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Early View

Review

ERS International Congress 2020 virtual: highlights from the Allied Respiratory Professionals' Assembly

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ERS International Congress 2020 virtual: highlights from the Allied Respiratory Professionals' Assembly

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Abstract

This article provides an overview of outstanding sessions that were (co)organised by the Allied Respiratory Professionals (ARP) Assembly during the European Respiratory Society (ERS) International Congress 2020, which this year assumed a virtual format. The content of the sessions was mainly targeted at ARP, including respiratory function technologists and scientists, physiotherapists and nurses, and is summarised in this highlights article. Short take-home messages related to spirometry and exercise testing are provided, highlighting the importance of quality control. In addition, the need for quality improvement in sleep interventions is underlined as it may enhance patient outcomes and the working capacity of healthcare services. The promising role of digital health in chronic disease management is discussed, with emphasis on the value of end-user participation in the development of these technologies. Evidence on the effectiveness of airway clearance techniques in chronic respiratory conditions is provided along with the rationale for its use and challenges to be addressed in future research. Furthermore, the importance of assessing, preventing and reversing frailty in respiratory patients is discussed, with a clear focus on exercise-based interventions. Research on the impact of disease-specific fear and anxiety on patient outcomes draws attention to the need for early assessment and intervention. Finally, advances in nursing care related to treatment adherence, self-management and patients' perspective in asthma and COPD are provided, highlighting the need for patient engagement and shared decision making. This highlights article provides readers with valuable insight into the latest scientific data and emerging areas affecting clinical practice of ARP.

Introduction

The Virtual European Respiratory Society (ERS) International Congress 2020 offered Allied Respiratory Professionals a wide range of appealing sessions (co)organised by Assembly 9, including Symposia, Expert view, Hot topics, Clinical Year in Review, and 266 abstract sessions spread over four oral communication and 13 E-poster sessions.

Early Career Members of the Allied Respiratory Professionals' Assembly, including respiratory function technologists and scientists (E. Smith, M. Thomas), physiotherapists (E. Calik-Kutukcu, I. Torres-Sánchez) and nurses (M. Granados-Santiago, J.C. Quijano-Campos), were invited to report on the following sessions selected by group chairs of the Assembly, which focused on recent research advances: two oral presentation sessions on the quality improvements in lung function and sleep diagnostics, and novel insights into nursing interventions for managing patients with asthma and COPD; three symposia on digital health, managing frailty in patients with acute or chronic lung disorders, and psychological wellbeing in chronic lung diseases; and an expert view in physiotherapy in chronic respiratory infections with focus on airway clearance techniques. We summarised the latest scientific and clinical insights gained from each session, targeting delegates who were present in the virtual sessions as well as those unable to attend.

Group 9.01: Respiratory Function Technologists and Scientists

Oral presentation session: Quality improvements in lung function and sleep diagnostics

This oral presentation session included the highest scored abstracts submitted to the Respiratory Function Technologists/Scientists (9.01) group.

Quality improvements in a Sleep Clinic: To increase capacity and time to treat in patients with OSA - P. Coss (Ireland)

P. Coss described the outcome of a quality improvement programme in the Sleep Department at St James's Hospital (Dublin, Ireland). This sought to reduce the time to treatment from a pre-intervention of 32 weeks to nine weeks, and address inefficiencies to increase the capacity of the department. Pareto analysis showed that the most significant delay was caused by General Practitioner referral to the first appointment with the Sleep Consultant. Through a series of Plan-Do-Study-Act (PDSA) cycles, the team identified those interventions which added value, which included adopting a Proforma for assessing the sleepy patient and co-locating consultant and physiologist assessments. Following the interventions, attendance was shown to be both improved and more consistent. The time from initial intervention to review in the Sleep Clinic was reduced from 196 to 14 days, and the number of new patients seen per month increased from four to 15. This talk was an excellent example of how standard Quality Improvement processes can be implemented in routine practice to achieve significant patient benefits.

Early effect of Continuous Positive Airway Pressure therapy on right ventricular function in patients with newly diagnosed Obstructive Sleep Apnoea - P. Coss (Ireland)

The second of piece of work presented by P. Coss was part of a cross-departmental project built on previous findings [1] and analysed right ventricular (RV) function in 19 Obstructive Sleep Apnoea (OSA) patients (70% male) following a 12-week intervention of Continuous Positive Airway Pressure (CPAP) treatment (mean compliance 4.1 hours/night). Outcome measures included basal RV diameter (RVD1), tricuspid annular plane systolic excursion (TAPSE) and fractional area change (FAC) – the latter two being measures of global RV function. Following CPAP treatment, a small but significant reduction in RV size, and an increase in FAC and TAPSE, markers of improved RV ejection was observed. It was proposed that, in patients with OSA, there are likely subclinical changes in the structure and function of the heart which are, at least in part, reversible with the application of CPAP treatment. The

presented results are preliminary and it will be exciting to see the results of the study once completed.

Quality control of cardiopulmonary exercise equipment - T. Souren (Belgium)

T. Souren presented an observation of the performance of four metabolic carts in use at University Hospital Antwerp (Belgium). The team used the Metabolic Simulator (Relitech Systems, NL) to verify the performance of each cart at four different metabolic levels, with breathing frequencies from 20-80 breaths/min, and $V'O_2$ and $V'CO_2$ from 1-4L/min. The carts studied included the Metalyser II (Cortex), Powercube (Ganshorn), CPET Oxygen Sensor II (Geratherm Respiratory) and Vyntus CPX (Vyaire). Varying performance of the four devices was demonstrated, with all devices being outside of the acceptability limits at least once (3% for $V'O_2$ & $V'CO_2$, 2% for V'E and 0.04 absolute for respiratory exchange ratio (RER)). It is advocated that the metabolic simulator should be part of at least once yearly routine quality check of metabolic carts and used as a complementary practice to the use of biological controls, to understand equipment variability and impacts on future data collection.

A respiratory exchange ratio of 1.05 should not be used to determine maximal effort during cardiopulmonary exercise testing - M. Thomas (United Kingdom)

M. Thomas presented a review of the American Thoracic Society/American College of Chest Physicians (ATS/ACCP) [2] and ERS [3] recommendations for determining maximal effort during cardiopulmonary exercise testing (CPET) and noted that both publications quoted target RER values (>1.15 and >1.05, respectively). A retrospective review of CPET data collected at University Hospital Birmingham (UK), where the patient achieved an RER >1.15 (n=176) to determine CPET outcomes at RERs of 1.05 and 1.15, compared to volitional exhaustion, was performed. From the patients assessed for pre-operative risk, at volitional exhaustion, 25% were classified as high risk ($V'O_2$<15ml/min/kg), whereas at RER=1.05 and 1.15, 77% and 45% of patients were considered high risk, respectively. In a sub-analysis of patients investigated for unknown cause of breathlessness, the proportion of those who returned an abnormal result based on ERS criteria [3] was 63%, 75% and 97% at volitional exhaustion, RER=1.15 and RER=1.05, respectively. The team provided robust evidence that a pre-determined RER value should not be used to determine the end of test as this is likely to overestimate pre-operative risk and result in mismanagement of patients undergoing CPET for diagnostic purposes.

A comparison of three sets of paediatric reference values for Cardiopulmonary Exercise Testing using cycle ergometry - P. Burns (United Kingdom)

P. Burns from the Royal Hospital for Children (Glasgow, United Kingdom) presented percent predicted VO_2 peak (n=766), where predicted values were calculated using three commonly used reference equations from Cooper et al. [4], Blanchard et al. [5] and Bongers et al. [6]. Bland and Altman analysis demonstrated wide limits of agreement (LoA) between all three equations, which was the greatest for Cooper vs. Bongers (Upper LoA 48%, Lower LoA -26%). It was noted that the commonly used Cooper equation was derived from the smallest data set (n=109) and simplest data analysis but the largest age range (6-17 years), and whilst the Blanchard equation looks initially promising with the largest data set and multivariate analysis, it was limited in its use in a paediatric laboratory due to the age range of subjects included (12–18 years). Findings evidenced that the reference equation used will have pronounced implications on the interpretation of paediatric CPET data, and that a 'GLI' approach of all age reference equations for CPET is needed to standardise laboratory practice and advance the field.

Deep learning automates complete quality control of spirometric manoeuvre - N. Das (Belgium)

N. Das, a PhD candidate from Leuven University (Belgium), presented one study on the use of deep learning for the purpose of spirometry quality control. The model presented was built upon previous work [7], further including the criteria of tidal breathing and maximal inspiration before and after forced expiration. Using the sample data set, the convolutional neural network (CNN) model had a greater area under the ROC curve (0.91), accuracy (87%) and specificity (81%) than the technician ATS/ERS rule-based model [8] (0.77, 67% and 32%, respectively). The major strengths identified, aside from the accuracy, were that the Shapley values were able to provide a clear visual feedback as to why the manoeuvre had failed the quality control check.

This was an excellent example of how deep learning could be used to complement the visual cognition of skilled technicians, working towards the automatic definition of spirometric acceptability. The authors are currently looking to adapt the tool to accommodate the latest 2019 guidelines [9].

Differences between percent predicted and z-score. The impact of severity classification in spirometry - A. Silva (Portugal)

The final presentation from A. Silva highlighted that the severity criteria used can affect the classification of disease in a paediatric population. The 2012 GLI reference equations [10] were used to generate percent (%) predicted and z-scores for 1869 children (aged 3-18, 55% male) who attended Santa Maria Hospital (Portugal). Normality and severity classifications were

defined according to both the ATS/ERS criteria [11] and the more recent proposal by Quanjer et al. [12] (Table 1). Nineteen percent of the spirometry tests returned a different severity classification using the two methods described above. Using Quanjer et al. criteria, 27% (120/440) of Mild (ATS/ERS) cases were classified as Normal. Notably almost all ATS/ERS definitions of Moderate (77/84), Moderate to Severe (44/44) and Severe (39/41) cases increased by ±1 severity score when reanalysed using Quanjer's z-score model. Whilst it was agreed that the new classification system is simple and easy to implement, they acknowledged that this would affect severity classification in some children which requires clinical validation. It should, however, be noted that clinical validation of the ATS/ERS severity scoring system is not yet robust.

(please insert table 1 here)

Take-home messages:

- There exist multiple tools for interpreting respiratory function data, the choice of which can have profound implications for disease classification. This requires further standardisation across the field.
- Internal quality improvement plans can be effective tools to increase the capacity and efficiency of a Sleep Department.
- cardiopulmonary exercise testing should not be terminated at a pre-determined RER but performed to volitional exhaustion, when it is safe to do so.
- A metabolic simulator can be a valuable tool to understand inherent differences between metabolic carts, when used as an adjunct to a biological control programme.
- The automation of spirometry quality control is being advanced by machine learning.

Symposium: Digital Health: a brave new world?

The healthcare sector is being rapidly transformed by the development and innovation of digital technologies. This symposium started by focusing on patients and end-users of these technologies, before focusing on specific applications of digital technologies in the management of asthma; it ended by looking at new horizons in digital technologies in respiratory medicine and discussing the promise of artificial intelligence.

The patient perspective - D. Hamerlijnck (The Netherlands)

D. Hamerlijnck is a patient expert with severe asthma. In this presentation, D. Hamerlijnck postulated that the vision for the future digitisation of care seemed to be replacing the doctor with an algorithm based on guidelines [13]. Whilst this is a useful strategy for the majority of patients, these guidelines are based on what is most common in a patient population. D. Hamerlijnck reported to be an example in which these algorithms cause issues, because D. Hamerlijnck is a patient with severe asthma that does not wheeze or cough. The talk then focused on patient advocacy and ensuring that patients and end-users are involved in the development of these digital technologies. The other speakers in this session all dedicated time in their presentations to reinforce the message that patient and end-user involvement is crucial to the future of these technologies.

Digital technology for asthma - O. S. Usmani (United Kingdom)

This presentation addressed the use of digital technologies in the management and diagnosis of asthma. O. S. Usmani suggested the key drivers for digital solutions are prevalence of disease, advancements in technology (both innovation of technology and patient digital literacy), and patient engagement. Development of digital technologies is critical in asthma with 300 million patients worldwide, 50% of which do not take medications as prescribed and 60% do not attend follow-ups [14]. Initial focus in the development of these technologies in asthma was on monitoring medication remotely. The aim was to identify those patients poorly controlled and in need of additional attention to help achieve disease control. Innovations employed included digital inhaler trackers [15] and new methods of monitoring device adherence [16]. Sulaiman et al. [17] developed an electronic acoustic recording device for dry powder inhalers to identify the types of error with their use. They found that 48% of patients would fail to generate a peak inspiratory flow rate >35 L/min. Other errors identified included patients performing multiple inhalations (23%), not inhaling at all despite introducing the blister pack (7.4%) or exhaling into the device (5.4%). Smart sensors introduced in inhaler devices demonstrated higher adherence in children aged 6-15 years old compared to the same device with the sensor function disabled (84% vs 30% [18]). The use of mobile applications for self-management of asthma was systematically reviewed by Hui et al. [19]. The most successful interventions included multiple features such as symptom monitoring and medication reminders. O. S. Umani then echoed D. Hamerlijnck's message about the importance of including the patient and end-users in the digital technology development process, and detailed a project called *myaircoach* that involves the analysis, modelling and

sensing of both physiological and environmental factors for the customised and predictive self-management of asthma. The group developing the project is making the user the centre of its design and implementation by approaching asthma patients and healthcare practitioners regarding the functionality and use of these systems for self-management [20]. Patients were most interested in technology improving self-monitoring, collecting data to present to healthcare professionals that demonstrates how their asthma has been, and alerting the patients and/or healthcare professionals to a deterioration in their asthma control before they would normally notice. In contrast, healthcare professionals wanted a device that offers advice regarding when additional medical attention should be sought or that provides instructions on how to manage their asthma in an emergency.

Artificial Intelligence in respiratory medicine - V. Poberezhets (Ukraine)

V. Poberezhets discussed new horizons in digital technologies for respiratory medicine where an ontological structure of digital medicine was presented (Fig. 1) [21]. The use of artificial intelligence (AI) and machine learning has been employed to improve diagnostic yield and decrease workload in thoracic imaging [22, 23], histopathology and cytology [24, 25]. AI could be used to improve diagnostic accuracy in the interpretation of pulmonary function tests, where it demonstrated to have a higher degree of accuracy than pulmonologists [26].

(please insert Figure 1 here)

V. Poberezhets highlighted interesting future developments in AI such as clinical decision support systems that will aggregate all data obtained in a patient's pathway [27]. The current systems are limited by having to process unstructured data such as patient complaints, or observations made in clinical examinations and recorded in notes; and AI may address these issues.

Artificial Intelligence in clinical trials - K. Kostikas (Greece)

K. Kostikas's talk detailed the promise of AI in clinical trials and research. The traditional drug development cycle takes up to 15 years and requires up to €1.7 billion, and AI may be able to reduce these figures by aiding in clinical trial design, feasibility assessment, patient recruitment, blinding of trials by aggregating anonymous data, performing the literature review, matching patients, real-time monitoring of data during trials, data collection and sharing [28]. AI has theoretical applications to increase study power by reducing population heterogeneity, for prognostic enrichment by selecting patients more likely to have measurable clinical endpoints, and for predictive enrichment by identifying patients more likely to respond to treatment [29].

Take home messages:

- Patient's trust in clinicians is, in part, developed by non-verbal communications that can be impaired by remote technologies and tele-consultations. Future technologies should consider this during development.
- The end users are both patients and clinicians, and both have distinctly different desires and expectations for remote monitoring tools.
- Artificial intelligence is not being developed to replace clinicians and we should embrace it, not fear it: "*a computer is not better than a human brain, but a computer supporting the human brain is better than the human brain alone*."

Group 9.02: Physiotherapists

Expert view: Physiotherapy in chronic respiratory infections - A. Spinou (United Kingdom)

According to PICO (Population, Intervention, Comparison, Outcome) question [30], A. Spinou presented a detailed overview about the ability of airway clearance techniques (ACTs) to reduce rate of exacerbations, hospitalisations or improve quality of life (QOL) in patients with chronic obstructive pulmonary disease (COPD), cystic fibrosis (CF) and bronchiectasis. First of all, A. Spinou gave some background information about ACTs and presented ACTs evidence for the aforementioned chronic respiratory diseases. After that, A. Spinou talked about research challenges in this area and the implementation of ACTs in clinical practice.

Airway clearance is a defence mechanism that is based on the relationship between the mucociliary escalator and cough. Cough is important for effective clearance of secretions in addition to helping to collect thicker secretions and increase secretion volume. Another important factor for removing secretions is airway surface liquid [31]. Airway clearance is compromised in some diseases due to impaired mucociliary function, alterations in secretion production and mucus rheology (i.e., fluid flow and deformation for mucus), and impaired cough reflex as a defence mechanism [32]. The main problem is that patients with bronchiectasis enter a vicious cycle in which impaired mucociliary clearance leads to structural airway damage and consequently lower airway tract infection that leads to inflammation. Inflammation causes recurrent pulmonary infections that increase mucus production. ACTs have the potential to break this cycle as increasing mucociliary clearance decreases structural airway damage [33]. ACTs are techniques (with or without the use of devices) that have been employed alone and in combination to facilitate airway clearance and increase the effectiveness of cough. Techniques include gravity-assisted positioning/postural drainage, manual techniques like percussion, vibrations, shaking and overpressure, active cycle of breathing techniques (ACBT), autogenic drainage (AD) and slow expiration with the glottis opened in the lateral posture (ELTGOL). There are also many devices to assist airway clearance: positive expiratory pressure (PEP), oscillating-PEP, and high frequency chest wall oscillation devices [34]. The rationale of these techniques and devices is based on physiological mechanisms including gravity/positioning, mucous viscoelasticity, two phase gas-liquid interaction, collateral ventilation, interdependence and equal pressure point [35]. Interestingly, some techniques are most preferred in some countries. Whereas ACBT is the most preferred method in the United Kingdom, PEP devices are frequently used in the United States by physiotherapists treating patients with bronchiectasis [36].

The outcomes most frequently used to assess the effectiveness of ACTs are sputum volume/weight (dry or wet), mucus transport rate, ventilation scanning, pulmonary function, lung clearance index, oxygen saturation, symptoms like dyspnoea and cough, adverse effects, duration and frequency of exacerbations and hospitalisations, need for antibiotics, health-related quality of life (QoL), patient preference, treatment adherence and mortality [37]. There are few studies that investigate the long-term effect of ACTs on outcomes. A Cochrane review comparing ACTs to no-ACTs during an acute exacerbation of COPD reported no change in the number of exacerbations at 6-month follow-up but it included studies with a small sample size [38]. In patients with stable COPD, there was a reduction in the need for hospital admission but there was no change in the total number of days at the hospital in the long-term. Studies showed that ACTs reduced the need for antibiotics in stable COPD [38]. A multicentre randomised controlled study also showed that the PEP technique was not effective in reducing the number of exacerbations, number of respiratory-related hospitalisations, total number of hospitalised days, need for antibiotics and mortality compared to controls at six months of follow-up after an acute exacerbation. This study also demonstrated that there was no benefit in terms of QoL [39]. In patients with bronchiectasis, a Cochrane review reported an improvement in QoL but no change in the frequency of exacerbations at 3-month follow-up [40]. In a randomised placebo controlled study published in 2018, patients with bronchiectasis that used ELTGOL technique showed an improvement in cough-related QoL and health-related QoL and decreased frequency of exacerbations [41]. Several Cochrane reviews have been published regarding ACTs in CF [33, 41]. Most of them compare the effect of different ACTs on mortality. A Cochrane review that included eight studies comparing ACTs with no ACTs in CF showed that no data is available regarding number of exacerbations/year, number of days in hospital/year, number of days of intravenous antibiotics/year and death [42].

In conclusion, there was low quality of evidence about the effectiveness of ACTs in chronic respiratory diseases [43]. The most prevalent methodological issues were difficulties in adherence and compliance in long-term investigations, ethical problems, lack of blinding, poor study design, poorly defined or misinterpreted techniques and lack of selecting appropriate outcome measurements. In a clinical setting, the selection of the optimal ACTs should take into account the diagnosis, the severity/stage of disease, whether the patient is in a stable or exacerbation phase, and existing comorbidities. Physiotherapists should also consider underlying physiology, contraindications/precautions, equipment, cost and burden of treatment technique. Clinicians should also pay attention to preference/ability, needs, age

and treatment adherence of the patients when planning treatment. As a key message, clinical practice about ACTs is mainly guided by physiology rationale and short-term benefits. There is an urgent need to take an action and perform high quality research on the long-term effectiveness of ACTs [43].

Take-home messages:

- There is low quality of evidence about the effectiveness of airway clearance techniques in chronic respiratory diseases (COPD, bronchiectasis and cystic fibrosis).
- In a clinical setting, the selection of the optimal airway clearance techniques method should take into account the diagnosis, the severity/stage of disease, whether the patient is in a stable or exacerbation phase, and existing comorbidities.

Symposium: Managing frailty in patients with acute or chronic lung disorders

In this symposium, several expert speakers provided an update on the latest knowledge about frailty in respiratory diseases.

Diagnosing, management and measures of frailty - M. Cesari (Italy)

M. Cesari started by explaining that frailty is not a disease. There is a consensus definition of frailty as "*a medical syndrome with multiple causes and contributors that is characterised by diminished strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or death*" [44]. Many practical operational definitions of frailty are available. In the phenotypic operational definition of frailty provided by Fried et al. [45], a frail individual was defined according to a number of predefined criteria: involuntary weight loss, weakness, poor endurance or exhaustion, slowness and sedentary behaviour. A person is considered frail when meeting at least 3 criteria and pre-frail when meeting one or two criteria. Another important school of thought tried to propose an operational definition that was aiming to provide a measure of the age-related accumulation of deficits that the person present in order to guess a surrogate of biological aging [46]. M. Cesari marked that the more deficits a person presents, the frailer he/she will be [47].

In the literature, we can find a huge number of instruments available to measure frailty. Nine instruments are highly cited (>200 citations). The most common assessment context was observational studies in older community-dwelling adults [48]. Frailty is the target condition

for applying a comprehensive geriatric assessment [49], a multidimensional diagnostic and therapeutic process for dealing with highly complex individuals. The presenter told that all information provided can be found in the "Integrated care for older people" document published by the World Health Organization [50].

Skeletal muscle stem cells and capillaries; important neighbours in muscle tissue of COPD patients - T. Snijders (The Netherlands)

T. Snijders explained how muscle fibres relate to frailty. Satellite cells (SC), as stem cells, are able to provide growth and regeneration capabilities to the muscle fibre. SC content and function are known to decline with increasing age [51]. SC function is even lower in COPD patients compared with age-matched controls and, therefore, it might be a key factor in the accelerated aging of skeletal muscle tissue [52]. Circulation plays an important role in the activation and functioning of the SC [53]. Hence, it is not surprising to find SC close to capillaries. This distance has shown to be increased in healthy elderly adults compared to young adults (particularly in type II muscle fibres) [54].

Performing prolonged exercise training can restore the balance between SC and capillaries. The preliminary results in the studies of T. Snijders et al. showed no significant difference in SC content between COPD and age-matched controls. Fibre capillarisation was lower in type I (and type II) muscle fibres compared to young elders as well as age-matched healthy controls.

Most importantly, they investigated the SC distance to its nearest capillary. In the healthy young individuals, they found no differences between the type I and type II muscle fibres, while in the healthy older adults, this distance was about 20% higher in the type II muscle fibres. In COPD patients, this distance was equally large in type II muscle fibres compared to healthy older adults. In the type I muscle fibres, there was a greater distance compared to healthy young and healthy older adults. SC distance to nearest capillary was greater in type I muscle fibres of COPD versus controls. In conclusion, changes in muscle tissue are associated with frailty and can be modified by exercise training.

Frailty during and after hospitalisation - Margaret Herridge (Canada)

M. Herridge spoke about critical illness as a model for frailty, functional and cognitive disability and the intersection of these. In the study by Bagshaw et al. [55], the association between frailty and short- and long-term outcomes among critically ill patients was shown. They found that frailty was common among critically ill adults aged 50 and older and identified a population at increased risk of adverse events, morbidity and mortality. Frailty can be modifiable over time as patients showed that they may transition to a better frailty state.

Disability and cognitive impairment may overlap with frailty, but many patients acquire frailty in isolation [56].

After a severe episode of acute respiratory distress syndrome (ARDS), patients sustain important muscle wasting and weakness of approximately 20% of their baseline weight [57].

Levine et al. and Puthucheary et al. showed the relentless atrophy of the diaphragm [58] and muscles of the axial skeleton [59]. Among older persons with critical illness, more than half died within one month or experienced significant functional decline in the following year, with particularly poor outcomes in those who had high levels of premorbid disability. These results may help to inform discussions about the prognosis and goals of care before and during critical illness [60]. But is not just physical disability but also cognitive disability. Hopkins et al. showed a decrement in processing speed, memory, executive function, poor attention and concentration in survivors of severe ARDS [61]. Critical patients may be vulnerable to long-term cognitive dysfunction [62]. Patients can also show mood disorders, such as persecutory delusion and post-traumatic stress disorder [63].

Frailty in chronic lung disorders - L. Lahousse (Belgium)

In this presentation, L. Lahousse discussed three main points: (i) the prevalence of frailty in COPD patients, (ii) the mechanisms that frailty and COPD share, and (iii) the impact of frailty in patients with COPD. Frailty is higher in these patients (10.2%) compared with people without COPD (3.4%), and its prevalence is highly associated with the degree of airflow limitation [64]. The prevalence of pre-frailty is inversely associated with the severity of airflow limitation. The reason behind this is that people with severe disease transfer from a pre-frail to a frail state. COPD is closely related to frailty as both are associated to ageing, smoking, deregulated inflammation and endocrine dysfunction. Mechanisms of accelerated aging and related inflammation in genetically susceptible people might underlay both COPD and frailty. Epigenetic alterations and altered intercellular communication are ageing mechanisms which are likely to be involved in lung diseases such as COPD and idiopathic pulmonary fibrosis [65, 66]. We need to better understand which mechanisms drive frailty in patients with COPD, as frailty reduces QoL [67] and increases hospitalisations, hospital readmissions [68] and in-hospital mortality [69] in these patients.

Rehabilitative interventions to reverse frailty - M. Maddocks (United Kingdom)

The final speaker in this symposium discussed rehabilitative interventions in frailty. M. Maddocks provided an overview of the effectiveness and ease of implementation of a range of possible interventions regarding frailty. Exercise-based interventions appear to be an overall

best solution, comprising both easy implementation and demonstrated effectiveness [70]. In a study by M. Maddocks et al., results showed that overall rehabilitation in patients with COPD led to a shift away from frailty and towards a more robust state [71]. Proportionally, more frail patients experienced deterioration in their condition or hospital admission during the programme. Frailty was also a strong independent predictor of non-completion. In this regard, participants had to overcome unpredictable disruption to participation: some maintained determination despite disruption, others were supported by rapport and flexibility of services, but for some, pulmonary rehabilitation was no longer seen as a good fit [72]. A list of approaches on how to adapt rehabilitation programmes for frailty was given, comprising building trusting relationships, shared understanding of priorities, individualised content to match priorities, capacity to address multidimensional losses and flexibility in service delivery [73].

Take-home messages

- There exist several definitions of frailty and multiple assessment tools to evaluate it
- Muscle satellite cells content is not significantly different between patients with COPD and healthy age-matched controls.
- Muscle satellite cells distance to it nearest capillarity is significantly greater in patients with COPD compared with healthy age-matched controls.
- Frailty may be acquired during illness and hospitalisation. It is an independent risk factor for poor outcome. It may occur with or separate from disability and cognitive impairment. Frailty may be uniquely amenable to rehabilitation and represent a novel opportunity for intervention.
- Frailty is common (>10%) in patients with COPD and is the strongest determinant of survival in COPD. Frailty and COPD share inflammatory mechanisms.
- Frailty can be prevented and reversed by rehabilitation. Exercise remains a powerful intervention for people with respiratory disease and frailty.
- Pulmonary rehabilitation needs to “flex” to ensure a good fit for some of this group, without compromising quality.

Group 9.03: Nurses

Symposium: Fear and anxiety, psychological wellbeing and prevention of psychological in chronic lung diseases

This symposium aimed to identify psychological symptoms in chronic respiratory patients and provide novel treatment approaches that focus on psychological wellbeing and prevention of psychological distress. Four respiratory expert speakers provided an update on the latest knowledge about psychological comorbidities and its management. Besides, a patient testimony with a diagnosis of idiopathic pulmonary fibrosis (IPF) was included.

Patient perspective - R. Flewett (United Kingdom)

This symposium presented the opportunity to voice the experience of a patient with IPF giving advice for healthcare professionals. R. Flewett was diagnosed with IPF at the age of 53 years old and given a life expectancy of 3-5 years. "*I just felt so alone and so desperate at that point, having no one to turn to for help*", R. Flewett said after diagnosis. Frustrated by previous medical experiences, fears and changing moods, R. Flewett provided four advices to healthcare professionals: (i) encourage communication, (ii) reassure the patient that it is ok to feel sad, (iii) put them in touch with other chronic patients, and (iv) promote exercise but clarify the dangers of overexertion. R. Flewett highlighted that the nurse-patient relation enables to identify patients' requirements in a confidential environment and the perception of the patient's family, the caregiver mainly. R. Flewett emphasised that "*sometimes it is the simplest gestures that can help to unlock suppressed emotions*".

Disease-specific fears in COPD - T. Rejinders (Belgium)

Anxiety is the main psychological comorbidity, being observed for 10% to 55% in patients with COPD [74]. Multiple studies have suggested that disease-specific fears of patients with COPD may aid or interfere with the participation in pulmonary rehabilitation (PR) and self-care [75, 76]. The principal fears of these patients are dyspnoea perception and physical activity because of the increase in this symptom [77]. Patients showed a greater perception, but also greater neural processing of respiratory sensations, which emphasise the attention-demanding feature of these sensations [78]. Patients with COPD with higher levels of dyspnoea-specific fear increase attention to respiratory sensations and decrease physical activity. T. Rejinders demonstrated that high levels of disease-specific fears independent of general anxiety were associated with poor outcomes of PR in patients with COPD [79]. Therefore, dyspnoea-specific fears in patients with COPD should be identified as early as possible to improve the effects of PR.

Nurse-led cognitive behavioural therapy in COPD - K. Heslop-Marshall (United Kingdom)

Dyspnoea is the main symptom in patients with COPD. However, anxiety and depression have a significant impact despite not being evaluated and treated properly. Thus, the key elements of self-management in patients with COPD are: (i) mental health, (ii) physical activity, and (iii) addressing physical symptoms. K. Heslop-Marshall highlighted the importance of addressing psychological comorbidities and how cognitive behavioural therapy (CBT) delivered by respiratory nurses can help patients with COPD. CBT is an evidence-based intervention for anxiety and depression in the general population [80]. This intervention was found to decrease anxiety levels and reduce resources use and hospital admission in patients with COPD, being a cost-effective intervention [81].

Expressing empathy in 15 minutes or less: challenges for clinicians - D. Reynolds-Sandford (Australia)

Empathy is the ability to understand and share the feelings of another person, discovering what that person needs and then giving that [82]. Empathy is a skill anyone can develop. Practicing empathy involves: (i) understanding and responding to the suffering of others, (ii) challenging prejudices and preconceived ideas, (iii) practicing active listening, and (iv) speaking up [83]. Healthcare interventions provided with empathy showed many benefits including enhanced patient's experiences, adherence to treatment recommendations, better clinical outcomes, and fewer malpractice claims [84]. Nevertheless, there is a negative part with a higher psychological cost to healthcare professionals. The vicarious trauma is the professional's continuous emotional engagement with patients' problems that creates cognitive distortions and changes in core belief systems within the professionals [85]. It is important that healthcare professionals understand the symptoms associated with this phenomenon to identify, prevent and/or minimise their effects.

Integrating early palliative care for patients with idiopathic pulmonary fibrosis and their caregivers - K. Lindell (United States)

Idiopathic pulmonary fibrosis (IPF) is associated with variable disease course, tremendous symptom burden and poor QoL [86]. Palliative care should be initiated early in the illness course according to the individual patient's needs, preferences and culture to overcome the symptom burden and poor QoL [87]. SUPPORT is an intervention aimed to provide education about seven key elements in IPF patients: (S) symptom management, (U) understanding their disease, (P) pulmonary rehabilitation, (P) palliative care, (O) oxygen therapy, (R) research

opportunities, and (T) transplantation. The final objectives of SUPPORT were understanding the illness, caring for the patient, providing information for the carer, and planning for the future to improve symptom burden and QoL [88].

Take-home messages:

- The main fears of patients with COPD are dyspnoea perception and physical activity.
- Cognitive behavioural therapy is a cost-effective intervention to decrease anxiety levels in patients with COPD.
- Empathy is a skill that healthcare professionals can develop to enhance patients' experiences and clinical outcomes.
- Palliative care should be initiated early in the illness course to overcome the symptom burden and poor quality of life.

Oral presentation: Novel insights into nursing interventions for managing patients with asthma and COPD

This virtual oral presentation session provided an overview of state-of-the-art advances in nursing care related to respiratory conditions by focusing on three main themes: treatment adherence; self-management and patients' perspective.

Treatment adherence (three oral presentations)

Reasons for inhaled corticosteroid non-adherence disclosed by African American adults during primary care visits for uncontrolled asthma - M. George (United States)

Treatment adherence among adults with asthma: A report from the OLIN asthma cohort - S. W. Lindmark (Sweden)

Study to evaluate satisfaction with the inhalation device used by patients with asthma or COPD and the association with adherence and disease control - D. Diaz-Perez (Spain)

M. George et al. aimed to identify reasons for inhaled corticosteroids (ICS) non-adherence by African American (AA) adults with asthma during primary care visits. Using grounded theory, three themes emerged from the analysis of audio recordings of 80 visits for uncontrolled asthma within AA adults: (i) "personal misconceptions", (ii) "management confusions" and (iii) "external influence". Findings suggest that primary care providers should assess patients' knowledge, beliefs and suspicions and consider patient-centred strategies to improve ICS adherence (e.g., shared decision-making and patient engagement). Similarly, in the study

presented by S. W. Lindmark, 1006 adults with asthma were followed up to study pharmacological treatment adherence in northern Sweden. Results showed that 579 participants used asthma treatment during the last year and also that that three out of five had high adherence according to the MARS-5. Forgetfulness was the most common reason for non-adherence and men had poorer adherence than women. The authors emphasised the importance of healthcare professionals to monitor adherence and reasons for non-adherence among patients with asthma.

D. Diaz-Perez presented a multicentre observational cross-sectional study evaluating patients' satisfaction with the inhalation device used and its association with adherence and disease control. The study included 400 participants with asthma and COPD and results showed a high degree of satisfaction, with no difference among device types [89]. Furthermore, having a higher level of education was associated with a higher level of satisfaction. Findings suggest that shared decision making between patients and healthcare professionals is a key factor for the acceptance of the inhalation device.

Self-management (two oral presentations)

Ecare-COPD: a massive open online course to empower nurses to enhance self-management skills in patients with COPD - M. Padilha (Portugal)

An exploratory qualitative study of patients' and healthcare professionals' views on self-management in bronchiectasis - C. Kelly (United Kingdom)

Two studies highlighted self-management for patients with respiratory condition. The Ecare-COPD was presented by M. Padilla as an online training programme for nurses to promote self-management in people with COPD. This e-learning tool was available in three levels (nursing students, general nurses and specialist nurses) with positive feedback from users in terms of usefulness, easiness and intention to use similar online courses.

Kelly et al. conducted study to explore preferences of self-management in adults with bronchiectasis and healthcare professionals involved in their care. Participants were recruited from three sites and participated in three focus groups (17 patients) and 11 one-to-one interviews with healthcare professionals. Findings revealed four themes: (i) what is self-management; (ii) the purpose and impact of self-management; (iii) barriers to self-management; and (iv) enablers of self-management. The authors concluded that both groups were positive about self-management, but some barriers were identified. Specialised healthcare professionals were recognised as precursors to effective self-management.

Patients' perspective (two oral presentations)

Patients' perspectives on point-of-care diagnostics and treatment by emergency medical technicians in acute COPD exacerbations: A Qualitative study - H. M. Christensen (Denmark)
An exploration of dyspnoea and determinants in patients with COPD - E. M. Nerheim (Norway)
Two studies focused on patients' perspective. In Demark, Christensen et al. explored patients' perspective on point-of-care diagnostics and treatment by emergency medical technicians in acute COPD exacerbations. The authors conducted 19 qualitative semi-structured interviews which revealed that patients valued the experience and safety of the ambulance staff using technical equipment and treatment of dyspnoea. Additionally, patients felt confident when general practitioners followed up the treatment initiated during the emergency episodes at home.

Nerheim et al. examined how physical and affective dimensions of dyspnoea were associated in 203 patients with COPD attending a 4-week inpatient PR programme. Results showed that patients with greater dyspnoea severity reported a higher degree of anxiety (HADS-A (B:0.97, $p<0.001$)) and depression (HADS-D (B:0.55, $p=0.002$)), according to the HADS (Hospital Anxiety and Depression Scales). The authors concluded that an individual approach is needed to explore physical and affective dimensions of dyspnoea.

Take-home messages:

- Respiratory professionals should monitor treatment adherence and reasons for non-adherence in patients with respiratory conditions.
- Patient engagement and shared decision making between clinicians and patients might be useful to improve treatment adherence in respiratory care.
- Training and specialised knowledge in respiratory care are important to implement effective self-management interventions.
- Patients' perspectives need to be considered during the assessment and treatment in respiratory care.

Concluding remarks

This article highlights some of the most memorable sessions during the Virtual ERS International Congress 2020 and provides readers with valuable insight into the latest scientific data and emerging areas affecting clinical practice of Allied Respiratory Professionals. The authors wish to inspire readers' enthusiasm to appreciate the value of staying up to date in their field of interest. A new scientific group was created this year in the Allied Health Professionals Assembly, 9.04 Psychologists and Behavioural Scientists, therefore, we believe that next year there will be even more interesting sessions to share the latest scientific data. We hope to see you all in Barcelona in 2021 for the next highly successful ERS International Congress.

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Figure caption

Figure 1. The ontological structure of digital medicine. Reproduced from [21] with permission.

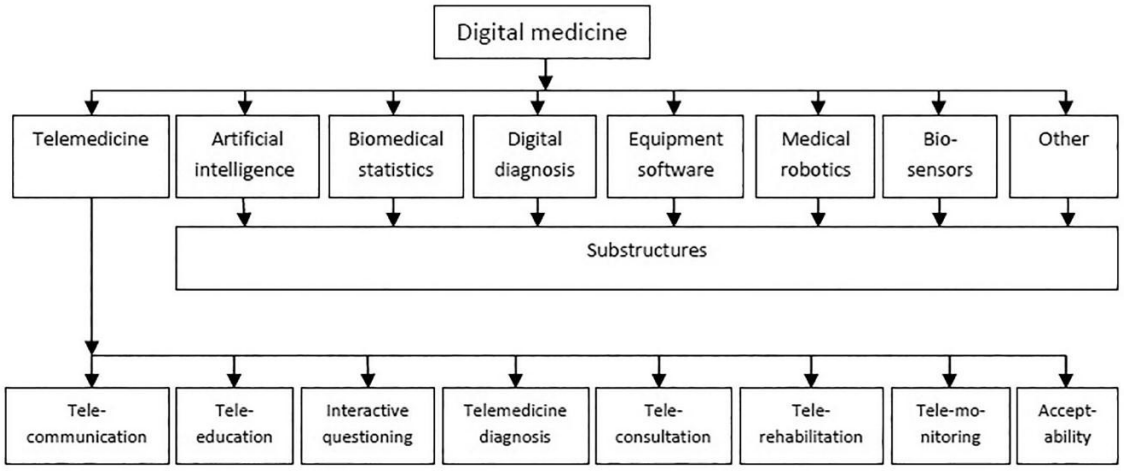

Table 1. Recommendations for the classification of airway obstruction severity, as defined by the American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines [11] and the more recent proposal by Quanjer *et al.* [12].

FEV_1 value		Classification
%predicted	Z score	
≥ 70%	≥ -2.0	**Mild**
60-69%	-2.5 - -2.0	**Moderate**
50-59%	-3.0 - -2.5	**Moderate to severe**
35-49%	-4.0 - -3.0	**Severe**
<35%	<4.0	**Very Severe**

FEV_1, Forced expiratory volume in 1 second