European Respiratory Society International Congress 2021: highlights from best-abstract awardees

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Shareable abstract (@ERSpublications)
This article provides an overview of some of the highlights of the @EuroRespSoc Congress 2021 from the perspective of the best-abstract awardees of the ERS Assemblies @EarlyCareerERS @OrphaLung https://bit.ly/3JCjHYS

Every year, the European Respiratory Society (ERS) offers grants to recognise the best overall abstracts of the 14 ERS Assemblies submitted for the ERS International Congress, covering all respiratory areas. The authors of the best abstract (*i.e.* the highest average score of abstract reviewers and only those who have not applied or were not eligible for a sponsored award) were invited to write a short summary about their virtual Congress experience and view on the evolving field of research in light of their respective Assembly. This article provides an overview of some of the Congress highlights and gives the stage to the promising best-abstract awardees as they are the future of the ERS.

Assembly 1: Respiratory clinical care and physiology (Sanjay Ramakrishnan)

The coronavirus disease 2019 (COVID-19) pandemic has focused minds on respiratory health and disease. The ERS Congress 2021 abstracts continued to remind us of the extraordinary burden of lung disease that continues to exist outside COVID-19.

A timely global Delphi survey of primary care physicians and healthcare professionals ranked chronic cough management, asthma monitoring, asthma exacerbation prevention, tobacco use cessation and COPD comorbidity management as the most urgent research priorities in primary care [1].

With the pandemic causing a sudden increase in clinician time requirements globally, the interest in tools, powered by artificial intelligence, to help clinicians process information quickly and accurately is growing. The symposium on digital health really showed how far these tools have come (Digital health in respiratory medicine: opportunities for everyone, session 136). The World Health Organization (WHO) has started using artificial intelligence-based reporting of chest radiographs as part of tuberculosis (TB) screening efforts [2, 3]. Routine pulmonary physiology is another area that could be managed safely without clinician reporting with high fidelity algorithmic tools [4]. Virtual consultations and mobile monitoring of patients has been used widely in many settings during the pandemic. But how do clinicians and patients perceive it? Even better, could we succeed in changing our patients' behaviours with mobile

and virtual health solutions? To answer these questions, M. Verkleij elegantly summarised the challenges of implementing effective solutions in the clinic in a presentation on "Behavioural changes of patients and health professionals in the digital era". Electronic health solutions must be acceptable to patients and clinicians. Patients with chronic disease consistently report the value of having access to face-to-face care when needed. However, even in complex areas such as cognitive behavioural therapy, an online programme of cognitive behavioural therapy was feasible and acceptable to adults with cystic fibrosis in Amsterdam [5]. The key was to co-design the programme with the patients. The discussion in the symposium did warn about not trying to rush algorithmic/computer-based treatments into clinical practice. Instead, clinicians wanted all artificial intelligence (AI) tools used in clinical practice to undergo rigorous clinical trials with adequate clinical outcomes before use.

Take-home messages
- Despite the burden of the pandemic, primary care physicians still emphasise the need for research on common ongoing issues: asthma, chronic cough and COPD management.
- Artificial intelligence and e-health tools are already helping respiratory clinicians globally. Patient co-design helps improve take up and effectiveness.

Assembly 7: Paediatrics (Fabien Beaufils)
The 2021 ERS International Congress was full of great sessions focusing on the field of paediatrics. Regarding paediatric respiratory infections, a great topic highlighted the differences between adults and children in terms of COVID-19 risks by addressing the protective and risk factors of severe disease and death in the latter [6, 7]. The COVID-19 pandemic has led to the need for the development of digital health, such as telerehabilitation and telemonitoring, which have shown great benefit for chronic lung disease in children [8]. Digital health and telemedicine has also gained in interest in the management of children with different sleep breathing disorders [9]. Concerning paediatric sleep disorders, the interest of the Optiflow interface for chronic continuous positive airway pressure has been discussed [10]. The session dedicated to asthma epidemiology was focused on fetal and infant origins of asthma and altered lung function in relation to maternal distress [11] and antibiotic use during pregnancy [12], microbiota disturbance [13], and rapid weight gain in the first years of life [14]. In addition, in childhood asthma and preschool wheezing, more than phenotype-based treatments, clinicians need to consider endotype-based treatment which may better reflect the pathophysiology of the diseases [15–17]. Individually, air pollution and pollen exposure increase the risk of allergic and asthma development. As stated at this Congress, their synergistic interaction increases this risk even more and deserves to be more widely studied in the future [18]. For the future in paediatric lung diseases, CRISPR-Cas9 gene editing may represent a therapeutic tool for genetic disease such as cystic fibrosis [19], STAT3 hyper-IgE syndrome [20] and sickle cell disease [21].

In conclusion, the ERS Congress provided a broad overview of paediatric respiratory diseases from the early origins of lung disease to future opportunities in disease management presented by an exciting mix of international experts in the field.

Take-home messages
- Asthma could have its origins before birth and requires endotype-based treatment rather than phenotype-based treatment.
- The COVID-19 pandemic has a lesser impact in children than in adults and it led to the development of digital health that will be useful for future practice.

Assembly 9: Allied respiratory professionals (Jana De Brandt)
Across all Assembly 9 groups, COVID-19 received plenty of attention during the ERS Congress. Research by respiratory function scientists confirmed that diffusing capacity abnormality is most abundant in patients with severe COVID-19 [22]. Respiratory physiotherapists provided evidence on symptoms of long-COVID, *i.e.,* the manifestation of several physical and psychological abnormalities 3–6 months after infection [23, 24], and several research groups showed that pulmonary rehabilitation improves functional and psychological status in patients with post-acute COVID-19 [25–27]. Respiratory nursing research provided qualitative evidence on the fear of being infected among patients with COPD leading to self-isolation and accompanying problems [28], and formulated international consensus that awake prone positioning is an attractive, simple and safe way to improve oxygenation in hypoxaemic patients with COVID-19 [29]. Psychologists and behavioural scientists provided a strong message that mental health is seriously impacted by COVID-19 and timely intervention is needed [30, 31].

Furthermore, some well-deserved attention seems warranted for the Assembly 9 award/grant winners. Research results from three well-developed randomised controlled trials in the physiotherapy field showed that:

1) daily neuromuscular electrostimulation during hospitalisation for acute exacerbation of COPD (AECOPD) improves lower-limb muscle strength (p<0.001) and quality of life (p=0.018) (presented by L. Lopez Lopez) [32];

2) treadmill (TT) or cycle (CT) endurance training elicits similar improvements in functional capacity (6-min walk test: TT=+63 m *versus* CT=+26 m; p=0.16; similar results for muscle strength, maximal work rate during cycle ergometry test and 30 s sit-to-stand test) after lung transplantation (presented by R. Sebio Garcia) [33]; and

3) beta-alanine (BA) supplementation increases muscle carnosine (BA: +54% *versus* placebo: −12% of baseline value; p<0.001) in patients with COPD, but has no beneficial effects on exercise capacity and muscle function (p>0.05) (presented by J. De Brandt) [34, 35].

S. Dacha presented that no significant differences were observed in dyspnoea, oxygen saturation and functional performance during submaximal functional tasks when wearing different facial masks; however, some masks (*e.g.* cloth masks) resulted in more breathing effort in comparison to no mask (p=0.001) or a surgical mask (p=0.012) [36]. Lastly, A. Oliveira provided qualitative evidence (semi-structured interviews with patients, healthcare professionals and policy makers) that rapid access rehabilitation after AECOPD is well accepted by the different stakeholders [37].

Take-home messages
- COVID-19 infection leads to long-lasting abnormalities in physical and psychological status which can be improved by pulmonary rehabilitation.
- Qualitative and quantitative research was presented in the area of respiratory physiotherapy which focuses on providing suitable/optimised forms of rehabilitation for patients with chronic respiratory diseases (stable/acute).

Assembly 10: Respiratory infections (Kerri Viney)

The ongoing COVID-19 pandemic has significantly impacted the way in which patients seek care and the delivery of healthcare services for people with respiratory diseases, including for those with TB [38, 39]. One of the highlights of the 2021 ERS International Congress was a presentation on TB and COVID-19 in the Hot topic session 'Digital innovations in tuberculosis and implementation research in the era of COVID-19" (session 280), which showcased collaborative activities between the WHO and the ERS. Emerging research priorities for TB and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) include those related to the impact of SARS-CoV-2 on the progression from TB infection to TB disease, clinical management for patients with both diseases, determinants of mortality and the impact of co-infection on healthcare services in high TB burden countries, as discussed in this Hot topic session [40, 41]. A study conducted by the Global Tuberculosis Network involving 767 patients from 34 countries attempted to answer these questions [42]. Clinical evidence from this study could not show that COVID-19 predisposes to reactivation of previous TB or progression from TB infection to TB disease. However, the study authors describe that additional data from longitudinal studies may offer better insights into this hypothesis.

The study from the Global Tuberculosis Network also reported that the care of patients with TB and SARS-CoV-2 is complex, with 32% requiring supplemental oxygen and 18% requiring invasive ventilation [42]. Mortality for patients with both diseases was 11% overall (9.6% if other causes of death were excluded) [42], which is higher than the mortality rate for people with TB, at 1–2% [38, 42]. Furthermore, among those who died, there was a higher frequency of patients with TB and SARS-CoV-2 and one additional comorbidity compared to those who survived (86% *versus* 50%, p<0.001) [42]. A higher risk of death was observed in patients with both diseases if they were male, older or receiving invasive ventilation [42].

In this Hot topic session, other evidence presented suggests that COVID-19 has a substantial impact on healthcare services, resulting in reduced TB case notifications (including for people with drug-resistant TB), fewer outpatient department consultations and an increase in the provision of telehealth services [38, 39].

Take-home messages
- SARS-CoV-2 can appear before a TB diagnosis, during TB treatment or TB and SARS-Cov-2 can appear at the same time, but existing data could not show that SARS-CoV-2 increases the risk of progression from TB infection to disease.

- Mortality for patients with TB and SARS-CoV-2 is ∼10%, is higher than for patients with TB alone and is increased for those who are male, older or who received invasive ventilation [42].
- There is a demonstrable impact of the ongoing COVID-19 pandemic on the provision of TB services including a reduction in TB case notifications, fewer outpatient department consultations and an increase in telehealth services [39].

Assembly 11: Thoracic oncology (Claire Bradley)

The 2021 ERS International Congress had several thought-provoking sessions highlighting developments within thoracic oncology. Immunotherapy advancements were a popular theme. The "Hot topics in thoracic oncology" session explored current and emerging evidence for adjuvant and neo-adjuvant checkpoint inhibition in early-stage lung cancer from an oncological (Karim Vermaelen, Belgium), pathological (Aurelie Fabre, Ireland), and surgical (Isabelle Opitz, Switzerland) perspective. Recent studies have reported promising rates of pathological response with neo-adjuvant immunotherapy [43, 44] and multiple phase III trials are ongoing. Evidence is also emerging regarding the safety and potential complexity of subsequent thoracic surgery in this group [45, 46].

Within the "State of the art: thoracic oncology" session, approaches to oligometastatic nonsmall cell lung cancer (NSCLC) were explored, including current guidelines advocating consideration of local consolidative therapy in addition to systemic treatment [47] and the potential roles of immunotherapy [48] and salvage surgical resection [49], given that this group may experience extended progression-free survival. During the "New clinical and biological developments in lung cancer" oral presentation session, J. Ramos Paradas (Spain) presented a research study conducted on a retrospective cohort of 196 individuals with NSCLC and described the novel immunophenotypes and potential biomarkers identified by the research group that may predict response to immunotherapy [50].

Another topic of interest was technology and AI in thoracic imaging. An abstract by AUDELAN et al. [51] detailed good performance of a deep learning algorithm with 172 of 177 malignant nodules detected by the system. In a talk titled "Early detection of thoracic malignancies and artificial intelligence: a rapidly evolving field", A. Snoeckx (Belgium) presented an overview of some of the key developments and challenges relating to AI, especially within the context of lung cancer screening [52]. Recently, a deep learning algorithm for malignancy risk estimation of nodules detected on low-dose screening computed tomography (CT) demonstrated comparable performance to thoracic radiologists, confirmed in three external validation cohorts [52]. However, multiple challenges remain regarding the integration of AI into clinical practice (e.g. where in the radiology workflow might AI fit? Who owns the healthcare data?); and, despite the availability of 100 commercial AI radiology products, the peer-reviewed evidence base for the majority of these products is currently lacking [53]. On the topic of lung cancer screening, R. Meza (USA) outlined the recent updates in eligibility criteria for screening in the USA, specifically a change in the lower age limit (50 years from 55) and minimum pack-years smoking history (20 pack-years from 30), in an effort to include more high-risk women and racial minorities in screening [54].

Finally, in "Hot news from the pleura", T. Cook described his experience of receiving a diagnosis of mesothelioma and the impact this had on his life. Similarly, E.M. Grabczak (Poland) emphasised the importance of personalised patient-led care during her succinct summary of the evidence base for the management of malignant pleural effusions.

Take-home messages
- The role of immunotherapy in lung cancer continues to expand and advance.
- Artificial intelligence in thoracic imaging is a rapidly developing field, especially regarding nodule detection.
- Personalised patient-led care is paramount in thoracic oncology.

Assembly 12 – Interstitial lung diseases (Vincent Cottin)

One of the highlights of the 2021 ERS International Congress in the field of interstitial lung diseases was a clinical trials session entitled "Abstracts Leading to Evolution in Respiratory Medicine Trials (ALERT) Asthma in adult, in children and ILDs (session 333), where the results of several clinical trials in interstitial lung disease were reported. NACCACHE et al. [55], from the French collaborative group OrphaLung, reported the results of the EXAFIP study, which was a placebo-controlled randomised trial of intravenous cyclophosphamide in patients with acute exacerbation of idiopathic pulmonary fibrosis (IPF) [55].

Acute exacerbations of IPF [56] occur in ∼5–10% of patients diagnosed with IPF annually [57, 58], and are associated with substantial morbidity and mortality [59].

Whilst it was hoped that immunosuppressive therapy would improve the outcome of this very severe complication, no significant differences were found between groups in time to all-cause mortality, with even a trend in favour of increased mortality at 3 months in patients receiving cyclophosphamide compared with those receiving placebo (45% *versus* 31% all-cause mortality, p=0.10) [60]. Although negative, this trial ends a long-lasting debate, and it is now accepted that cyclophosphamide should no longer be used in this indication. The findings are reminiscent of those of the PANTHER trial, which demonstrated an increased risk of death and hospitalisation in patients who received a combination of prednisone, azathioprine, and N-acetylcysteine to treat IPF in the absence of acute exacerbation [61]. Antifibrotic treatment appears to reduce the risk of all-cause mortality and acute exacerbation in IPF [62], but it remains to be determined whether any drug therapy, including glucocorticoids, improve the outcome of this event once it occurs.

The need for new drugs to slow down and hopefully to halt the progression of IPF was emphasised by the presentation of the results of the PINTA study, a placebo-controlled proof-of-concept trial evaluating GLPG1205, a small molecule targeting G-protein-coupled receptor 84 (GPR84) [63]. The study demonstrated the feasibility of randomised trials in IPF patients receiving standard of care antifibrotic therapy, although possibly with poorer tolerability, and suggested that assessment of lung volumes by high-resolution CT may become a useful endpoint alongside forced vital capacity in future IPF studies. This serves as a reminder of the enormous challenges ahead to improve further the outcome in patients with IPF.

Take home messages
- Clinical trials are feasible in a real-world situation in patients with IPF, including when receiving standard of care antifibrotic therapy, or in the situation of acute exacerbation of pulmonary fibrosis.
- Enrolment in randomised clinical trials is warranted to address the unmet medical need in IPF.

Assembly 14: Clinical techniques, imaging and endoscopy (Maged Hassan)

The role of thoracic ultrasound (TUS) in respiratory diseases was explored by several abstracts presented at the 2021 ERS International Congress. The first theme explored was guiding pleural procedures. HASSAN *et al.* [64] reported the results of the SIMPLE randomised trial which compared TUS-guided pleurodesis *versus* standard care (313 patients with malignant pleural effusion (MPE) randomised 1:1). Lung sliding was scored by TUS to decide time of removal of the chest tube when lung adherence was noted. Results showed that TUS-guided pleurodesis reduced length of hospital stay by a third (from 3 to 2 days) with rates of pleurodesis success at 3 months similar to standard care. The full study results have recently been published [65]. LIM *et al.* [66] reported the results of TUS-guided biopsy of lung, nodal or pleural abnormalities when performed by respiratory physicians. In 154 procedures spanning 3 years of practice, the diagnostic yield was 85%, similar to results achieved in interventional radiology series. The added benefit of real-time TUS guidance during local anaesthesia of the pleura during thoracentesis was explored in a comparative study of 24 patients (12 per arm) by SUNDARALINGAM *et al.* [67]. TUS-guidance appeared to be associated with less post-procedure pain scores. However, the group did not report how many of their participants in either arm exceeded the minimal clinically important difference for pain score.

The second theme was TUS in defining lung pathology. DAVIDSEN *et al.* [68] examined lung transplant patients with symptoms suggestive of allograft dysfunction. TUS was useful to differentiate between bronchiolitis obliterans and restrictive allograft syndrome (diagnosis confirmed by chest CT), a differentiation that has important prognostic and therapeutic implications. DELESTRAIN *et al.* [69] studied TUS in children with sickle cell disease admitted to hospital with acute chest syndrome. At day 3 post-admission, chest radiography revealed abnormalities in 23% of patients correctly diagnosed with TUS. Two studies [70, 71] used TUS to define the extent of COVID-19 pneumonitis. SMARGIASSI *et al.* [71] found that, in patients newly admitted to hospital with SARS-CoV-2 infection, a composite TUS abnormality score of lung regions was concordant with disease extent seen on CT imaging. However, the authors did not report whether the scores correlated with outcomes. PIERRAKOS *et al.* [70] reported that a higher TUS score in 137 patients admitted to intensive care units in three different countries was not a good predictor of mortality or failure of extubation (area under the curve (AUC) <0.65). Another novel use of TUS in COVID-19 patients was determining diaphragm function by measuring thickening fraction using linear probe. This was studied by DE BOER *et al.* [72] in 25 patients with COVID-19 pneumonitis. Diaphragm strength was inversely correlated with the degree of dyspnoea as measured on a visual analogue scale (R −0.602, p=0.002).

The third (and novel) theme related to quantifying echogenicity of various thoracic structures on TUS images using computer software. Levi *et al.* [73] examined the feasibility of diagnosing pneumothorax by comparing lung echogenicity between the normal and diseased sides by physicians from different specialties. The grayscale and artifact ratio between pairs of images had a high diagnostic power in all specialties. Hassan *et al.* [74] calculated the relative echogenicity of the collapsed lung to that of the liver in 63 patients with MPE undergoing medical thoracoscopy and found that relative lung echogenicity could predict lung non-expansion following drainage with an AUC of 0.85.

Take-home messages

- TUS-guided pleurodesis in MPE is as effective as the standard method and facilitates shorter hospital stay.
- TUS has high sensitivity in delineating inflammatory lung pathology, with sensitivity exceeding that of chest radiography and almost matching chest CT.
- Relative echogenicity of the lung is a novel tool that may aid in diagnosing pneumothorax or non-expandable lung.

Final remarks

The best abstract awardees have provided an overview of some of the highlights of the 2021 ERS International Congress. We hope to inspire clinicians and researchers to submit an abstract for the next ERS Congress as this increases the visibility of their work and gives them an opportunity to be elected as the 2022 best-abstract awardee for their Assembly. You can find the latest news about the Congress on the official ERS website (https://www.ersnet.org/congress-and-events/congress/) and on the ERS social networks: Twitter (@EuroRespSoc, @EarlyCareerERS) and Facebook (@EuropeanRespiratorySociety, ERS Early Career Members group). If you have any questions, you can contact the Early career member representative from your Assembly. We hope to see you in Barcelona!

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