December 2020 VOLUME 21, ISSUE 3

ARTP

Association for Respiratory Technology & Physiology

Inspire

INSIDE THIS ISSUE:

www.artp.org.uk

ARTP Association for Respiratory Technology & Physiology

ARTP EXECUTIVE Council

Dr James Hull	**President**
Julie Lloyd	Chair
Joanna Shakespeare	Vice Chair
Mike Lang	Treasurer
Cara Roberts	Secretary
Ken Hutchinson	Non-Executive Director (HR)
Mark Hubbocks	Non-Executive Director (Finance)
Position vacant	Non-Executive Director (Patient)
Position vacant	Non-Executive Director (Medical)

ARTP EXECUTIVE Board

Julie Lloyd	**Chair**
Joanna Shakespeare	Vice Chair
Dr Karl Sylvester	Past Chair
Mike Lang	Treasurer
Cara Roberts	Secretary
Emma Ince	Communications Chair
Dr Vicky Moore	Education Chair
Sara Parsons	Sleep Chair
Kelly Pauley	Events Chair
Peter Moxon	Standards Chair
Sara McArthur	Workforce Chair
Dr Jane Kirkby	Paediatrics Chair
Position vacant	Early Careers Representative

ARTP EDITORIAL BOARD

Emma Ince	**Communications Chair**
Aidan Laverty	Inspire Editor
Position vacant	Inspire Deputy Editor
Alison Butler	S-news Editor
Dr Andrew Robson	
Prof Brendan Cooper	
Keith Butterfield	
Dr Karl Sylvester	
Martyn Bucknall	
Kimberley Lewis	
Dr Katie Bayfield	

ALL ARTP CORRESPONDENCE TO:

ARTP Administrator, Executive Business Support Ltd., Unit E1 City Wharf, Davidson Road, Lichfield, Staffordshire WS14 9DZ

Tel: 01543 442141

Fax: 0121 355 2420

e-mail: admin@artp.org.uk

ENQUIRIES TO THE EDITOR or ARTICLES FOR SUBMISSION:

Please contact the Editor, Aidan Laverty Inspire@artp.org.uk

INSPIRE is published three times per year: 1st April, August, December. Deadline for articles two weeks prior to publication.

ADVERTISING RATES Please contact ARTP Administration for more information on admin@artp.org.uk or see the ARTP website http://www.artp.org.uk/en/about-artp/admin/advert-rates.cfm

FIRST WORD

VOLUME 21, ISSUE 3. DECEMBER 2020

Welcome to Inspire December 2020.

When I wrote **'First Word'** for the April 2020 issue we were only starting with COVID-19 preparations, with the recently prepared ARTP guidelines becoming a valuable reference. Indeed the Birmingham conference was relatively fresh in our memories. I cannot recall if at the time I realised just how much upheaval in our work and life in general there was to be and how prolonged the disruption would last. We saw in the August issue some novel methods for dealing with the patient appointment backlog and reading on the ARTP forum recently it is evident that laboratories are gradually returning to a 'near as normal' level of operations. Like many, we have started a home spirometry service and are just about to trial a home sleep study service (this is in Paediatrics). At the time of writing, a vaccine looks as if it will be available soon but it would seem that home studies are here to stay and will become more routine as valuable additional services which will need to be adequately costed for in the future.

Where to start for this issue? How about with a double helping of **'Fresh Air'**? Two high quality articles from ARTP Research and Innovation Committee concerning the **perceptual and muscular response to CPAP** and an **overview of just how respiratory and sleep physiology departments around the country adapted to the COVID-19 situation**.

Earlier this year, the lung function department in the North West Lung Centre at Wythenshawe Hospital was awarded IQIPS Accreditation. Nigel Clayton, manager of the Centre, discusses with Martyn Bucknall **here** what this involved and the support processes required if planning to apply. Congratulations to the team!

Dr Karl Sylvester is now the Chair for the European Respiratory Society (ERS) Group 9.01, which *"exists to represent all scientific and educational activities in the ERS with relation to all aspects of clinical respiratory physiology"*. See **here** for further information about the **ERS** and Group 9.01.

The other regular features are here: **'How it Works'** explains the evolution of metabolic studies, **'Top Forum'** neatly summarises a pretty busy ARTP forum (at least until recently) and **'On the Blower'** rounds up the latest manufacturer news. Julie Lloyd begins the issue by summarising what has been happening in ARTP world since the August Inspire in **'A Word from the Chair'**.

I am grateful to all the contributors who have made the time to provide these articles. Also to the Editorial team, whose corrections and suggestions are always helpful, both to me and the contributors (I hope).

Wishing you all the best for Christmas and for 2021 (a virtual conference beckons!).

Aidan Laverty

Julie Lloyd

ARTP Honorary Chair

A WORD FROM THE CHAIR

Hello, and welcome to another edition of Inspire and 'A Word from the Chair'.

Normally, at this time of year, I would be talking to you all about Christmas parties and the excess of everything that Christmas tends to bring. I suspect that Christmas this year will be a very different affair for almost every one of us. This edition would also be the opportunity to remind everyone of all of the exciting sessions that our Annual Conference has to offer as we all prepare for the event, but!

This year has been anything but normal, but despite this, the **ARTP Events Committee** has been working flat out to put together what looks to be a very exciting virtual Conference program that will run on 18th and 19th March 2021. Many of your favourites including an Extreme Physiology session and the scientific poster sessions will be there, along with a number of new joint professional sessions and basic science sessions. Details of how to submit your research will be available shortly, so now is the time to get those research projects, service reviews and audits finished to present at Conference. Our manufactures have continued to support our Conference and will be present in a number of ways throughout the event. The virtual platform also allows us the opportunity to deliver several parallel sessions with speakers from all over the world, so we hope there will be something to interest everyone. More details of the program will be released shortly along with registration details and I look forward to seeing as many as possible of you there at this exciting event.

The **ARTP Education Committee** are continuing their work on delivering as many of our courses in a virtual format in 2021 and each of the course leads are looking at ways we can deliver the high quality our members expect using a virtual platform. I am delighted to report that the ARTP Practitioner and Associate Examinations were successfully held in a virtual format very recently and the feedback from candidates was really positive. ARTP will continue to evaluate how we can take the professional examinations forwards over the coming months. As our Annual Conference is virtual in 2021, successful examination candidates will be offered the opportunity to have their certificates

presented at the 2022 Conference, which we hope to hold as a face-to-face vent.

You may have noticed some changes to the ARTP groups following the decision by Yahoo to close their platforms from 15th December 2020. One of the groups affected by this change is the **ARTP Forum**. The ARTP Forum proved to be an invaluable resource during the difficult first wave of the COVID 19 pandemic and it continues to be a place to get helpful advice from colleagues and friends. The ARTP Forum now has a new email address: forum@artp.org.uk and if you would like to continue to access the ARTP Forum, you will need to complete the on-line registration form, which was circulated recently. If you are having any problems with access, please contact ARTP Admin who will organise this for you.

I was recently fortunate enough to be invited to take part in the latest ARTP webcast, along with Professor Brendan Cooper (University Hospitals Birmingham) and Joanna Shakespeare (University Hospitals Coventry and Warwick). Following on from the previous webcast that explored the experiences of ARTP members re-deployed during the first wave of COVID 19, this session, hosted by Edward Parkes from University Hospitals Coventry and Warwick, explored the reasons behind the formation of the **ARTP COVID 19 group** and the way in which it developed guidance and responded to questions during the pandemic. I hope that you will enjoy listening to this as much as I did taking part. I am sure Edward would be keen to hear your feedback on any other topics you would like to be discussed during further webcasts once the current series are completed.

As 2020 draws to a close, it is a time when we reflect on how the year has affected us professionally and personally. It is sometimes easy to look at only the negative things about 2020, and focus on the challenges, difficulties and those things that did not go so well as we would have hoped. However, from what our members have shared on Twitter and the ARTP Forum, it is a year when each of us overcame challenges, learned new skills and worked in new ways with our colleagues to deliver care for our patients. Like all of you, I am hoping that 2021 brings calmer waters for us all and with a number of vaccines becoming available, some return to a sense of 'normality'.

Wishing you all a safe and enjoyable Christmas and with best wishes for the New Year.

ON THE BLOWER

Matt Rutter
Alan Moore
Prof. Brendan Cooper

This edition of 'On the blower' has the latest product updates from Intermedical, Vitalograph and Vyaire.

intermedical

Winner of the ARTP Small Diagnostic Manufacturer Award for 2018, Intermedical Cardio-Respiratory will once again be showcasing (virtually) its specialist range of lung function testing and sleep diagnostic systems. The range is designed with a fresh approach to Respiratory diagnostic testing and monitoring.

Intermedical is proud to have been a key provider of our services throughout the current pandemic. Following on from supplying thousands of portable oxygen concentrators to NHS trusts across the UK, we are now providing a unique home spirometry solution to over 7000 (and still counting!) vulnerable patients to ensure that they are able to be monitored effectively and safely at home. The **Spirobank Smart** is a hand-held spirometer that works with an App on the patient's Smartphone. The test can be performed in real time and sent directly to the clinician. The App displays the Flow Volume graphs as well as the actual values, % predicted and LLN of all the key parameters and the PDF report produced is based on the ATS recommendations. The Spirobank can also integrate into a number of monitoring portals such as PatientMPower and the Project Breathe and Breath RM portals. Integration into the NHS Health Hub is also under development.

There are some exciting future developments to be announced imminently which are truly ground-breaking in the way that remote Spirometry can be performed. Watch this space!

In other news, we are seeing a big increase in interest for our networked spirometry solutions that can be integrated with hospital EMR and are license-free. This includes our **EasyOn PC**, **EasyOne Air** and portable full PFT system (**EasyOne Pro/ProLab**) for use in Community/outreach lung function testing.

The new version of the **Resmon Pro oscillometry/FOT** device uses the same proven algorithms as the previous device and has the additional advantages of a full colour touch screen and improved connectivity. Tests involve tidal breathing only and do not require forced manoeuvres. FOT is more sensitive to peripheral airway changes than spirometry.

The **Bedfont NObreath** is proving to be extremely popular in both Primary and Secondary care, facilitating cost-effective and accurate FeNO testing. Contact us for our latest offers.

And finally, Intermedical are pleased to have partnered with Finnish company **Ventica** to extend the use of their technology in testing children aged 1-5 as other lung function tests are difficult in this age group. The device measures tidal breathing patterns overnight by impedance pneumography and analyses variability. Reduced variability is associated with persistent wheeze and obstruction. A number of published papers demonstrate its efficacy and we are in the process of facilitating additional UK-based studies.

Vitalograph®

A Global Leader in Respiratory Diagnostics

It would be an understatement to say that 2020 has been a challenging year for the National Health Service, and most especially respiratory services. It is good to see the Royal College of Physicians recently recognised the vital role of healthcare scientists, clinical physiologists and technologists. A huge thank you from all of us for your hard work in these trying times!

Here at Vitalograph, we have been busy supporting clinical staff with our range of remote respiratory monitors, screeners and spirometers. Popular models include the lung monitor **BT Smart** and non comms **asma-1**. Hot off the press is the soon-to-be-released **Vitalograph respiratory app** and clinical web portal for use with the micro BT Smart spirometer and lung monitor BT Smart.

Our busy development team will soon release the next-generation **Pneumotrac**, **Alpha** and **In2itive** spirometers. These new spirometers have been developed around the ATS/ERS Standardization of Spirometry 2019 Update, meet the ISO 26782:2009 standards and exceed the ± 2.5% accuracy requirement. The new PC-based Pneumotrac features **Spirotrac 6**, the latest iteration of our clinical workstation software, whilst the new desktop Alpha and handheld In2itive have completely rewritten graphical user interfaces. Improvements include inclusion of the new acceptability criteria, FEV_1 and FVC grading and recommended comments from the new standards.

We are also launching **Vitalograph Connect**, which will be included as standard. This connectivity software links your EMR with our spirometers, providing the ability for automatic bidirectional transfer of subject details and test results.

Over the past two annual conferences we have showcased our new **pulmonary function testing** range of devices. As with many things, Covid19 has put a delay on the regulatory process, but we are happy to say that our devices are in the system and we hope to officially launch these devices in the very near future. Email sales@vitalograph.co.uk if you would like to be kept up to date with progress.

The final news, in what has proved to be an eventful year, is on our brand refresh. In the background our marketing team has been working hard on a new look for Vitalograph. You will see not just a new design and feel to our devices but a new look to our website and content. Towards the end of this year we will be launching our new website; designed for easy navigation and valuable information.

"I couldn't be happier with the new devices we are working on and the plans for the new website. I think customers will be pleasantly surprised by how Vitalograph has paid attention to their needs and are working on producing the best solutions to meet those needs." said Adrian Fineberg, EVP UK & Ireland Healthcare.

	Enquiries	Technical Support
Telephone	01280 827110	01280 827117
Email	sales@vitalograph.co.uk	tech.support@vitalograph.co.uk

vitalograph.co.uk

COVID-19: Vyaire Supporting Healthcare Professionals

The COVID-19 pandemic had a huge impact in both the private sector and NHS, particularly in unprecedented demands on acute care. Vyaire is committed to helping this workforce respond to the pandemic by bringing together guidance and resources in relation to the latest national developments.

Ventilation – The pandemic lead to an unprecedented need for ventilators. Vyaire worked across the globe to support demand including working with the Department of Health to supply **bellavista™** ventilators across the UK.

Hygiene – In the field of respiratory diagnostics, Vyaire presented further testing on the efficiency of **MicroGard™ II** respiratory filters, including high flows, to support prolongation of cleaning cycles of Vyaire PFT systems.

Training – Vyaire is committed to the provision of training to support the safe use of all of its systems. In the current environment, Vyaire has adapted external training to reflect the needs of its users.

Respiratory Diagnostics: Vyaire announced a programme of 9 webinars tailored to the new normal of remote education.

Ventilation: During the peak of COVID-19 Vyaire trained healthcare professionals across the UK to ensure effective use of the bellavista.

Airway Management: A series of podcasts and research studies are available on Vyaire's COVID-19 Response Centre https://intl.vyaire.com/covid-19-response for the treatment of patients.

Service – As Respiratory Diagnostics departments start to return to a form of normality, Vyaire's sales and service teams are ready to support you for product queries, service, breakdown support and training needs either in person or by remote contact. Contact GMB-UK-Respiratory-Sales@Vyaire.com

Vyaire applauds all healthcare professionals for their tireless efforts, who come to work to save lives every single day. Your hard work and dedication during this difficult time is remarkable. Vyaire is thankful for everything both the private sector and NHS staff are doing in the face of pressure from the coronavirus pandemic.

Vitalograph®

A Global Leader in Respiratory Diagnostics

OUR NEXT GENERATION Healthcare Solutions

Bringing the ATS/ERS Standardization of Spirometry Update 2019 to life

Introducing new Pneumotrac™ PC-based spirometer with next generation Spirotrac® 6 software and Alpha™ desktop spirometer with brand new user interface.

Unrivalled free 5-year warranty
(T&C Apply)

Key Features

- Meet/exceed ISO 26782:2009 standards and ATS/ERS 2019 ±2.5% accuracy requirements.
- Automatic feedback using ATS/ERS 2019 acceptability criteria and FEV_1 & FVC grading.
- Built in ATS/ERS 2019 standardized comments.
- GLI predicted equations including LLN, % Predicted & Z-Scores.
- Improved patient incentive animations (Spirotrac 6).
- Fast integral thermal printer (Alpha).
- Automatic computer interpretation based on ATS/ERS & GOLD standards.
- Validated cross-contamination efficiency >99.999% with Eco BVF™.
- Low running costs.
- Minimal cleaning required.
- Bi-directional EMR connectivity via **Vitalograph Connect** (included as standard).

Call 01280 827110 or email sales@vitalograph.co.uk for further information.

56097_1

Vitalograph®

vitalograph.co.uk

How it Works

Exercise Testing

By Kevin Hogben

Metabolic Studies are not new, the evaluation of the physiological responses in a dynamic state has always been of interest for wellbeing, fitness, ability to work and perform tasks, rehabilitation from illness to sports performance and even space travel. This is not so much a development more a journey in knowledge.

History and the Journey:

The most fundamental and still referred to as the "Gold Standard" is the collection of expired gases and volume in a Douglas bag. This is a simple method of deploying a three-way tap and two-way valve so the subject inspires ambient air and then exhales the breath in to a Douglas bag (typically 50 to 100 litres in size) in a closed circuit with an oxygen and carbon dioxide analyser including a drying column of Calcium chloride or similar to remove water vapour (the gas is then in STPD condition). This is repeated at regular (typically one minute) intervals and the collected gas analysed. The volume of gas was typically measured by emptying the gas either to a dry gas meter (the same as household gas consumption is measured) or into a spirometer. Volume is then corrected to BTPS and the uptake of the gas measured as the uptake of Oxygen and the production of Carbon dioxide in l/min STPD, whilst the Ventilation is reported in litres per minute, in BTPS.

It was a regular sight in Physiology labs to see a rack carrying as many as 8 to 10 bags with taps and tubing, the students armed with stopwatches would then collect samples every minute and analyse the gas and volume to perform the calculations.

You can quickly see this method of measurement would only successfully define the metabolic study at 8 or 10 points during an 8 or 10 minute test.

* Note that this article is the author's personal view and not all devices are covered. Please email the editor at inspire@artp.org.uk if you would like to write a history of your favourite(s).

The Douglas "bag" was named after the user, in 1911 and the bags ability not to diffuse gas was improved by Douglas & Priestley in 1948.

Whilst this technique worked it was impractical for Clinical studies due to space restraints and the number of staff required, so whilst of interest in Physiological training and Research this was not a common Clinical test.

On the "journey" the respiratory manufacturers looked to Tissot spirometers to collect and measure the volume of gas. With capacities of up to 1000 litres the gas could also be measured inline throughout the test. This then led to mixed expired methods as a more compact design. In this approach the Douglas bag was replaced by a mixing chamber and gas meter. The mixing chamber allowed a continuous collection. The mixing chambers took various forms. At P.K. Morgan, the original type was two cones with a series of "pan scrubbers" in the centre, the cones created a vortex to cause turbulent flow, the pan scrubbers were to increase mixing and the second cone to create more mixing before the gas was sampled at the distal end. Others were variable in volume allowing the size to be increased as the level of ventilation intensified. The final design was assisted by the RAF at Farnborough where coloured gases were injected at various frequencies into the chamber and it was then possible to analyse where homogeneous mixing had occurred, this allowed an optimal chamber of 4.5 litres with the sample point at the last baffle before the exit port.

MIXING CHAMBERS

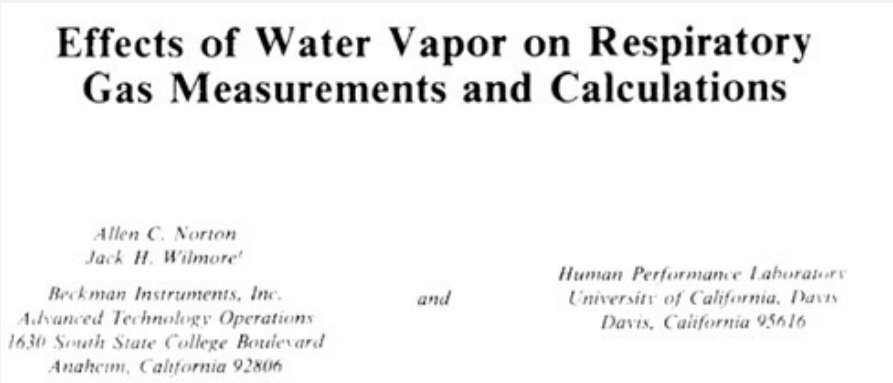
The introduction of the mixing chamber provided exciting advances as now it was possible to take an average of data over 15 or 20 second epochs to the nearest whole breath, this increased the data collection to 3 to 4 points a minute from the 1 per minute in the Douglas bag method, therefore a 10 minute exercise exam would be described by 30 to 40 data points.

Moving away from the Douglas bag presented other challenges as the most common form of inline volume measuring transducer was the Fleisch or Lilly pneumotachographs. These could be both bulky and less accurate with expired humidity, which was overcome by placing the Volume determination on the Inspired limb of a two-way valve subjected to normal humidity inspired conditions and then applying the Haldane expression using the Fraction of inspired and expired Nitrogen to correct the volume expired volume that could then be expressed as STPD for gas conditions and BTPS for Ventilation measurements.

At the same time the manufacturers were looking for a lighter means of measuring the Volume either on Inspiration or expiration.

Turbines and hot wire anemometer seemed the most popular at the time along with the South African work using a flexible orifice pneumotachograph with variable resistance. This work was essential as the common Lilly and Fleisch pneumotachographs were limited in range and this often led to incorrect values at low or high flow rates.

The increased resolution with increased data points heralded further improvement with the Beckman company in the USA moving to real time data collection with the Horizon system. To obtain real-time data collection the analysers had to be without chemical absorbers and therefore resilient to operating in humid sample situations. Allen Norton and Jack Wilmore published on the influence of Water vapour and methods to correct and allow for it. The development to real-time data analysis now opened the door to many manufacturers as of course the instrument of choice would now be a Mass spectrometer. These rather expensive devices allowed small volume, rapid measurements of a gas (in 70ms). At that time Centronics and Perkin Elmer were two of the leaders in this field, with perhaps an unlikely contender also joining the frame, VG with the VG Micromass Spectralab-M, unheard of in the Respiratory industry. I remember seeing one unit at Harefield hospital being demonstrated to Dr Yacoub. Also in the UK a name familiar to the ARTP, Derek Pike. had left Centronics with his colleague and partner Dave Avery and formed Airspec on the Biggin Hill Industrial estate.



Effects of Water Vapor on Respiratory Gas Measurements and Calculations

Allen C. Norton
Jack H. Wilmore

Beckman Instruments, Inc.
Advanced Technology Operations
1630 South State College Boulevard
Anaheim, California 92806

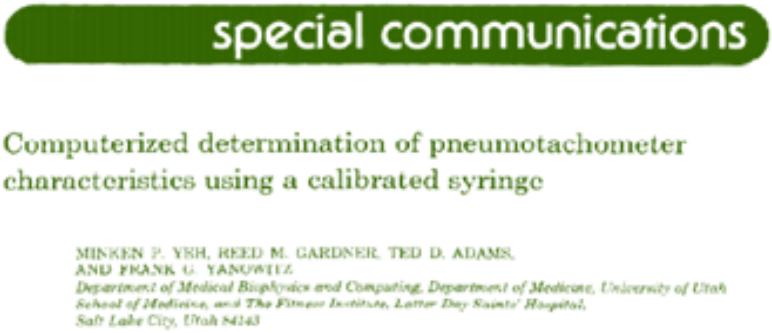
and

Human Performance Laboratory
University of California, Davis
Davis, California 95616

The team led by Dr Karlman Wasserman were investigating the practical application of Clinical Exercise Testing with breath-by-breath data analysis originally using the Perkin Elmer mass spectrometer. They produced multiple publications on this in the late 1970 and early 1980's.


Breath-by-breath measurement of true alveolar gas exchange

WILLIAM L. BEAVER, NORMAN LAMARRA, AND KARLMAN WASSERMAN
Department of Medicine, Division of Respiratory Physiology and Medicine, Harbor-UCLA Medical Center, Torrance, California 90509


special communications

Computerized determination of pneumotachometer characteristics using a calibrated syringe

MINKEN P. YEH, REED M. GARDNER, TED D. ADAMS, AND FRANK G. YANOWITZ
Department of Medical Biophysics and Computing, Department of Medicine, University of Utah School of Medicine, and The Fitness Institute, Latter Day Saints' Hospital, Salt Lake City, Utah 84143

In 1982 Minken P Yeh et al. had published on a method to computerise and linearise a Fleisch No3 Pneumotachograph in order to extend the working range.

This work overcame some of the earlier problems in correct volume determination during exercise, however it was still common to measure only the inspiratory volume and use the Haldane correction. Many investigators wanted to be able to actually align both inspiratory and expiratory ventilation with the corresponding gas analysis; volume always leads gas analysis in breath-by-breath measurement as the breath is analysed for volume then travels to the gas analysers and is delayed by both transport time and response time of the gas analysers. Typically it is expected this can be achieved with a 150ms response.

This comes directly for the work performed in UCLA. When Brian Whipp returned to the UK to work at St Georges Hospital in Tooting, South London, he purchased two Airspec mass spectrometers, I had the pleasure to be involved with that work and Brian explained the mass spectrometer of the time had a measurement response time of 70ms per gas. To avoid water vapour correction it was typical to measure 4 elements, Oxygen, Carbon Dioxide, Argon and Nitrogen, summing for these elements to 100% excludes water vapour. However on a single mass spectrometer this would need an analysing cycle of 4 x 70 ms thus 280ms to read all four elements. By using two matched mass spectrometers it was possible to achieve a response of 2 x 70ms thus 140ms to cycle the elements. For discrete gas analysers a typical response of less than 150ms is adequate for breath-by-breath analysis.

The measurement of breath-by-breath metabolic data became a key focus of the relatively new Medical Graphics Company, formed in 1977. They "leapfrogged" many of the other companies by moving directly to the commercialisation of breath-by-breath measurements, the mass spectrometer being out of the financial range of many clinical settings. Whilst the development of breath-by-breath was largely limited by the computing power available, the Medical Graphics Company had been working on a new development, using the Pitot principle, basically defined as a device which is used for measuring the velocity of flow at any point. The Pitot tube works on the principle of Bernoulli's equation. We more commonly would come upon a Pitot tube

when taking a flight on an aircraft as it is the principle used to measure speed by velocity and can by used to accurately place an aircraft in a position on its flight plan.

Evaluation of a symmetrically disposed Pitot tube flowmeter for measuring gas flow during exercise

JANOS PORSZASZ, THOMAS J. BARSTOW, AND KARLMAN WASSERMAN
Division of Respiratory and Critical Care Physiology and Medicine, Department of Medicine, University of California at Los Angeles Harbor Medical Center, Torrance, California 90509

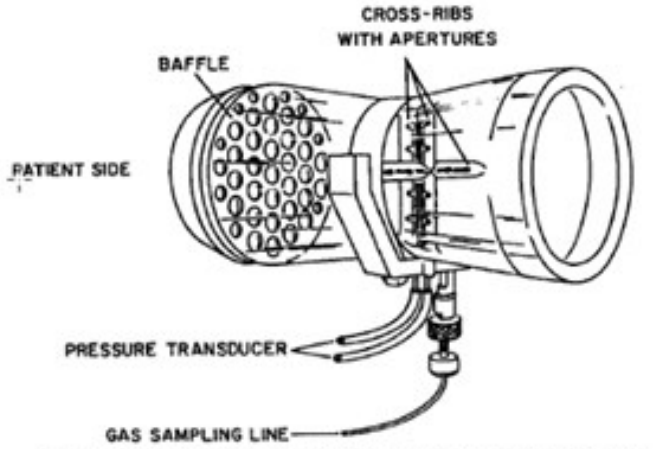


FIG. 1. Schematic of flowmeter. Note ribs with apertures facing into upstream and downstream of airflow. Ribs are connected to 2 differential pressure transducers, which are sensitive over 2 different ranges of pressure. See text for details of operation.

Using a bi-directional Pitot tube and differential pressure amplifiers a new "in line" breathing sensor was introduced that was not affected by temperature or water vapour. This transducer was evaluated for use in Exercise Testing by the Wasserman team and the paper published in 1994 JAP. This has remained a key transducer in the measurement of Metabolic function.

The device is connected to low and high flow transducers with high accuracy over a full flow range. As discussed in the last issue, the hot wire anemometer was seen as an answer to providing a "low or no" respiratory resistance method of measuring volume and flow and the Pitot has found a similar place in solving this question. In exercise testing, we try to minimise all additional loads which can impact the work of breathing and the breathing circuit is part of the loading we need to pay attention to in order to obtain a good result.

At this point we need to reflect on the Respiratory WWW (Wasserman-Whipp–Ward, of course). This team, in addition to the Wasserman publications and the book 'Principles of Exercise Testing and Interpretation' have done much to improve our understanding of exercise and how to then interpret the numbers obtained. Sadly we have already lost Karlman Wasserman and Brian Whipp but we can continue to enjoy the teachings and presentations of Sue Ward, a much appreciated contributor to Respiratory Medicine.

Prior to the Wasserman approach of case studies and pattern recognition in the presentation of the data graphically, the guidance came from the equally famous camp of Norman Jones and his reference 'Clinical Exercise Testing'. Norman's studies were more aimed at stages of exercise testing and obtaining steady state conditions. His publications brought us into contact with the McHardy's four quadrant "spirogram" as it was affectionately known, This was another Graphical way to express the metabolic performance of a subject during exercise.

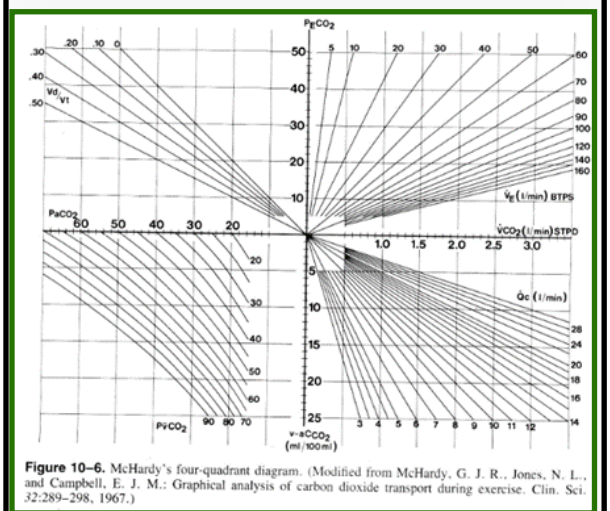
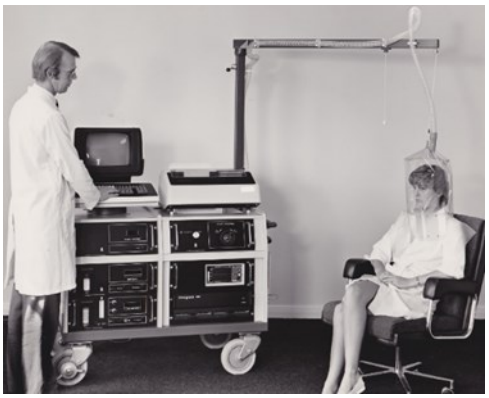


Figure 10–6. McHardy's four-quadrant diagram. (Modified from McHardy, G. J. R., Jones, N. L., and Campbell, E. J. M.: Graphical analysis of carbon dioxide transport during exercise. Clin. Sci. *32*:289–298, 1967.)

Pattern recognition is a large part of understanding a metabolic study and the performance of the subject, as typically a linear change is expected between work as a function of load to Ventilation, Oxygen uptake and Heart rate, so performance-limited exercise should be recognisable. We use metabolic studies for many situations in life. The World Health Organisation (WHO) took a large interest in the work needed to perform occupational studies and the British Medical Research Council (MRC) commissioned development of a product. The research and concept was devised by Simon Humphreys at Northwick Park Hospital Harrow London and brought to commercial reality by P.K. Morgan Limited as the OXYLOG, a portable oxygen consumption meter, this was used all over the world to measure human load during routine occupation and was also extended to some zoo applications to look at metabolic function in animals.

Metabolic Studies are also linked to nutrition and diet and used in catering to develop healthy meals; indirect calorimetry is an important measurement and was used in the development of the famous Cambridge diet in the mid 1980s. Nutrition and weaning are also applied to metabolic measurements in Intensive Care units, in regulating the ventilator control and nutrition of the patient to sustain life. Rehabilitation can be aided by metabolic studies as a way of reassuring patients of their ability to gain strength. We use simplified methods to evaluate metabolic response with six minute walk tests and similar.

We can look at dynamic function in the ways that Cardiac Output, pulmonary circulation and perfusion all interact. The evaluation of metabolic function is applied to Pre-operative assessment to advise on the expected outcome to surgery and quality of life. Studies have looked directly at the effects on diffusion from exercise and of course the progression of Heart/Lung transplant subjects. Clinical exercise testing and metabolic function linked to cardiac function defines the Cardio-Pulmonary Exercise Testing (CPET) we perform today. The manufacturers engage in designing smaller, less obtrusive machines to minimise anxiety caused by the test environment. Exercise laboratories have become more like a "walk in the park" to allow assessment of the true responses of the subject and have come on a long journey from the simple Douglas bag that enabled the original work.



Edited by

Dr. James Stockley

FRESH AIR !

Dear Reader, welcome back to 'Fresh Air'. These articles, sourced or provided by the Research and Innovation Committee, are designed to communicate novel trends in research, innovation and clinical practice from both respiratory and sleep sciences.

After a brief hiatus due to COVID-19, we are delighted to present two articles in this edition of Inspire. First, Dr Claire Griffith-Mcgeever, who completed her PhD at the School of Sport, Health and Exercise Sciences, Bangor University, has written an article on inspiratory muscle loading in obstructive sleep apnoea. Second is the summary of results from the recent survey on Innovations in Lung Function & Sleep during COVID-19, designed and written by Gavin Comber, a Clinical Scientist from University Hospitals of North Midlands.

Perceptual and muscular response to loading in Obstructive Sleep Apnoea patients before and after 12 weeks of Continuous Positive Airway Pressure treatment.

Dr Claire Griffith-Mcgeever, School of Sport, Health and Exercise Sciences, Bangor University

Background

Repeated cessations of airflow in the form of apnoeas and hypopnoeas result in transient periods of hypoxaemia and hypercapnia[1-2], sleep fragmentation, and respiratory effort-related arousals (RERA) that attempt to re-establish the airway patency and normalise blood gases[3-4]. The inspiratory efforts generated against the obstructed airway dysregulates blood flow to the respiratory muscles[5-7].

Strong inspiratory efforts against the occluded airway result in chronic overloading of the inspiratory muscles during sleep that has the potential to exacerbate the cyclical pattern of sleep instability[8] . Consequently, the overloading of the inspiratory muscles during sleep is thought to lead to an increased risk of fatigue at rest and during incremental exercise[9-10]. An adaptive response could be hypothesised in patients with Obstructive Sleep Apnoea (OSA), whereby the inspiratory activity alternates between the diaphragm and inspiratory/accessory muscles in order to balance the work of breathing and minimise the development of fatigue[11-13]. However, relatively few studies have addressed the potential perceptual alterations that occur as a result of the chronic intermittent hypoxic stress experienced during sleep in OSA.

Tun and colleagues revealed that patients with OSA have an impaired inspiratory effort sensation (measured via CR10 Borg scale) to added inspiratory resistive loading that is reversed following 2 weeks of continuous positive airway pressure (CPAP) therapy[14]. More recently, Earing et al. reported that patients with severe OSA (measured by Apnoea Hypopnoea Index; AHI) produced lower inspiratory forces at a fixed rating of perceived exertion (RPE) of 14 (on the 6-20 Borg Scale) following repeated bouts of loading[15]. These findings suggest that OSA patients demonstrate an altered perceptual response to loading that is modified by CPAP therapy. However, no study to date had fully examined the perceptual and muscular response before and after inspiratory loading in OSA patients compared to "trained" (VO_{2max} >55 ml·kg·min^{-1}) and "untrained" (VO_{2max} <40 ml·kg·min^{-1}) individuals. Furthermore, the effect of three months of CPAP therapy had not been investigated.

Methods

At the School of Sport, Health, and Exercise Sciences (Bangor University), we designed a non-invasive experimental protocol to progressively load the inspiratory muscles under standardised conditions in order to determine whether the inspiratory pressures generated at RPE14 changed in response to loading whilst minimising the recruitment of accessory muscles (Figure 1).

Figure 1. Drawing illustrating the forward leaning posture adopted throughout the protocol to minimise recruitment of accessory muscles.

A pilot study was conducted to systematically explore the test-retest reliability of the novel inspiratory loading protocol[15]. Sixty three males volunteered to participate in the study, which included 37 healthy participants (mean BMI = 23.1 ± 1.5 kg/m^2) and 26 overweight (BMI: 28.2 ± 2.5 kg/m^2) participants. Test-retest intraclass correlation coefficients were assessed during inspiratory pressures generated at RPE14 on the Borg scale, after each set of 20 breaths with the Powerbreathe Plus device (POWERbreathe International Ltd, Warwickshire, UK). A second assessment was conducted after 1 week under similar testing conditions. The pilot study produced an acceptable test-retest reliability of 0.967 with a 95% confidence interval of 0.953 - 0.978.

The effort sensation paradigm as reported by Earing et al.[15] was then utilised to assess the perception of effort and inspiratory muscle activity before and after repeated bouts of loading in patients with newly diagnosed OSA at Ysbyty Gwynedd compared with trained and untrained individuals. *(21 patients with newly diagnosed OSA (mean age: 55.1 ± 2.0 years; height: 173.4 ± 1.4 cm; mass: 101.5 ± 4.6 kg; BMI: 33.7 ± 1.4 kg·m^2; AHI: 42.8 ± 6.7 events/hr) at Ysbyty Gwynedd compared with 21 trained (mean age: 35.1 ± 2.1 years; height: 179.5 ± 1.5 cm; body mass: 76.5 ± 2.4 kg; BMI: 23.7 ± .65 kg·m^2); VO_2max: 61.0 ± 1.8 ml·kg^{-1}·min^{-1}), and 19 untrained individuals (mean age: 28.4 ± 1.8 years; height: 176.8 ± 1.9 cm; body mass: 82.0 ± 4.1 kg; BMI: 25.6 ± .89 kg·m^2; VO_2max: 39.7 ± 1.4 ml·kg^{-1}·min^{-1}.*

All participants recruited were male). The procedure adopted in the current study was not externally controlled (such as holding a weight or tension for a set duration), rather our participants were instructed to match the inspiratory pressure generated at RPE14 before and after repeated bouts of loading. The corresponding electromyogram (EMG) amplitudes were also recorded to determine the muscle activity changes in response to loading. Intercostal and Trapezius EMG amplitudes were measured by applying bipolar pairs of silver/silver chloride electrodes on cleaned, abraded skin of the Intercostal and Trapezius muscles[16-17].

In the present study, the maximal inspiratory pressure (PI_{max}) was firstly measured from residual volume according to ATS/ERS guidelines to determine participant's respiratory muscle strength with a resistive breathing device (KH2 POWERbreathe International Ltd, Warwickshire, UK)[18]. Participants were instructed to produce five inspiratory pressures at a fixed effort of 14 'reference point' (IP_{14}) using standard procedures[19], corresponding to the verbal anchors of 'somewhat hard' to 'hard/heavy' on the 6-20 Borg scale. This allowed participants to gauge how much pressure was required to represent the target RPE before loading. The EMG amplitudes of Intercostal and Trapezius muscles were also recorded during these tasks to determine the muscle activity prior to loading.

The inspiratory loading protocol was explained to each participant and, thereafter, performed in five sets of twenty loaded breaths at a fixed intensity of 50% of the pre-recorded PI_{max}. Participants were instructed to adopt a natural breathing style throughout the loading protocol. After each set of twenty loaded breaths, participants generated an inspiratory pressure at RPE14 that allowed us to reassess the pressures and corresponding EMG activity. The same experiment was repeated following 12 weeks of CPAP treatment in OSA patients. Figure 2 illustrates the step by step measures completed during the experimental procedure. Fifteen males with diagnosed OSA completed the follow-up assessments after receiving 3-months of CPAP therapy (age: 55.2 ± 2.3 years; height: 173.3 ± 1.3 cm; mass: 99.7 ± 5.6 kg; BMI: 33.1 ± 1.7 $kg{\cdot}m^2$). The AirviewTM feature of the AirSenseTM 10 AutoSet RedMed device was utilised to re-assess the AHI and adherence after 3 months of CPAP treatment (mean pressure: 8.67 ± 0.8 cmH_2O, usage: 7.06 ± 0.4 hrs / night (range 4.11-9.23 hrs / night), and days of usage > 4hrs: 93.7 ± 3.5 %) (*ResMed (UK) Limited, Didcot, UK*).

Inspiratory pressures at a fixed RPE of 14 (IP_{14} reference and loading) were studied according to the absolute (cmH_2O) and relative values (normalised according to maximal inspiratory pressure and expressed as a % of PI_{max}). Electromyography (EMG) data was recorded and analysed offline using commercially available software (AcqKnowledge 3.9, BIOPAC systems, US). EMG signals were amplified (gain x 1000), band-pass filtered 35-500 Hz, and digitised at a sampling rate of 2000 kHz. Root mean square (RMS) amplitudes with a time constant of 100 ms were analysed over the 0.5 second window for the PI_{max}, IP_{14} reference and loading measures. EMG data was studied according to absolute (μV) and relative amplitudes (normalised according to maximal EMG and expressed as a % of RMS). Data measured after the fifth set of loading (100 breaths) was excluded from analysis due to participants knowing they were facing the last measure and altering their behaviour either through giving a 'last inspiration', or disengaging altogether from the task, which resulted in higher or lower inspiratory pressures generated at RPE14.

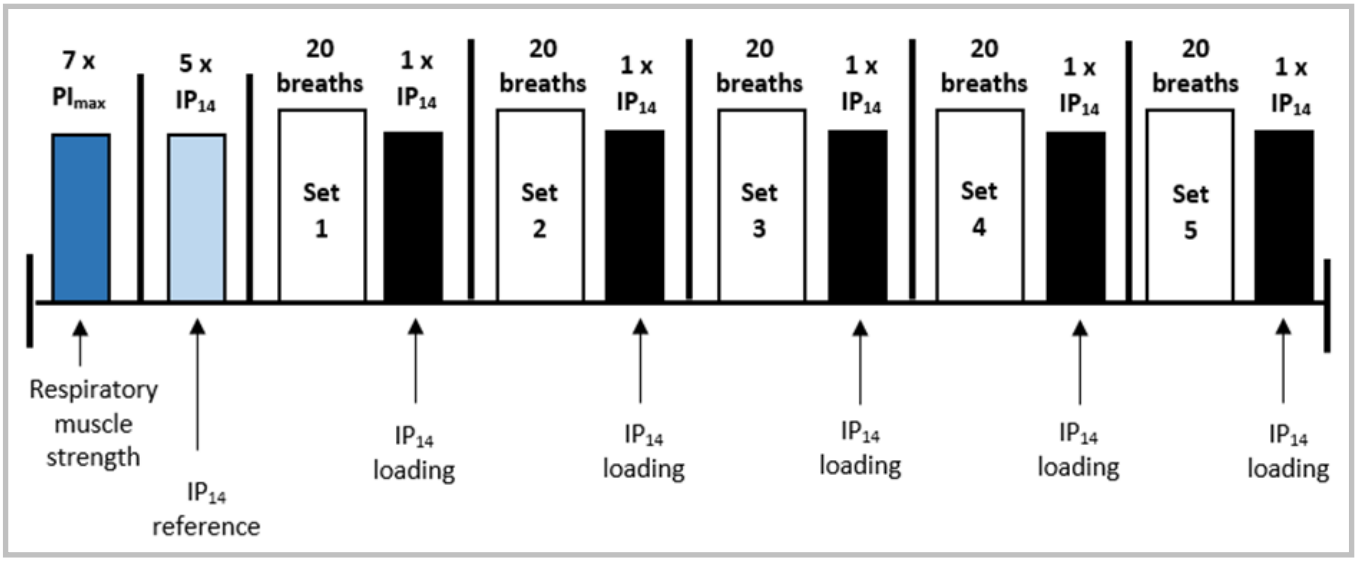


Figure 2. Schematic diagram of the inspiratory loading protocol, showing the determination of Maximal Inspiratory Pressure (PI_{max}) and Inspiratory Pressure at RPE 14 (IP_{14}) at baseline, followed by the five cycles of 20 loaded breaths and single IP_{14} manoeuvre.

Statistical analyses were performed using SPSS version 25 for Windows (SPSS Inc., Chicago, IL, USA). Data was expressed as mean ± SEM with $p < 0.05$ considered statistically significant. Shapiro-Wilk tests were performed to determine the data's assumption of normality. Repeated measures analysis of variance (ANOVA) and follow-up analyses were performed to determine whether loading had an influence on the relative inspiratory pressures at RPE14 (IP_{14}). Kruskal-Wallis tests and follow-up Mann-Whitney U tests were performed to analyse potential differences between the groups given the non-parametric nature of the EMG data. Paired-*t* tests were performed to examine the effect of CPAP therapy on the inspiratory pressures at RPE14. Spearman's rho analyses were performed to determine whether correlations existed between participants' physical characteristics, AHI, and the inspiratory pressures generated at RPE14.

Research Findings and Implications

The experiment was conducted to determine whether effort was perceived differently when the inspiratory muscles were loaded in OSA patients compared with trained and untrained individuals and what impact CPAP therapy may have in OSA patients. We firstly examined the inspiratory pressures generated at RPE14 to determine the reference point of effort perception during unloaded conditions. Our study firstly demonstrated patients with newly diagnosed OSA generated inspiratory pressures (as a % of PI_{max}) that were similar to those observed in healthy individuals at the reference point (Figure 3A). We then examined the inspiratory pressures generated at the reference point in OSA patients after receiving CPAP treatment. The present study revealed that OSA patients generate significantly higher inspiratory pressures at the reference point following 3 months of CPAP treatment ($p < .01$; Figure 3A).

A

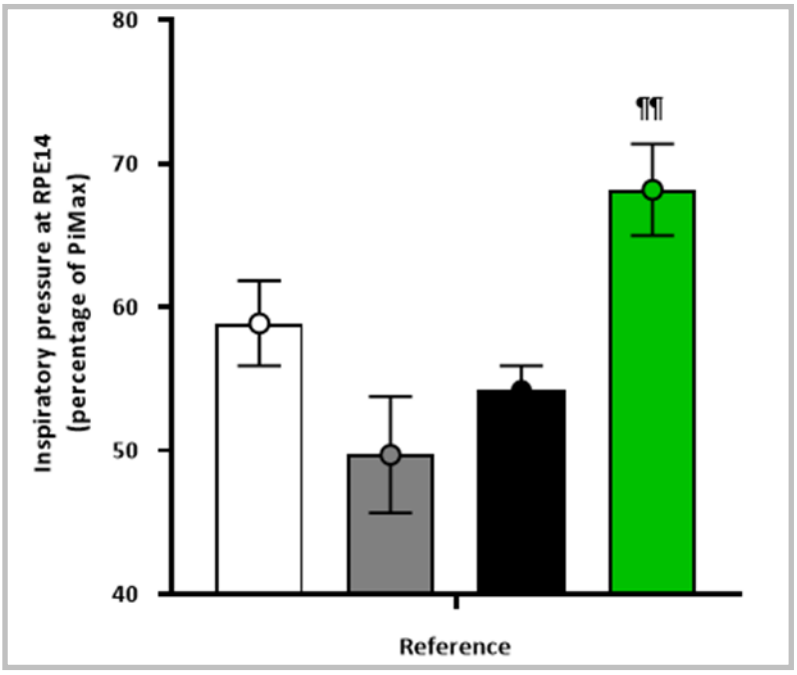


Figure 3A. Inspiratory pressure at an RPE of 14 (IP_{14}) measured at the reference point. Pressure data is expressed as Mean ± SE. △ = Trained group (n=21); ▲ =Untrained group (n=17); ▲ =OSA group (n=17) and ▲ =Post-CPAP group (n = 15). **NOTE:** Abbreviations: PI_{max}, Maximal Inspiratory Pressure; IP_{14}, Inspiratory pressure at RPE 14. ¶¶ = $p < 0.01$ vs. Pre-CPAP.

The inspiratory pressures were then measured at RPE14 after each completed bout of loading. Our study revealed the inspiratory pressures generated at RPE14 were increased following repeated bouts of inspiratory loading at 50% PI_{max} in untrained individuals and OSA patients ($p < 0.05$; Figure 3B). The experiment further demonstrated the relative pressures generated at RPE14 following loading were shown to operate at the same level as the reference point following CPAP therapy. Therefore, the alteration of inspiratory effort is only observed at rest following CPAP treatment in patients with OSA.

B

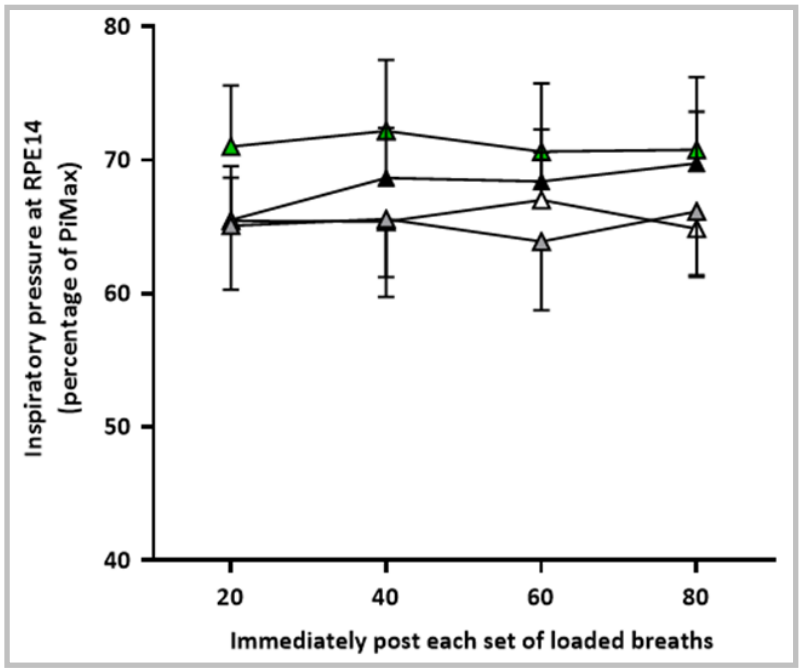


Figure 3B. Inspiratory pressure at an RPE of 14 (IP_{14}) measured after repeated bouts of loading. Pressure data is expressed as Mean ± SE. △ =Trained group (n=21); ▲ =Untrained group (n=17); ▲ =OSA group (n = 17) and ▲ = Post-CPAP group (n = 15). **NOTE:** Abbreviations: PI_{max}, Maximal Inspiratory Pressure; IP_{14}, Inspiratory pressure at RPE 14.

These outcomes suggest that patients with OSA utilise a lower assumed capacity of their primary inspiratory muscles (possibly due to weakness) that is compensated by recruiting additional respiratory and accessory muscles to support inspiratory efforts at the reference point[20]. This concept is further supported by the significant correlation we observed between AHI (OSA severity) and the inspiratory pressures generated at the reference point in OSA patients before CPAP therapy (r_s = -0.567, p = 0.02 – data not shown). From this finding we can deduce that patients with severe OSA generate lower inspiratory pressures at the reference point (before CPAP therapy) that is potentially due to respiratory muscle weakness and the lower motor drive sent to the inspiratory muscles. These findings can also be interpreted as an adaptation occurring following CPAP therapy, whereby there is an increased motor drive to the expected level. Consequently, the respiratory system would enable OSA patients to produce greater forces with less effort required. Interestingly, the relationship between AHI and inspiratory pressures generated at the reference point was not observed following CPAP treatment which provides further evidence to suggest CPAP therapy leads to a normalisation of AHI and possibly changes to the motor drive at rest.

The inspiratory muscle recruitment at a fixed RPE of 14 was revealed to be different at the reference point in OSA patients compared with healthy trained and untrained individuals. The Intercostal EMG amplitude (% RMS) was found to be similar between the groups at the reference point (Figure 4A). Whilst, the Trapezius EMG amplitude (% RMS) was revealed to be significantly increased in OSA patients at the reference point compared with trained individuals (p < 0.01).

The present study further revealed the inspiratory effort perception after loading was differentially affected in OSA patients compared with trained and untrained individuals. The relative Intercostal EMG amplitude was found to be unchanged at RPE14 following loading in all groups (Figure 4B). However, the normalised Trapezius EMG

A

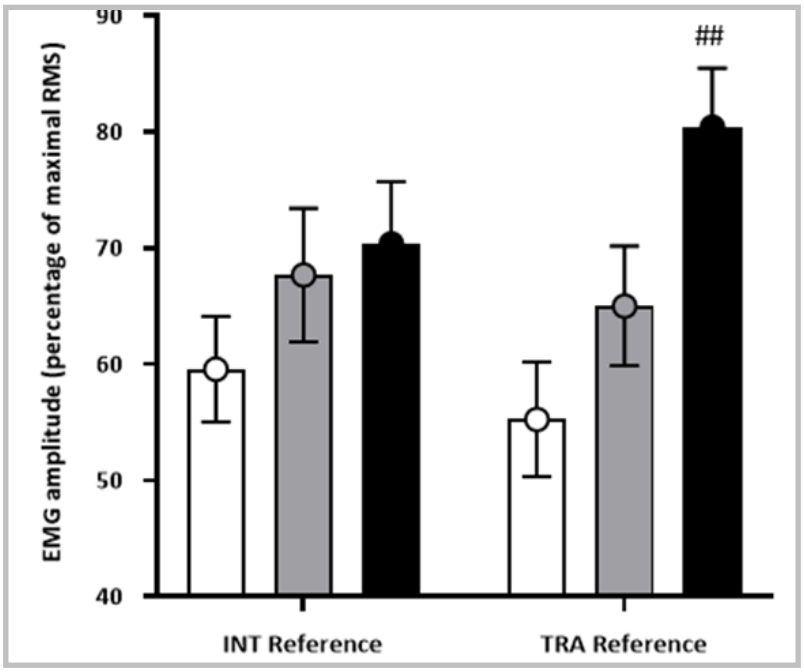


Figure 4A. Intercostal (INT) and Trapezius (TRA) EMG amplitude during the IP_{14} measured at the reference point. EMG data are expressed as Mean ± SE. □ = Trained group (n = 21); ▩ =Untrained group (n = 16); ■ = OSA group (n = 14). ## = p < .01 vs. Trained.

amplitude was found to be significantly increased at RPE14 following loading in OSA patients and untrained individuals compared with trained individuals ($p < 0.05$; Figure 4C).

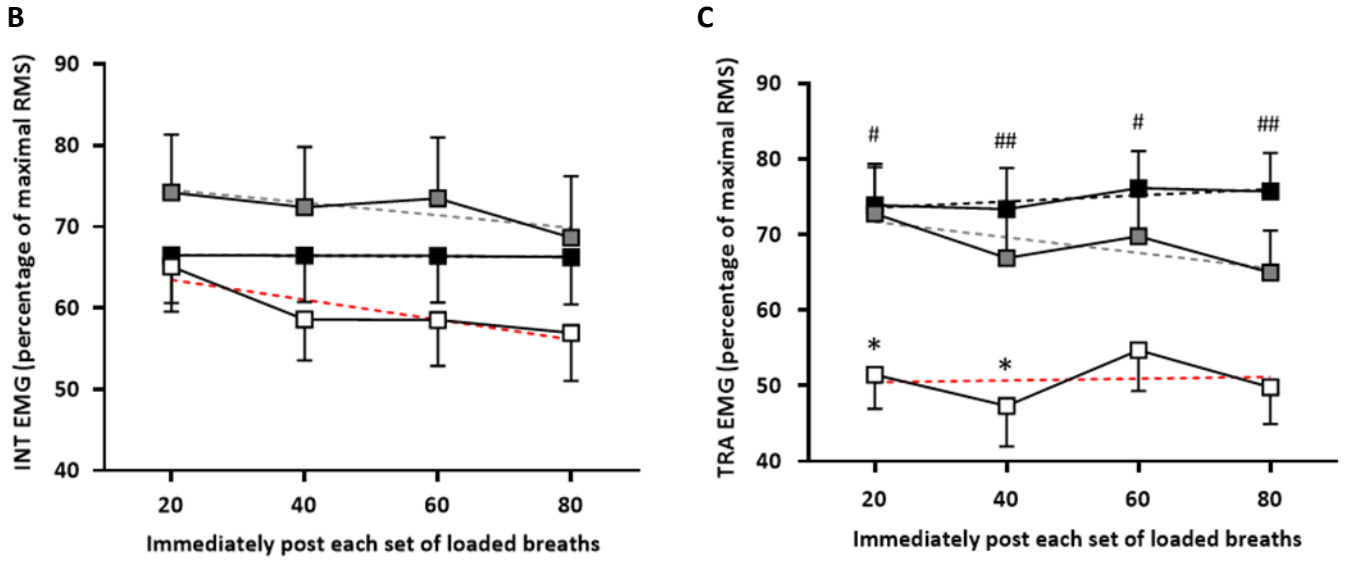


Figure 4B-C. Intercostal (B) and Trapezius (C) EMG amplitude measured during the IP_{14} after repeated bouts of loading. EMG data are expressed as Mean ± SE. □ = Trained group (n = 18); ▩ = Untrained group (n = 16); ■ = OSA group (n = 14). The dashed line represents the linear trend line. **#** = $p < 0.05$, **##** = $p < 0.01$ vs. Trained. * = $p < 0.05$ vs. Untrained.

Patients with newly diagnosed OSA were shown to utilise a significantly greater percentage of their accessory muscles to supplement the primary respiratory muscles when generating inspiratory pressures at RPE14 following loading (compared with the reference point). These outcomes support an integrated motor output that is based upon the sensory feedback derived from a multitude of afferent proprioceptive receptors (located within the airways, thorax, lungs, and inspiratory / accessory muscles) in addition to a complex central regulation to mediate the sense of respiratory effort[21-23].

This concept is supported by the EMG activity of the inspiratory and accessory muscles recorded at RPE14, which reveals that OSA patients utilise the Trapezius muscles to a significantly greater extent during loading. Presumably, this reflects the accessory muscle supporting inspiratory efforts when the capacity of the inspiratory muscles are diminished due to weakness/fatigue[24-25]. The strategy could also be seen as the respiratory system attempting to redistribute some of the workload / demand of breathing to the accessory muscles in order to minimise breathing effort and discomfort[26]. Based upon these findings, we can also infer that there is no change in the total motor drive observed following loading in OSA patients treated with CPAP therapy given the capacity of key muscles are being utilised to their maximal limits.

In conclusion, the results of the present study provide further evidence that newly diagnosed OSA patients demonstrate a heightened inspiratory effort perception and greater reliance upon the accessory muscles before and after inspiratory loading. The study provides further insight into the impact of CPAP therapy, which was shown to upregulate the perception of inspiratory effort at rest. These findings support the recommendation of an intervention such as Inspiratory Muscle Training (IMT) alongside usual CPAP treatment in OSA patients given the need to improve the overall efficiency of the inspiratory muscles (i.e. increase Intercostal muscle activity and decrease the reliance of Accessory muscles), reduce frequency of obstructive events, and attenuate the heightened perception of effort within this clinical population.

References

1. Halliwill, J.R., et al., *Effect of hypoxia on arterial baroreflex control of heart rate and muscle sympathetic nerve activity in humans.* Journal of Applied Physiology, 2002. **93**(3): p. 857-864.
2. Mullington, M.J., et al., *NIH Public Access. Cardiovascular,Inflammatory and Metabolic Consequences of Sleep Deprivation.* Prog Cardiovasc Dis, 2009. **5**(4): p. 294-302.
3. Guilleminault, C., et al., *The Sleep Apnea Syndromes.* Annual Review of Medicine, 1976. **27**(1): p. 465-484.
4. Somers, V.K., et al., *Sympathetic neural mechanisms in obstructive sleep apnea.* Journal of Clinical Investigation, 1995. **96**(4): p. 1897-1904.
5. Remmers, J.E., et al., *Pathogenesis of upper airway occlusion during sleep.* Journal of Applied Physiology, 1978. **44** (6): p. 931-938.
6. Wiegand, L.Z.C., *Obstructive sleep apnea.* Disease-a-Month, 1994. **40**(4): p. 197-252.
7. Drager, L.F., et al., *Obstructive sleep apnea: An emerging risk factor for atherosclerosis.* Chest, 2011. **140**(2): p. 534–542.
8. Wilcox, P.G., et al., *Respiratory muscle function during obstructive sleep apnea.* The American Review of Respiratory Disease, 1990. **142**(3): p. 533-539.
9. Chien, M.Y., et al., *Inspiratory muscle dysfunction in patients with severe obstructive sleep apnoea.* European Respiratory Journal, 2010. **35**(2): p. 373-380.
10. Chien, M.Y., et al., *Electrophysiologic changes with incremental exercise in obstructive sleep apnea.* Muscle and Nerve, 2013. **48**(2): p. 212-218.
11. Fitting, J.W., et al., *Dissociation between diaphragmatic and rib cage muscle fatigue.* Journal of Applied Physiology, 1988. **64**(3): p. 959-965.
12. Sharp, J.T., et al., *Effects of Mass Loading the Respiratory System in Man.* Journal of Applied Physiology, 1964. **19**(5): p. 959-966.
13. Yokoba, M., et al., *Respiratory muscle electromyogram and mouth pressure during isometric contraction.* Respiratory Physiology and Neurobiology, 2003. **137**(1): p. 51-60.
14. Tun, Y., et al., *Inspiratory effort sensation to added resistive loading in patients with obstructive sleep apnea.* Chest, 2000. **118**(5): p. 1332-1338.
15. Earing, C.M.N., et al., *Factors associated with the severity of apnoea hypopnea index in obstructive sleep apnoea.* Bangor University, 2014.
16. Cescon, C., et al., *Effect of electrode array position and subcutaneous tissue thickness on conduction velocity estimation in upper trapezius muscle.* Journal of Electromyography and Kinesiology, 2008. **18**(4): p. 628-636.
17. Hawkes, E.Z., et al., *Diaphragm and intercostal surface EMG and muscle performance after acute inspiratory muscle loading.* Respiratory Physiology and Neurobiology, 2007. **155**(3): p. 213-219.
18. Miller, M.R., et al., *Standardisation of spirometry.* European Respiratory Journal, 2005. **26**(2): p. 319-338.
19. Noble, B.J., et al., *The Borg scale development, administration, and experimental use*. Perceived exertion, 1996. p. 59 -89.
20. Sharp, J.T., et al., *Diaphragmatic responses to body position changes in obese patients with obstructive sleep apnea.* American Review of Respiratory Disease, 1986. **133**(1): p. 32-37.
21. Scano, G., et al., *Do obstructive and restrictive lung diseases share common underlying mechanisms of breathlessness?* Respiratory Medicine, 2010. **104**(7): p. 925-933.
22. Gandevia, S.C., *The perception of motor commands on effort during muscular paralysis.* Brain, 1982. **105**(1), p. 151-195.
23. O'Donnell, D.E., et al., *Pathophysiology of dyspnea in chronic obstructive pulmonary disease: A roundtable*. Proceedings of the American Thoracic Society, 2007. **4**(2); p. 145-168.
24. Dempsey, J. A., et al., *Consequences of exercise-induced respiratory muscle work.* Respiratory Physiology and Neurobiology, 2006. **151**(2-3): p. 242-250.
25. Orozco-Levi, M., et al., *Activity of latissimus dorsi muscle during inspiratory threshold loads.* European Respiratory Journal, 1995. **8**(3): p. 441-445.
26. Mead, A.F., et al., *Diaphragm remodeling and compensatory respiratory mechanics in a canine model of Duchenne muscular dystrophy.* Journal of Applied Physiology, 2014. **116**(7): p. 807-815.

Edited by

Dr. James Stockley

Innovations in Lung Function and Sleep Services during the COVID-19 Pandemic

Gavin Comber – Clinical Scientist on behalf of the ARTP Research & Innovation Committee

Introduction

2020 has been an unprecedented year for us all. In a short space of time, the Coronavirus Disease (COVID-19) has spread across the globe and impacted severely both sociologically and economically. At the time of writing, the World Health Organisation (WHO) has reported 47.4 million cases worldwide with 1.2 million deaths. Here in the UK, we have seen 1.1 million cases and 60 thousand deaths. Of course, these numbers are debatable, with cases likely to be far higher due to limitations with testing and deaths depending on how their cause is recorded. This is without considering the additional impacts on other services; elective surgeries, cancer pathways, diagnostics and many other little talked about services.

The NHS has undergone a rapid transformation to cope with the needs of those patients who have been severely affected by COVID-19 which, in turn, has impacted on other services (including elective surgeries, cancer pathways, diagnostics and many more). The situation is ever-changing and we as a healthcare community have had to research factors that we would not usually consider, such as droplet dispersal, aerosol generating procedures (AGPs) and air change rates (ACH) to name but a few. It has seen specialisms that usually work in isolation come together for a common cause, staff adopting new roles and the innovation of novel practices to optimise patient care whilst ensuring the safety of all. Some of these changes were through necessity, whereas others were already under consideration but the plans to implement them rapidly accelerated.

As the crisis phase of the first wave was ending, the ARTP Research & Innovation committee sought to investigate the impact of the COVID-19 pandemic on Respiratory & Sleep Physiology departments around the country and how they adapted.

Results

There were 51 responses to the survey from a variety of different departments, although most were predominantly mixed respiratory and sleep departments (Figure 1). Of the 51 responses, 50% of all staff were redeployed to work in a capacity outside their normal remit. The most likely members of staff to be redeployed were those working at a band 6 or 7 level (accounting for 48% of all redeployment), with 71% being band 5 or higher (Table 1). This demonstrates the valuable, transferrable skills that respiratory and sleep physiologists and scientists possess as well as their ability to work flexibly.

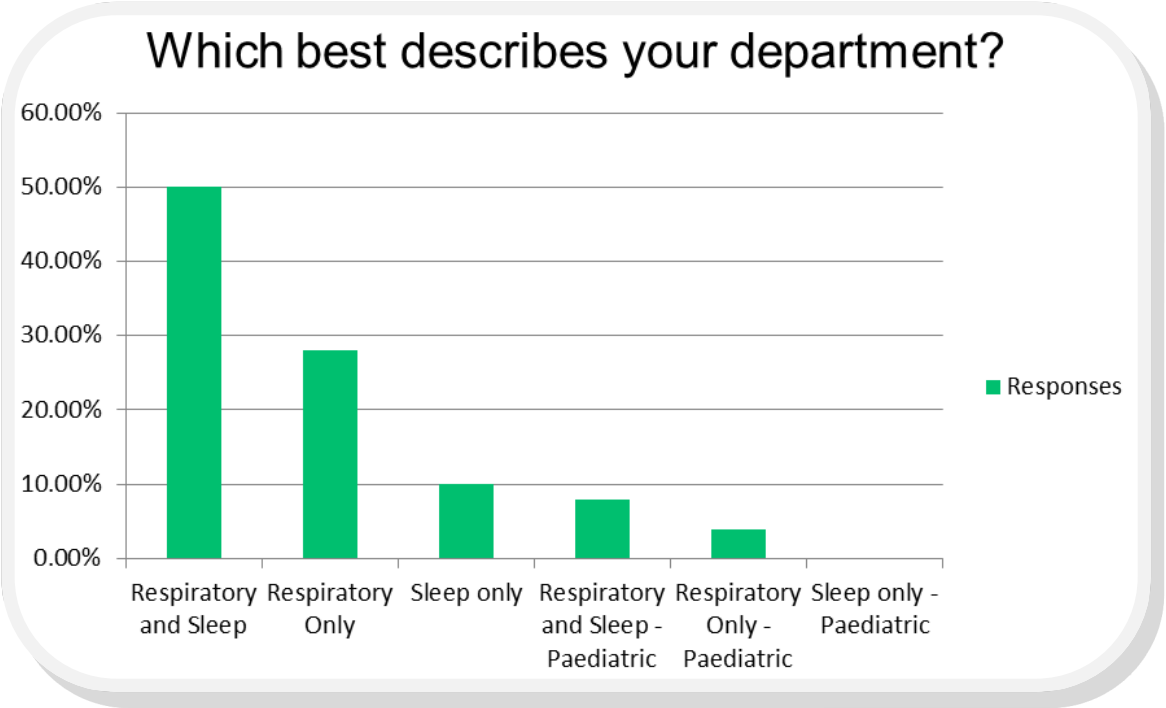


Figure 1: A summary of departmental types

Band	% Departments with staff redeployed (by band)	Number of staff redeployed
Band 8	50.00%	23
Band 7	73.68%	40
Band 6	81.58%	66
Band 5	39.47%	27
Band 4	31.58%	22
Band 3	39.47%	29
Band 2	26.32%	14

Table 1: A summary of staff redeployed to roles outside of their normal working practice

Respiratory and sleep physiology staff have a combination of both generic transferable skills and advanced, specialised abilities. Figure 2 demonstrates that the majority of roles performed were centred on CPAP and NIV provision, particularly providing training to others. This approach was seen in a number of Trusts and allowed for a rapid increase in staff numbers with adequate skills to provide additional respiratory support to patients and safeguard this service in the event of physiology staff contracting the virus themselves. Other roles included supporting PPE training and distribution, support for community or cancer services along with working as family liaison providing crucial links between inpatients and their loved ones who were unable to visit.

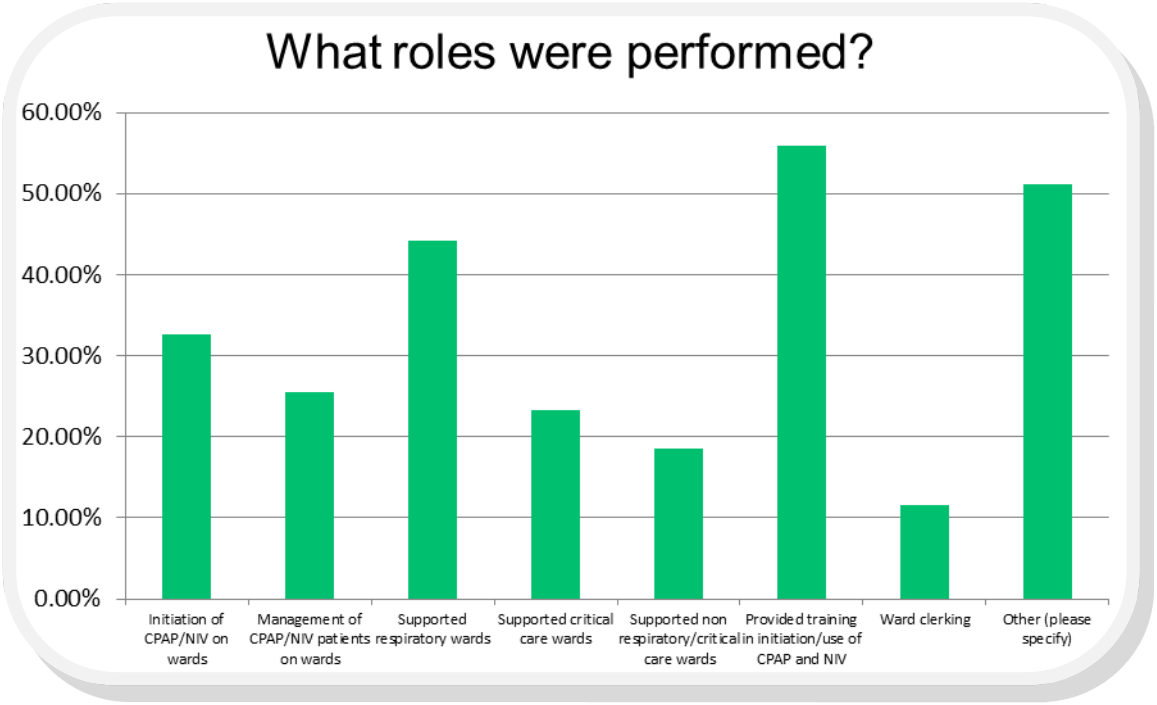


Figure 2: A summary of novel roles adopted by physiologists during the first wave of COVID-19

The survey found that just 4% of services were able to continue as normal through the crisis phase of the pandemic. The majority of departments continued seeing some patients face-to-face and 82% continued with remote monitoring of CPAP/NIV. 69% implemented more stringent triaging processes, prioritising and seeing only urgent patients for consultation and 82% for testing respectively. 12 % stopped all consultations whereas 14% stopped all testing (Figures 3 & 4).

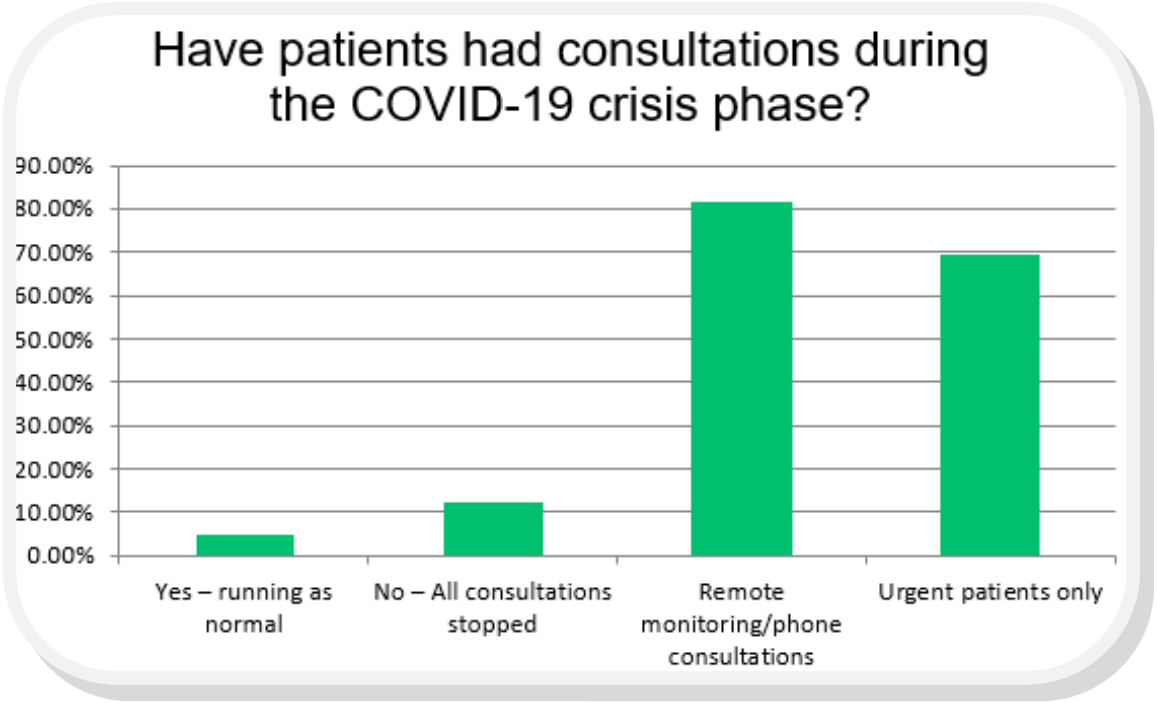


Figure 3: A summary of the service continuation/adaptation of Trusts during COVID-19

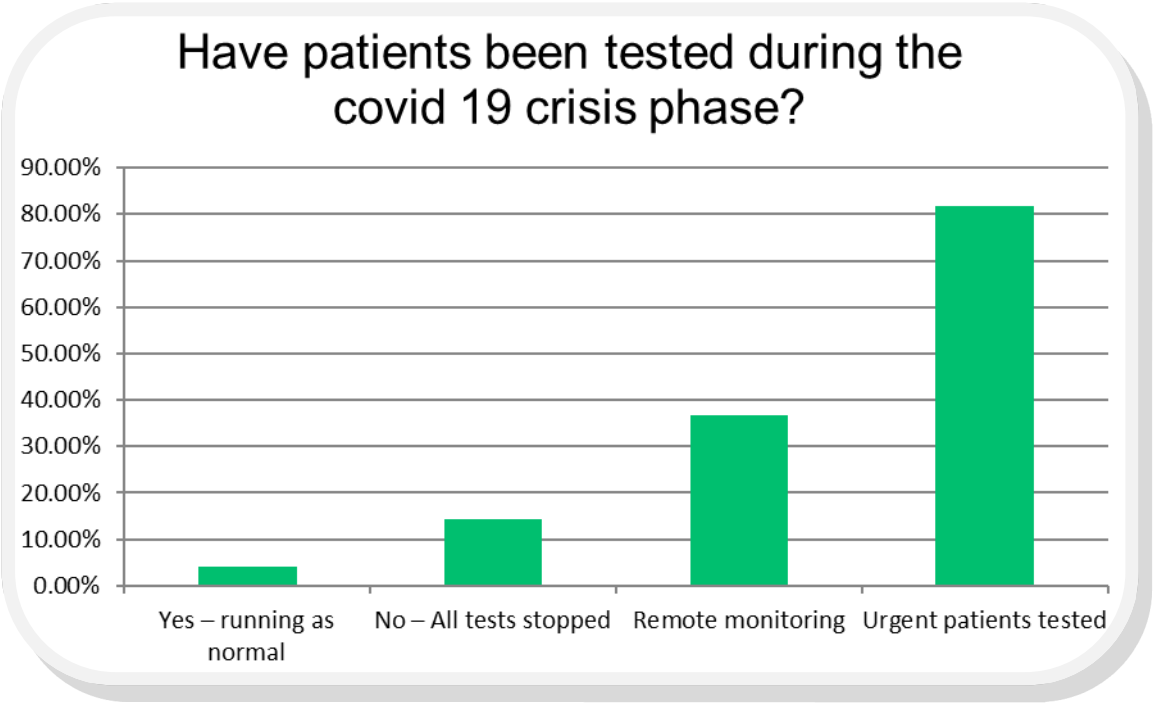


Figure 4: A summary of the service continuation/adaptation of Trusts performing tests during COVID-19

Of the most commonly performed respiratory and sleep investigations/procedures (Figure 5), challenge testing and PSG were the only two which stopped completely during the crisis phase. Spirometry and full PFTs continued in 68 and 70% of departments, respectively. Sleep diagnostics saw more services continuing with overnight oximetry than multi-channel studies, likely a reflection on the simplicity and ease of issuing to patients without face-to-face contact. With the management of sleep disordered breathing, departments were more likely to be able to continue with the on-going care of those on CPAP or NIV devices compared to initiating treatment. Again, with the likely cause being the difficulty in providing suitable patient education and mask fitting whilst maintaining safety.

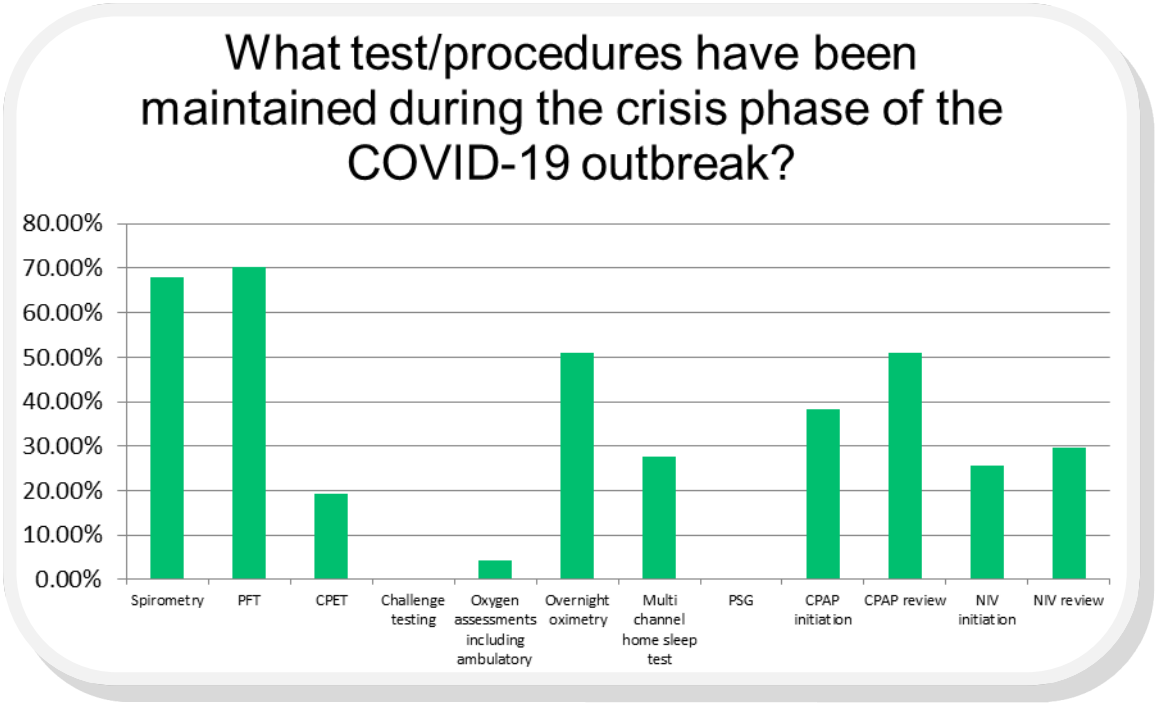


Figure 5: A summary of the tests maintained during the COVID-19 crisis phase

As previously mentioned, innovative practice has been the cornerstone of successfully managing patient care throughout the COVID-19 pandemic. 73% of departments have had to lengthen appointment slots to allow for additional cleaning or air settling, donning/doffing of PPE and communication problems due to masks. 65% have developed stricter triaging processes and 44% have been sending equipment out to patients' homes. Other practices have included drive through diagnostics and equipment collections and COVID-19 screen via questionnaires, swab testing and temperature checks (Figure 6).

With all these changes in practice, the question remains; Have they improved respiratory and sleep physiology services or are they just a stop gap until COVID-19 is no longer a serious threat?

Survey responses indicate a belief that stricter triaging (67%) and remote monitoring (65%) will continue after the COVID-19 pandemic has abated and, to a lesser extent, posting out of equipment (44%) and providing patient education via video tutorials (17%) may become the new standard of care for some Trusts (Figure 7).

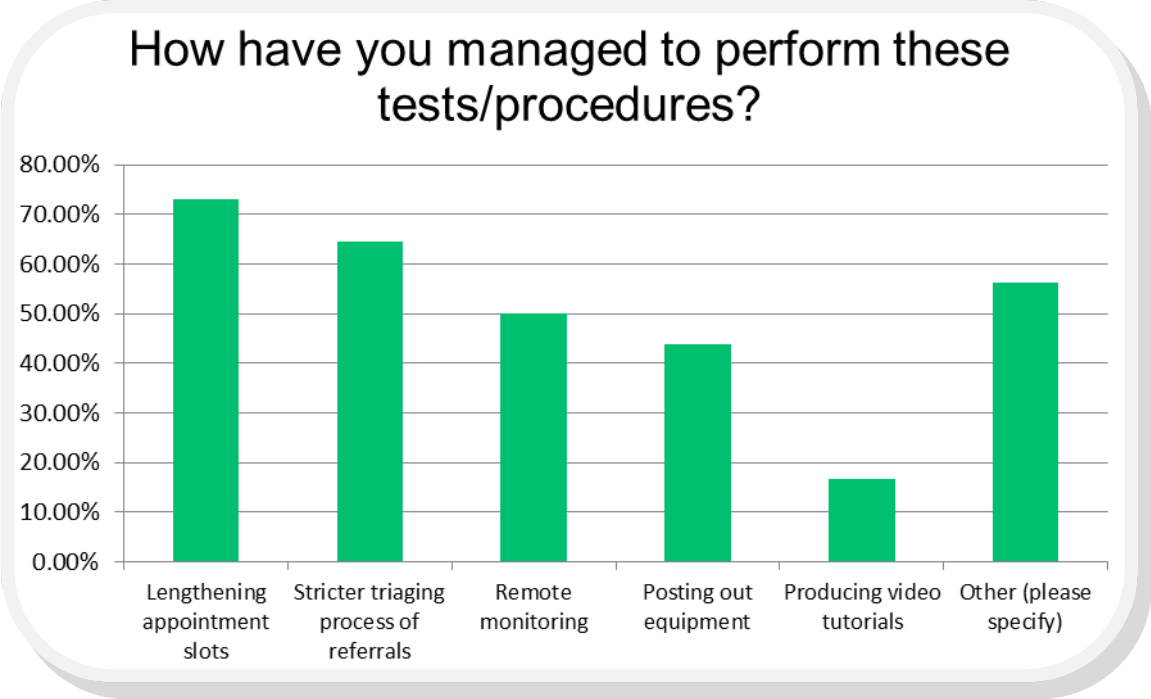


Figure 6: Innovations put into practice to optimise lung function and sleep services during COVID-19

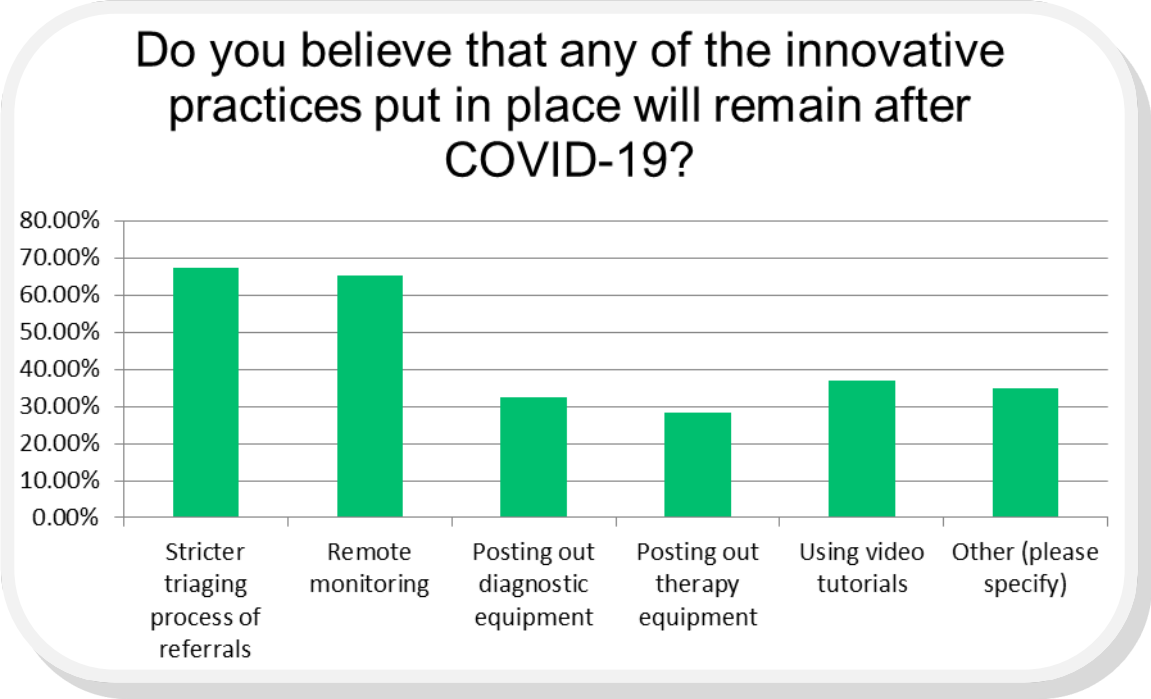


Figure 7: Lung function and sleep innovations predicted to continue after the COVID-19 pandemic

It is common for respiratory and sleep physiology services to see a high volume of patients and increased waiting lists. With the significant decreases in capacity resulting from the COVID-19 pandemic, the profession as a whole has a huge backlog to clear, whilst also dealing with new referrals as service users recommence their own clinical consultations. The respiratory services appear to have the largest waiting lists, with almost fifteen thousand patients waiting for full PFTs and over five thousand waiting for spirometry alone. With current capacity, it would take 11 weeks to fully clear the backlogs. However, new referrals and the reopening of other services are likely to extend this timeframe. The procedure with the greatest expected time to clear backlogs is challenge testing, where there is a waiting list of over 800 patients but a weekly capacity of only 39. Sleep physiology fares better with an estimated 1.4 – 5.2 weeks to clear waiting lists (Table 2).

Test	Waiting list	Weekly capacity	Weeks to clear backlog without new referrals
Spirometry	5452	788	6.9
PFT	14545	1318	11.0
CPET	751	91	8.3
Oxygen Assessments	266	62	4.3
Challenge Testing	803	39	20.6
Overnight Oximetry	2102	439	4.8
Multi-Channel Sleep Study	2979	569	5.2
PSG	61	31	2.2
CPAP Initiation	2038	356	5.7
NIV Initiation	71	49	1.4

Table 2: A comparison of the number of patients waiting for each test and weekly capacity, with the predicted timeframe to clear each backlog (values expressed as a total of the 51 sites)

Summary

This survey provides an insight into the impact of COVID-19 on the respiratory and sleep physiology profession as a whole and demonstrates the ways in which healthcare scientists have worked together to overcome the challenges faced. There is, however, much more work to be done in developing methods of increasing capacity nearer to pre-COVID levels and validating the changes to determine whether they should continue long term; Are they more efficient? Are they beneficial or detrimental to patient care? What do patients think of the changes?

Many of these questions must be assessed and answered based on local situations but, by sharing ideas amongst the ARTP community and beyond, we can all help to develop best practice in the interest of the patients we serve and face the ongoing challenges together.

IQIPS Accreditation

Congratulations to the respiratory team at the North West Lung Centre in Manchester

Questions by Martyn Bucknall

In March 2020, the lung function department in the North West Lung Centre at Wythenshawe Hospital (Manchester University Foundation Trust) was awarded IQIPS Accreditation in recognition of meeting the standards for accreditation. The Trust also is accredited for its vascular, cardiology and audiology services.

In this article, Nigel Clayton, who manages the Lung Centre, discusses this fabulous achievement. Congratulations to the team at Wythenshawe.

Accreditation is not mandatory, so why did your service decide to work towards IQIPS Accreditation?

We felt that a regional service should be able to demonstrate that it works to a range of quality standards specified by UKAS and the professional body. Accreditation also provides reassurance to our patients that we are working to a nationally recognised standard, providing a safe and effective service.

Since attaining the award, I feel that it has improved our reputation across the region and has enabled us to recruit and retain well qualified and competent staff. UKAS accreditation against the IQIPS Standard is also fully endorsed by NHS England.

What were the 3 major barriers in applying and/or working through the IQIPS process and how did your service overcome these?

Time – Prior to retiring, one of my key objectives had been to achieve the IQIPS award. Unfortunately, due to time constraints (lack of staff, increasing university commitments, increasing patient numbers etc.) this was never achieved. Returning from retirement and working 2 days per week allowed me the time and commitment to gather and document the required evidence.

Staff engagement – All staff need to be involved in the process. At first this was difficult to achieve, however, giving responsibilities to key members of staff helped enable the collection of evidence and for them to gain a better understanding of the IQIPS process.

Lack of understanding of the process and the amount of evidence required for each of the 4 domains being assessed.

Fortunately, the Trust already had accreditation in three other disciplines. By extending the scope to include Respiratory enabled me to work closely with colleagues in other departments and to view the evidence provided against their disciplines.

How important is engaging the whole respiratory team in achieving IQIPS accreditation?

If all team members are not involved in the process you are unlikely to achieve the award. At Wythenshawe, Senior members of the team were engaged by giving them individual responsibilities for the standards required across each of the four domains (Patients, Facilities, Safety, Clinical). Clerical staff were also engaged in updating the procedures manual covering all aspects and processes of patient administration.

The whole process of gathering evidence for accreditation allowed the staff to recognise the importance of documenting our processes and procedures. We also recognised where the lab fell short in some of the standards, such as patient engagement and certain aspects of audit. Patient feedback also enabled us to improve the overall patient experience. Improvements were also made to the way weekly test quality audit and peer review processes were documented and fed back to staff.

The IQIPS accreditation visit is very similar to that of a Care Quality Commission (CQC visit), in that any member of staff may be questioned on lab procedures, standards, patient safety, and how we access all the related documentation.

A level of trepidation built prior to the visit, however this certainly motivated staff to prepare for the day. For those ARTP members who have been through the ARTP Part 1 / Practitioner exam process, the assessment day is very similar, in that a professional person employed by UKAS follows a patient through the laboratory, making notes on staff performance and asking questions on processes relating to guidelines, data quality, audit etc.

At the end of the day the staff thought the process was not as stressful as expected. One assessor even asked a member of my staff if they wanted a job!

I know your service is large, but what advice would you give to other services, especially. smaller services who might be thinking about working towards accreditation?

Firstly I would advise all labs to check out the IQIPS section on the UKAS website (https://www.ukas.com/services/accreditation-services/physiological-services-accreditation-iqips/).

Many of the standards being assessed should already be documented as part of everyday standard laboratory practice, such as competency checking, Calibration/Quality Control records, activity reports, infection control records. Trust wide policies will also exist which cover many of the standards such as health and safety, equality / diversity, incident reporting etc.

Fortunately, Manchester University Foundation Trust already had three departments with UKAS IQIPS accreditation. The leads in these departments were really helpful in explaining the process, but also allowed access to the documentation which they had to submit in order to gain accreditation. Some of this was generic across the Trust, so did not require duplication.

In my opinion, smaller services should ask for advice and assistance from those departments where accreditation has been achieved. A visit to the main lead at an accredited centre is probably the best way forward in allaying any fears you may have relating to the process.

Secondly, I would discuss the benefits of accreditation with Trust management. By engaging management, it may be possible to gain additional support and finance to facilitate the collection of evidence.

I talk to many services who are keen on working towards accreditation for their service, but down to time, workload and resource this simply is not achievable – what would your advice be?

I heard that one Trust had employed an expert in the accreditation process to work with several departments and to take the lead in documenting the evidence for each specialism. This is obviously a costly way of gaining accreditation, but one which might work for some Trusts where department work force numbers are small.

Rather than re-inventing the wheel, another way forward could be for accredited departments to share non-confidential documents, spreadsheets, policies, SOPs etc with other departments who could then adapt them for their own use. Using the recently launched ARTP file resource could be the ideal way in which departments share IQIPS documentation.

Difficult question – but if you had to estimate how many hours of time were dedicated to achieving accreditation, what would your estimate be? How long did the entire process take?

It certainly is a lengthy process, which I would estimate took up more than 300 hours to complete (approx. 2 months of 1 WTE).

I started documenting and uploading the evidence back in January 2019. This was finally completed in August 2019, with UKAS making an accreditation visit in November 2019. Following this there was a list of improvement actions which needed to be completed by the end of February 2020. The improvement actions were deemed acceptable and we finally gained the award on 6th March 2020.

Gaining accreditation has certainly raised our standards and quality of work... I believe that it has also improved the reputation of the laboratory across the region and has enabled us to recruit and retain well qualified and competent staff (though we are still

What were the advantages (and challenges) of working with the other physiology disciplines within your Trust?

As mentioned above, the main advantage was that three other departments had already gone through the accreditation process (vascular, cardiology and audiology). As a consequence, we were able to add respiratory as "an extension to scope" to the cardiology and audiology standards, which certainly helped in drafting and adding the required evidence for respiratory. The leads in all departments were really helpful and supportive in getting us through the process.

How supportive were your Trust Board, and clinicians and how did they support the accreditation process?

The Trust divisional management were supportive of the process and funded the IQIPS application, however no additional resource was provided in terms of staff time. I would suggest that additional resource is negotiated at the start of the process, particularly for small departments.

What service improvements did your service make during the journey through accreditation? Were there any quick wins?

IQIPS drives the documentation process for just about every task and activity delivered in a respiratory physiology lab. As a consequence, our risk assessments, SOPs and audit policies were improved.

IQIPS also required evidence of patient interaction in delivering and improving the service we provide. Apart from patient questionnaires, involving patients in the way the service is run was something new to the department. It was interesting to gain the view points from several patients, following which we made improvements to patient information leaflets and staff interaction. The patients also gained more

of an interest in the tests being performed and learnt a lot about the life and role of a Clinical Physiologist.

Early days, but what are the benefits to date of being an IQIPS accredited service?

Many people ask why we put ourselves through the process; after all, we have been providing a good service at Wythenshawe since the early 1960s.

The benefits of accreditation as I see them are that it makes you think about all aspects of your service. Are you really providing the best service possible? By measuring all aspects of the service against national standards, many of which have been set with professional body guidance, confirms you are delivering your service to a measurable national standard.

Gaining accreditation has certainly raised our standards and quality of work. As mentioned above, I believe that it has also improved the reputation of the laboratory across the region and has enabled us to recruit and retain well qualified and competent staff (though we are still looking for a new laboratory manager!).

Accreditation also helps to future proof the service, as commissioners are more likely to favour a UKAS accredited laboratory over one which is not accredited. CQC also recognise the UKAS/ IQIPS standard, so we should have no significant worries regarding our next CQC visit.

One final aspect of gaining the award is we have been able to use it for leverage for change with a business plan taking shape to increase the number of test rooms available.

By engaging all members of staff and patients in the process has enabled us to work closer as a team and to better understand and improve how the department works. I know our staff are certainly proud to work in a UKAS accredited laboratory.

It has been a very challenging time for all physiology services and patients during the coronavirus pandemic. How was the process of completing IQIPS accreditation altered? (if at all). Do you feel IQIPS accreditation helped to prepare your services for the challenges of delivering a respiratory service during a pandemic and in the months to follow?

Fortunately, we gained the award prior to the pandemic impacting the delivery of our service. As new infection control measures have been implemented, we have had to change a number of our SOPs and work practices. All changes to service are continually documented as part of the IQIPS process and uploaded onto the UKAS web-based assessment tool.

Any other points you wish to raise?

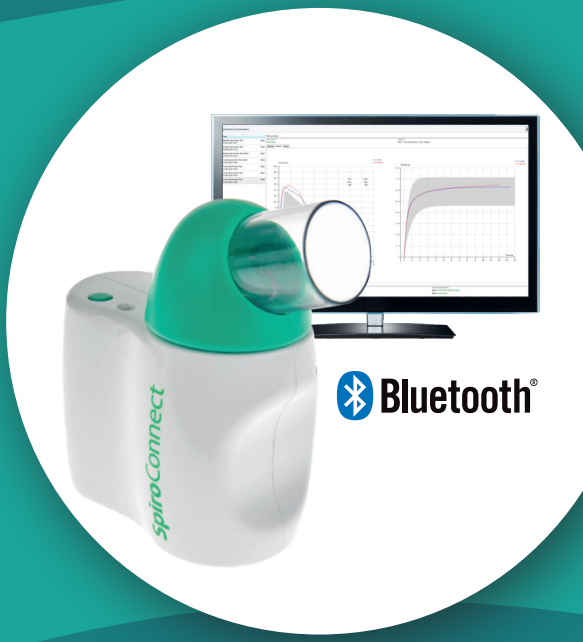
In conclusion, I would say that accreditation has been a positive process for the North West Lung Centre at Wythenshawe. If any centre wishes to learn more about accreditation, I will be more than happy to discuss what is involved in more detail and possibly help them through the process.

Why you should use SpiroConnect during the COVID-19 pandemic

SpiroConnect is the latest PC based spirometer, designed by the creator of the MicroLab, MicroLoop and SpiroUSB spirometers. It is ideally suited to in-car spirometry, spirometry hubs and post-COVID clinics, due to its Bluetooth connectivity.

The device can connect to a desktop, laptop or tablet through glass or plastic safety screens at a range of up to 20 metres. This means that full spirometry tests can be performed with the patient seated in isolation from the respiratory physiologist, either in their own car (with window completely closed), an isolated room/booth, or behind a safety screen.

In addition, bacterial/viral spirometry filters can be used, the turbine can be very quickly and easily disinfected between patients, and anti-viral/ bacterial wipes (e.g. Clinell) can be used to quickly disinfect the body of the SpiroConnect spirometer before use on the next patient.



Rental options are available starting from £35 + VAT per month

For more information about SpiroConnect, please visit **numed.co.uk/spiroconnect** or telephone **0114 243 3896**

numed healthcare | Dedication Innovation Trust

ResMed

Adopting remote setup pathways for CPAP therapy?

ResMed's **Remote Setup Guidebook for heatlhcare professionals** and user-friendly **patient resources** have everything you need for successful remote setups.

Get started

Helping your patients with **mask setups**

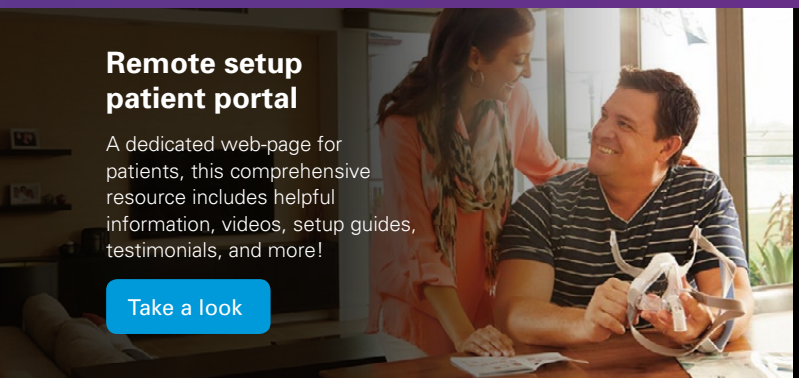
Supporting your patients upon receiving **their equipment**

Empowering your patients to **adhere to therapy**

Remote setup patient portal

A dedicated web-page for patients, this comprehensive resource includes helpful information, videos, setup guides, testimonials, and more!

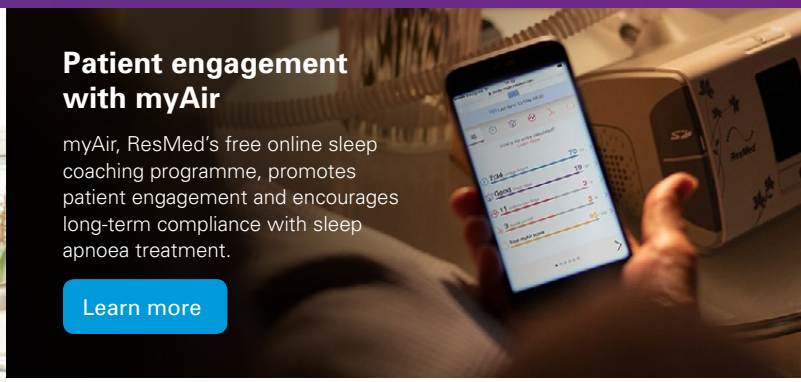
Take a look



Patient engagement with myAir

myAir, ResMed's free online sleep coaching programme, promotes patient engagement and encourages long-term compliance with sleep apnoea treatment.

Learn more



For more information, contact us: **accountexec@ResMed.co.uk**

ResMed.co.uk

Dr Harry Griffin (PhD)

Lead Respiratory Physiologist

Hampshire Hospitals NHS Foundation Trust

During the summer a day didn't go by without the forum being used by a physiologist to seek advice or share vital experiences with the ARTP community. Speaking from personal experience it helped enormously to hear what other departments were doing during such a unique and challenging time. In contrast, the forum has been relatively quiet this Autumn but nonetheless has remained a vital source of help for both junior and senior physiologists. As autumn progressed there was a shift from how to restore respiratory services following the first peak, to then how to maintain these services throughout the second peak. However, in a refreshing change there was also a number of physiologists asking non COVID-19 questions. Here is a roundup of the key topics discussed.

Top Forum

COVID-19 RELATED

Title: Time to vacate the lab

Date: 11/08/2020

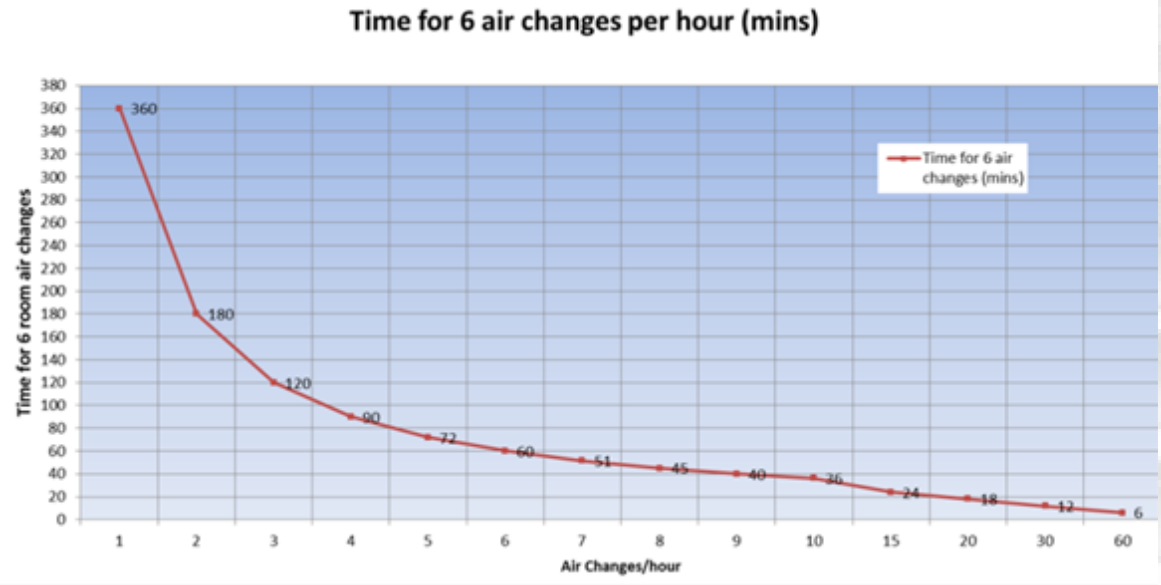
The question: PHE recommends 6 ACH and that one hour would be pragmatic to leave the room before cleaning. Our lab has 10.5 ACH, could someone advise how to calculate a revised wait time?

The replies: On behalf of the ARTP COVID-19 Group, a well-known senior physiologist provided a graph showing the duration of time required to provide 6 ACH at various rates of ventilation (see below).

Another physiologist provided a useful link to a document that provides information on the transmission characteristics of the novel coronavirus with additional guidance on ACH (see below).

https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/transmission-characteristics-and-principles-of-infection-prevention-and-control

This provoked another physiologist to ask whether there would be further guidance from ARTP on HEPA air scrubbers. They had read positive reviews on the technology but couldn't purchase any devices until they received support from professional bodies (i.e. ARTP). A member of the ARTP COVID-19 Group suggested this may be covered in



future publications. However, one physiologist stated they were already using air scrubbers to provide 10 ACH and they were very quiet.

The topic of ventilation just kept rolling and one physiologist asked whether having a fan would improve the ACH in rooms with only windows. The same question had previously been put to a hospital Estates department by another physiologist and they were told it wouldn't improve the ACH. It was highlighted that that in January 2019 a statement was published by the DoH stating the use of fans in clinical areas had been linked to cross infection in health and social care facilities (see below).

https://www.health-ni.gov.uk/sites/default/files/publications/health/EFA-2019-001.pdf

Title: Home spirometry using blue tooth

Date: 14/08/2020

The question: Are other departments using a home spirometry testing service that utilises blue tooth spirometers? Has it been successful? Any problems using the device and app? Any test quality issues or problems getting equipment back? The physiologist stated they believed these spirometers were typically used for monitoring purposes but were now being used for diagnostic purposes during the pandemic?

The replies: One physiologist stated they were just about to start this service and as such were happy to share their SOP. ARTP admin then reminded the forum that ARTP have an online file resource for ARTP members to use to share documentation. You can email your files to admin@artp,org.uk and access files at the Google Drive link shared in recent members emails (and elsewhere in this issue—Ed).

Title: CPAP annual reviews

Date: 16/09/2020

The question: Given the well documented strain on Sleep and CPAP services prior to COVID-19, are services now reviewing patients every two years rather than annually?

The replies: One reply stated that their department reviews some patients every two years if they are compliant and only need mask and filters. The physiologist was not aware of any specific guidance that says this shouldn't be done except for group 2 drivers. Indeed, a senior physiologist then provided DVLA guidance that states Group 1 drivers need assessment only every three years and they also stated that almost all UK CPAP devices are Class 2 electrical devices and do not need annual electrical testing.

NON COVID-19 RELATED

Title: Spirometry Query

Date: 11/09/2020

The question: This physiologist asked the forum how departments manage requests for bedside spirometry. They were receiving numerous requests for IP spirometry but were unable to deliver this service out of hours and struggled during normal hours. The physiologist had proposed hiring band 3 staff to support clinics/ wards but the trust had chosen instead to continue with unqualified staff.

The replies: One physiologist replied that apart from GB patients spirometry is rarely urgent enough that it cannot wait until there are ARTP certified staff available. They reported that various wards had purchased spirometers to provide an 'out of hours service' but the quality was very poor. They had appointed assistant physiologists at Band 2 level, upgrading them to Band 3 on successful completion of their ARTP Spirometry certificate which they felt had been really successful. An alternative was to consider a level 3 apprentice for this post.

This initial reply opened the flood gates for heads of departments to describe the strengths and weaknesses of their different approaches. Some departments had chosen to provide training to ward staff with mixed success. Although two physiologists felt this had gone very well, others raised the issue that these staff so infrequently performed spirometry that they were essentially de-

skilled by the time they had to perform it on critically ill patients.

This then lead to a discussion regarding whether IP spirometry for GB and MG patients is classed as monitoring and therefore doesn't need to meet the standards set out for diagnostic spirometry. This of course raised further questions about the implications of poorly performed spirometry in these critically ill patients. One physiologist asked whether you would be "happy for an unqualified member of staff to carry out full pulmonary function testing on an IPF patient if it was only for monitoring and not diagnostic?"

Title: DLCO Simulator

Date: 21/09/2020

The question: Is anyone using a Hans Rudolph DLCO simulator and software with a Vyaire Sentry Suite setup?

The replies: One senior physiologist described their experiences of using DLCO simulators 10 years ago. They reported having to change some of the software settings to use the simulator and that there was a big variation in the breath hold time. However, this was with older versions of the software that may now be resolved. This senior physiologist was able to help further by making a connection to a physiologist in Australia who had information on the Hands Rudolph simulator issue.

Title: Adult patients aged 18-20

Date: 23/09/20

The question: What reference ranges are in use in adult services for individuals aged 18 up to 20 years? I had always believed (prior to GLI) that once a person hit 18 we dropped using Rosenthal or Zapletal and exclusively use ECCS. However I now realise just how much of a difference there appears to be between manufacturers in opinion, and in default settings. I have the following options: 1) apply ECCS with age used as 25 for those 18-25, 2) apply Rosenthal which does cover 4-19.

The replies: Although not specifically answering the physiologist's question it was exciting to hear from a member of the GLI team that "GLI lung volume reference ranges will be published in the not too distant future". Indeed the physiologist stated "Final replies to reviewers comments submitted....and...International endorsement is currently being sought".

Title: Aerophagia

Date: 25/09/2020

The question: What are the best ways to deal with Aerophagia with PAP?

The replies: A really useful reply from one physiologist listed a number of techniques they had tried with some success. They suggested: 1) Raising the head of the bed, similar to that recommended in GORD, 2) No late night eating/drinking, 3) Use the lowest effective PAP, 4) A good mask fit to reduce excessive machine flow, 5) Anxious patients could consider using desensitisation techniques as described by The Sleep Apnoea Trust and 6) Investigate if there is a history of Barret's oesophagus?

Another physiologist recommended: 1) Using the highest expiratory release pressure (i.e. EPR – ResMed, cFLEX – Respironics), 2) Changing from a nasal mask to full face and 3) they also highlighted the importance of ensuring a low mask leak.

Title: BP recordings during CPET

Date: 07/10/2020

The question: I normally take manual BP for CPET testing but looking for any recommendations for automatic systems?

The replies: One physiologist who leads a CPET service provided a very useful, detailed response. In brief, they stated that BP measuring devices for an exercising patient use a microphone to measure Korotkoff sounds rather than sensing oscillations

(which is how most bedside monitors work, but obviously during exercise this is not ideal because these oscillations are drowned out by the noise of movement). You can get these devices integrated with most CPET kits, so it may be worth asking your manufacturer/distributor what they can supply.

The only standalone BP device that this physiologist was aware of that was specifically for exercise testing is the Tango system. Blood pressure can also be continuously measured via the finger (Finapres), but they thought this was mostly used in resting patients or during cycle ergometry rather than treadmill. Another lead for a CPET service also described using the Tango system on their treadmill and having few problems.

Title: Fall in diastolic blood pressure during exercise

Date: 15/11/2020

The question: Keeping to the same theme of BP during exercise testing, a physiologist asked if anyone knew what a "normal" decrease in diastolic blood pressure was during exercise? The physiologist had read that diastolic BP should remain unchanged or drop slightly during exercise due to vasodilation but they hadn't found anything that quantified what a "slight drop" was.

The replies: Only one reply to this question but it produced a detailed response from a CPET service lead. They also felt the decline in diastolic BP was not well defined in the literature. The SCST guidance (2008) mentions specifically a drop in systolic blood pressure of › 20 mmHg, the American Heart Association recommend terminating exercise after a 10 mmHg drop with signs of ischaemia. Both mention if blood pressure drops as a result of arrhythmia or ischaemic changes, then stop exercising. Values for the diastolic itself are not specifically mentioned in either of those cardiac guidelines for clinical exercise testing.

In the absence of guidance the physiologist provided their opinion and departmental guidelines. Tests could be stopped if the DBP dropped by ›10 mmHg but normally only if the patient reported relevant symptoms or had ECG changes. They stressed the importance of considering the medical history of the patient (e.g. AAA, congenital heart disease, arrhythmias, pacemakers, CAD, valve disease, cardiomyopathies etc.). The physiologist highlighted the point that blood pressure monitors have a relatively wide range of accuracy during exercise tests which is made worse if the patient has an arrhythmia.

ERS GROUP 9.01 NEWSLETTER

ARTP members have had the opportunity to have joint membership with the European Respiratory Society (ERS) for a few years now. With the introduction of membership renewals at any point in the year, getting hold of this joint membership option has never been easier.

Below we outline the benefits to being a member of the ERS, the assemblies available to choose from and what it means to be associated with a group within these assemblies.

There is also some information on the most relevant group to respiratory and sleep scientists, but there are many other options based on your particular area of interest. The best thing is that you don't just have to choose one group to affiliate to.

European Respiratory Society – Membership

If you join ERS through the ARTP, you will receive the full benefits of being an ERS member, including access to ERS publications, webcasts, scientific content, and discounts to conferences and events at a reduced annual membership fee of €30. Full ERS membership currently costs €170

Your membership entitles you to a range of benefits across ERS core areas of activity: science, education and advocacy.

Science

•Discounted access to the European Respiratory Society International Congress – the largest respiratory meeting in the world

•Online access to a range of publications covering the spectrum of respiratory topics

•Funding opportunities for research and attendance at conferences

•Opportunity to apply for the prestigious title Fellow of ERS (FERS)

Education

•Free online educational material to enhance your learning

•Reduced rates for training courses to network and learn from experts in the field

•Access to harmonised qualifications through the HERMES initiative

Advocacy

•Opportunities to shape public health policies

•Access to a patient network to incorporate the patient voice in your work and patient resources to use in your clinic

The ERS community is comprised of Assemblies and Groups that specialise in specific areas of respiratory medicine and set the scientific and educational agenda across all ERS activities. ERS has 14 Assemblies, divided into groups, which members can choose to become affiliated with.

1 Respiratory clinical care and physiology
2 Respiratory Intensive Care
3 Basic and translational sciences
4 Sleep Disordered Breathing
5 Airway Diseases, Asthma, COPD and Chronic Cough
6 Epidemiology and Environment
7 Paediatrics
8 Thoracic Surgery and Transplantation
9 Allied Respiratory Professionals
10 Respiratory Infections
11 Thoracic Oncology
12 Interstitial Lung Diseases
13 Pulmonary Vascular Diseases
14 Clinical Techniques, Imaging and Endoscopy

When you first log in to the myERS portal (**my.ersnet.org**), you can join up to 3 groups of interest: the first one is your main group where you can exercise your voting rights and the second and third choice groups allow you to keep up to date with this professional interest area via mailings and circulars relevant to this topic.

Joining the ERS assemblies is not compulsory but it is highly recommended in order for you to fully benefit from your membership and be active in the scientific and educational activities of ERS. By becoming affiliated to an assembly and working groups you become part of the nerve centre of ERS; voting for new leaders, shaping key activities such as the Congress programme and task forces, and being the first to hear about new opportunities and events in your professional interest area.

European Respiratory Society – Group 9.01

Group 9.01 exists to represent all scientific and educational activities in the ERS with relation to all aspects of clinical respiratory physiology. Respiratory function diagnostics and therapeutic monitoring are now key areas in healthcare delivery across Europe and the Group is interested in the scientific, technical and quality issues of these services.

Group 9.01 is open to all members who practice respiratory physiology, whether in primary care, secondary care or in a research environment. Education, research, and quality are the key issues in protecting patients from misdiagnosis and poor quality measurement. Group 9.01 intends to lead in research, training and quality in clinical respiratory physiology throughout Europe and in collaboration with the ERS School, and are supportive of all respiratory technology and services requiring physiological measurement.

European Respiratory Society – Introduction to Group 9.01 Officers

As your incoming group officers we thought it would be a good idea to introduce ourselves. Below we have included some background information on who we are, what we do and a couple of fun facts. We are very much looking forward to working with you all and hearing more from you over the coming years. We have plans of how we can all engage with each other and get to know each other a little better. We would love to hear from you to learn more about who **YOU** all are. Do send us some interesting details about you, where you are based and what you do and maybe we can all start getting to know each other.

Dr Karl Sylvester

Chair Group 9.01

Current role:

Head of Joint Respiratory Physiology Services across two sites in Cambridge UK.

Previous experience:

Completed my PhD at Guy's, King's & St Thomas' School of Medicine in London, UK. My PhD investigated the respiratory complications in both adult and paediatric patients with Sickle Cell Disease. This is where I gained my first exposure to the ERS and I have to say I was immediately hooked. I found and still find, the ERS congress such an exciting and exhilarating experience. To be among so many likeminded scientists, to feel the buzz of scientific collaboration and have the opportunity to learn so much from colleagues is amazing.

Fun facts:

When I finished my undergraduate degree I worked as a confectioner in a local bakery for a year. I have a varied family heritage that includes the UK, Ireland, Germany, Poland, Canada & Scandinavia

Rachel Ong-Salvador

Secretary Group 9.01

Current role:

Respiratory function technologist and clinical epidemiologist at Amsterdam University Medical Centers.

Previous experience:

Before moving to the Netherlands in 2006, I worked as a respiratory therapist in the Philippines. After finishing my second bachelor's degree I started to dabble in clinical research which led to my Master's degree in Evidence-based Practice in Health Care.

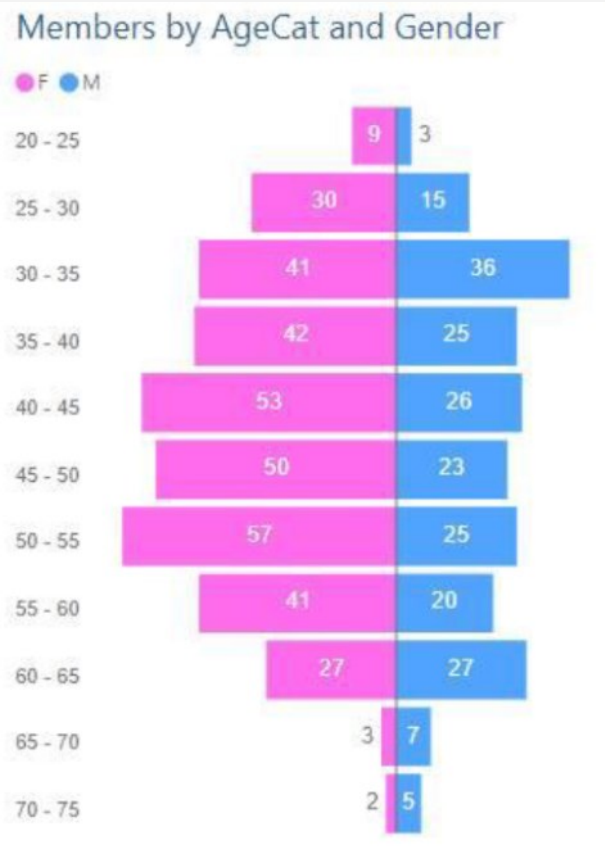
For me, attending the ERS congress is like riding a roller coaster. There's the adrenalin rush of having to present yourself and represent your research team, being objective while listening to critics, working up the courage to ask questions and feeling free to mingle with the ERS 'hotshots'. What I like most is that you get to interact with other professionals who are as driven and curious as you are.

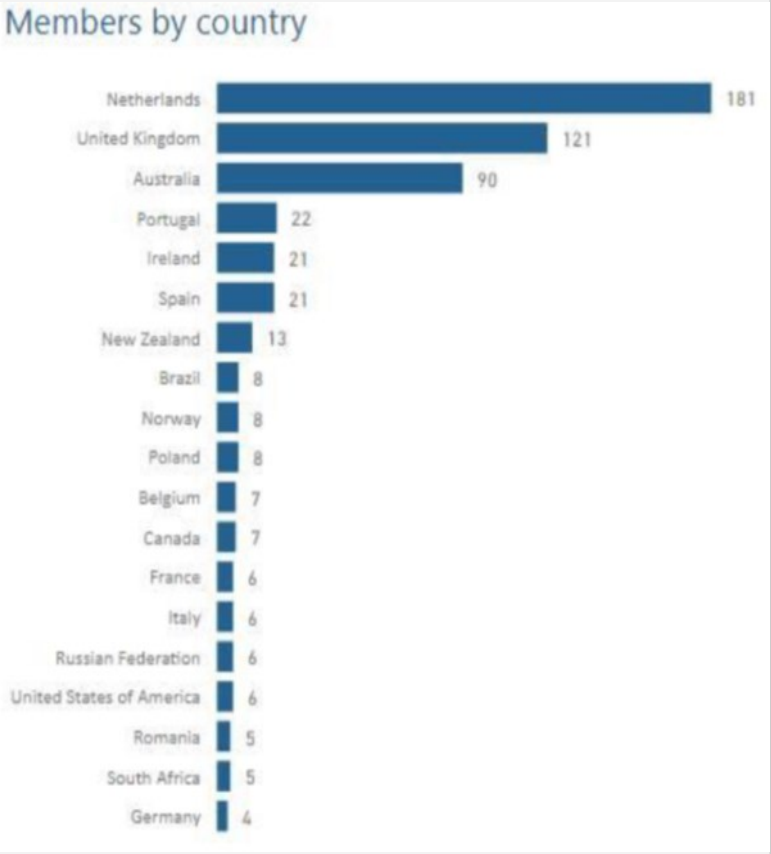
Fun facts:

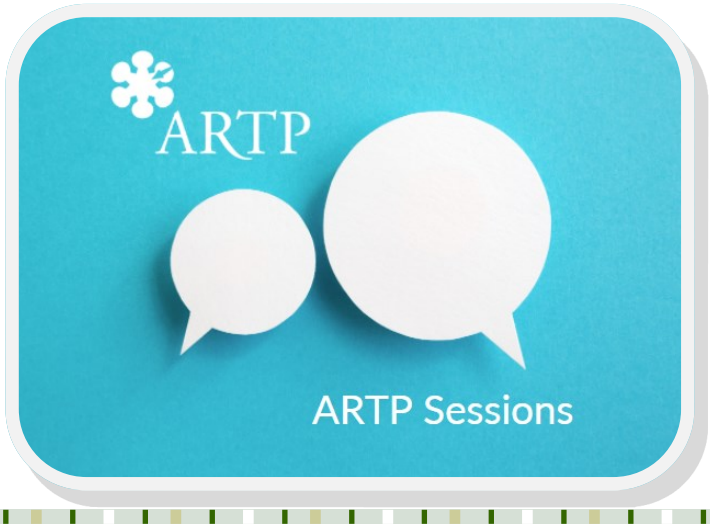
I almost burned down our kitchen when I tried to teach myself to cook. No fireman got hurt in this process. And yes, I'm still trying/learning to cook.

We thought you might like to see some information about the group, such as where we all are in the world!

European Respiratory Society – Group 9.01 Demographics







As you may be aware following previous correspondence, I in collaboration with ARTP membership have been working on the development of a series of webcasts to showcase Respiratory and Sleep Healthcare Science during the COVID-19 pandemic. I am pleased to announce that the first webcast was recorded on Friday 16th October and is now available to view exclusively by ARTP members through the private link below to the ARTP YouTube channel, or by visiting this webpage on the ARTP website whilst logged in to your membership account - https://www.artp.org.uk/News/artp-sessions-covid19. The first webcast is titled Clinical Re-deployment and explores the experiences and learning points from those who were re-deployed to other hospital services during the initial phase of the pandemic.

I'd like to thank those ARTP members who recorded the first webcast and to those who have volunteered to be involved in future webcasts over the forthcoming months. If you enjoy watching/ listening please hit the 'Like' button and if you wish you be notified of future webcast uploads hit the 'Subscribe' button. I am more than happy to be directed by you as the membership on what topics would be of interest so please get in touch with any feedback to admin@artp.org.uk.

Edward Parkes on behalf of ARTP

Please be reminded regarding the file resource for ARTP members which launched earlier this year. Some of you have requested access to certain types of documentation and resources that we do not have available on our website, so we have created a Google Drive folder open only to ARTP members. The idea is that we can each contribute files and documentation to the drive so that other members may easily source information. At present, you will find a COVID-19 support folder, which includes useful resources such as 3D print files and NIV Vented masks.
We are asking all of you to provide information you think might be useful for others, such as department SOPs and Business Cases, new ideas for innovative working practices, etc.
The Google Drive is Read Only, so while we can all access the information, nobody can edit or change the files you share.

If you would like to contribute to the Resource please send your files to the ARTP Admin - admin@artp,org.uk. Please highlight your email with 'Membership Files'. The Google Drive requires that your files are named in a specific way: *what the document is_version number_Name of trust* e.g. SOP Hypoxic challenge tests_v2_Maidstone and Tunbridge Wells.

To access the Google Drive go to: https://drive.google.com/open?id=1TAVqxUmq8ogAh236UgVKBv8H5UOg7AFD

Please read the terms of use, found in the Google drive folder carefully, these documents may not be endorsed by ARTP. For official guidelines from ARTP please see the ARTP COVID-19 page on the ARTP Website:
https://www.artp.org.uk/COVID19

We hope you will all contribute to this initiative. Together we will create something that we will all find useful.

Emma Ince, ARTP Communications Chair

F&P Evora

Compact Nasal Mask

Introducing F&P Evora™

F&P Evora incorporates CapFit™ headgear that has been designed to be put on like a cap – a simple and intuitive movement that patients are familiar with.

95% of Sleep Clinicians

Found Evora simple to fit.[1]

98% of Patients

Found Evora simple to take off and put on in the dark.[2]

For more information contact your local territory manager or our friendly customer services team on **01628 626136 or email customerservice@fphcare.co.uk.**

@fphcare

1. 20 out of 21 sleep clinicians rated the simplicity of the Evora Nasal mask as very simple or simple to fit. Internal validation study conducted with 21 sleep clinicians in the United States of America 2019. **2.** 43 out of 44 patients were able to put on and take off the Evora Nasal mask once fitted, in the dark. Internal validation study conducted with 44 participants in the United States of America 2019. F&P CapFit and Evora are trademarks of Fisher & Paykel Healthcare Limited. For patent information, see www.fphcare.com/ip.

www.fphcare.com

Fisher & Paykel HEALTHCARE

How Stowood is helping minimise Covid impact on sleep studies

Black series home sleep test: robust, easy setup, fast turnaround, easily cleanable.

As used by the Oxford sleep unit to overcome their Covid backlog.

High quality medical trolleys for sleep systems.

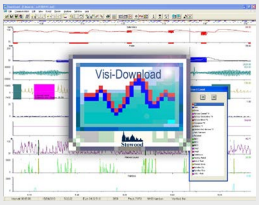
For when you need to move bedrooms.

Home oximetry

For when a simple screener with Visi-Download is best.

Visi-Download

For flexible, easy to interpret data analysis of oximetry or Black series data.



Full range of disposables also available

Tel. +44 1865 358860 sales@stowood.com www.stowood.com

WE HAVE EVERYTHING YOU NEED FOR PERFORMING SLEEP STUDIES QUICKLY, SAFELY, AND ECONOMICALLY

Stowood
Innovating sleep diagnostics since 1992