports no conflicts of interest.
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34. PATH. RSV Vaccine and mAb Snapshot [Available from: https://www.path.org/resources/rsv-vaccine-and-mab-snapshot/].
Figure 1: Exposures including lifestyle factors and infections can influence the risk of chronic diseases at individual level and in the future offspring. Epigenetic changes such as DNA methylation can be perpetuated to the future child, thus inducing potential amendments in phenotypes associated with disease susceptibility and immunity.