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inspire

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FIRST WORD

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Welcome to the bumper summer edition of ***Inspire*** and what an issue it is, packed with all of the abstracts from the recent ARTP conference. There was a noticeable buzz about the conference, as it was the first meet-up since you know what but the organisation and overall content were as good as ever. The abstracts were generally of a very high standard and covered a broad range of respiratory and sleep-related topics. Perfect for that beach read or perhaps suitable for a traffic queue near Dover, when the minutes of the AGM might be just what is required.

This issue also has an excellent article in 'Fresh Air', courtesy of the ARTP Research & Innovation Committee, who always seem ready with high quality content as each issue looms. I would say they are a pretty organised bunch!

'On the Blower' has been around since the early days, probably achieving 'National Treasure' status in the process (perhaps like the Lionesses) and possibly a bit more relaxed about deadlines but does have the task of rounding up what the manufacturers have to say.

'How it works' is absent from this issue although there is a brief piece commemorating the Queen's jubilee from the same team, who are usually quick to provide ideas for content and article prior to publication.

New kid on the block, 'Top Forum', usually but not always ready to go by a deadline and now with a fresh face to hopefully continue this useful summary of the ARTP Forum.

Probably the most chasing required is to the ever-busy ARTP Chairs (past and present), who probably have learned to dread any email from me with '***Inspire***' as the Subject. However 'Word from the Chair' is always there eventually, as it is this issue!

This is my final issue as Editor of ***Inspire***, just one issue short of a 10-year tenure (how is that for alliteration?) and I have enjoyed the journey since my first April 2013 issue. I took on the role following a conversation with previous ARTP Chair, Martyn Bucknall at ERS 2012, because I wanted to contribute to ARTP and felt this was a good way for me to do so. I have learned a lot about using Publisher plus the act of formatting and proofreading so many fantastic articles has been an education in itself. My thanks go to the authors of the 'Regular Features' for their ideas and content. Thanks also to the contributors of new articles for each issue– there has rarely been a time when I have been short of content. We have had images of respiratory equipment from history provided and a series of articles on Research Methods kindly contributed for all. My thanks go to the changing crew of the Editorial Committee both for their advice regarding the wisdom of publishing or not and style suggestions and of course an Editor can never have too many proofreaders. I shall miss ***Inspire*** but it is time for a change and I wish the incoming Editor and team the best of luck.

Aidan Laverty

A WORD FROM THE CHAIR

Julie Lloyd

ARTP Honorary Chair

Hello and a very warm welcome to this edition of your Inspire journal. I hope you have all enjoyed the extraordinarily good weather we have been experiencing this summer and that the water shortages have not affected you too drastically. Inspire reaches you as we begin the gradual transition from the summer to the autumn and it would seem an opportune moment to mention that the Inspire journal will be undergoing some changes as our Editor, Aidan Laverty, has taken the decision that after 10 years at the helm of Inspire, that this will be his last edition.

Editors note: images not quite up to date

I would like to take this opportunity on behalf of ARTP to offer an enormous 'THANK YOU' to Aidan (pictured here with his teams at GOSH) for the huge amount of time and dedication he has given to creating each edition of Inspire. I know that has been no easy task, as he carefully reviews all of the articles submitted for consideration, edits them for each edition and then has to chase individuals (I am definitely a serial offender!) for their contribution to the journal. This work is completed alongside his 'day job' as the Principal Clinical Physiologist (Respiratory/Sleep) at Great Ormond Street Hospital. Aidan will most definitely be a difficult act to follow, but I know he will provide support and guidance for the incoming editor as they take on this role.

If you have any suggestions or ideas for articles you would like to see in the next edition of Inspire, please let me know and I can feed this in to the Editorial Board. With new editors leading the way, you will see some changes, both to Inspire and our sleep journal, S-News in the coming months which I hope you will all enjoy.

Many of you will be attending the recent European Respiratory Society annual congress either in person in Barcelona or virtually via their electronic platform. ARTP continues to fly the flag for respiratory and sleep scientists at the congress with our own Dr Karl Sylvester as the Chair Group of Group 9.1 and Rosie Fillingham and Sara McArthur representing ARTP at the International Societies area.

ARTP past President, Professor Brendan Cooper received an ERS Special Educational award for his work with Dr Irene Steenbruggen to develop the European Spirometry Driving Licence program. This competency based training program has been rolled out across Europe and has extended as far far as Nepal, South Africa and Brazil! Congratulations to both Brendan and Irene for tirelessly working to raise spirometry standards across the globe.

With talk of Conferences, I am pleased to let you that the preparations for our own ARTP Annual Conference are well under way. After a great deal of work, we have now secured a venue for the conference and the final reveal will be coming soon – we do like to keep you guessing! ARTP have also opened the nominations for our Awards for Service to Respiratory Medicine and to Respiratory and Sleep Science. Please consider nominating a work medical or scientist colleague that you feel has made an exceptional contribution to respiratory or sleep and deserves recognition.

I will draw this edition of 'Word from the Chair' to a close and wish you all the best for the coming months. I look forward to seeing many of you at the ARTP National Strategy Day, which is scheduled for 2nd December at Hilton Birmingham Metropole. As always, I look forward to continuing to work with you all as your Chair and hearing your thoughts for the future directions of ARTP.

On The Blower

Matthew Rutter
Brendan Cooper
Ian Cliff
Peter Moxon

In this edition of on the blower we have a few highlights from the manufacturers awards and exhibition at this years ARTP conference, a press release from Koko PFT and an update from Vitalograph.

With the change to the manufacturers awards we would greatly welcome any nominations or examples of support the industry partners have provided for you over the last year. Please send details to manufacturersliasion@artp.org.uk.

If you are experiencing issues that you require assistance to resolve please send details to watchdog@artp.org.uk.

Best Manufacturer Video: Intermedical

Best Manufacturer Exhibition Stand: Stowood

Intermedical prize draw winner

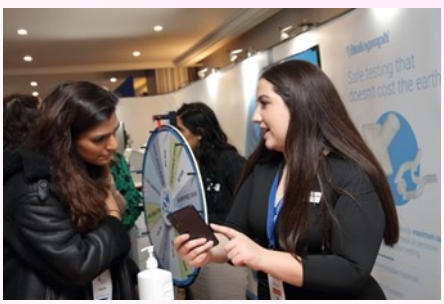
Stowwod winer with the highest score

From around the exhibition

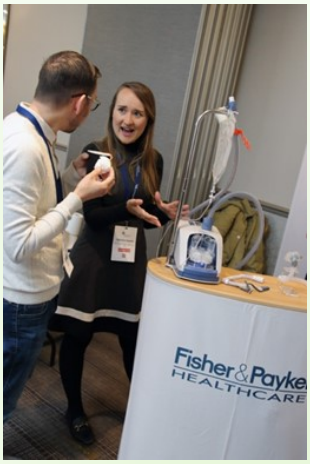


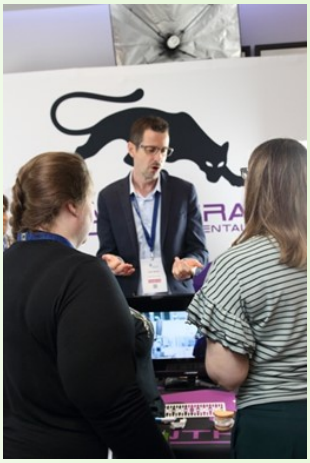







From around the exhibition





Manufacturer updates

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United Kingdom
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Fax: +44 (0)1992 526309
http://www.kokopft.com

PRESS INFORMATION

KoKo moves manufacture of PFT equipment to Europe

Koko PFT Ltd has announced plans to transfer the manufacture of the company's flagship PFT systems, the PX3000 and PX4000, to Europe. "This move is being made in response to challenging supply chain issues and as part of our ongoing value engineering and product development programme," explains Adrian Gee -Turner, General Manager of Koko PFT Ltd. "This initiative will involve the rationalisation of our global locations for Koko PFT, Koko LLC and Koko GmbH, and the group's new international structure will be established by the end of 2023."

KoKo PFT will continue to supply the SX1000 Spirometers on short lead times but the PX3000 and PX4000 full PFT systems will initially be available on longer lead times, and on a case-by-case basis. However, Adrian says: "Koko will continue to provide spares and consumables alongside our full service and maintenance capability".

"Thank you for your support."

For any questions regarding product supply parts service or maintenance please contact us on info@kokopft.com

Contact:

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General Manager, Koko PFT Ltd
Acting CEO, Koko LLC

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Tel. +44 (0)1992 526300

https://kokopft.co.uk/

Vitalograph®

A Global Leader in Respiratory Diagnostics

Thank you ARTP for another fantastic Annual Conference and to all delegates who visited our stand.

May saw a welcome return of a face-to-face ARTP Annual Conference and it was fantastic to see such a great turn out. Congratulations to all those who received their certificates and awards at the Gala dinner in front of their colleagues and peers!

The conference was a perfect platform to showcase our new spirometry product line, including the Pneumotrac PC-based Spirometer, Pneumotrac RMS (Respiratory Muscle Strength) Spirometer with MIP/MEP & SNIP, In2itive Handheld Spirometer and Micro Handheld Spirometer.
These all come with FREE online device training and FREE 5-year warranty.

We displayed some of our **Vitalograph Morgan PFT** range of full pulmonary function testing systems for delegates to test themselves on. The VitaloLAB static PFT system and VitaloROV+ portable PFT systems are complete testing systems aimed at the needs of the modern respiratory service, featuring the following tests as standard:

- Static spirometry – relaxed vital capacity
- Dynamic spirometry – flow volume loop with advanced incentives
- Bronchodilator responsiveness test
- Maximum Voluntary Ventilation
- Bronchial challenge protocols (methacholine, mannitol, exercise etc)
- Respiratory muscle strength (MIP & MEP)
- Sniff nasal inspiratory pressure (SNIP)
- Manual data entry (i.e., for tests not performed on the device)

Safe testing that won't cost the earth

Vitalograph®

A Global Leader in Respiratory Diagnostics

We also presented our range of Eco BVFs™. These are made from recyclable materials using less energy and plastic than our standard BVFs, whilst continuing to meet international standards for efficiency and resistance. We have a range of solutions from a BVF on its own, with a nose clip and with a bite-on mouthpiece for full PFT testing, and they are suitable for use with all leading brands of PFT equipment, helping you to make a more sustainable choice when it comes to safe testing. Order your free trial pack NOW.

Together we fight for lung health!

A very enjoyable evening was had by all at our social evening in aid of the charity Asthma + Lung UK. It offered a great opportunity for delegates to unwind on the first evening and catch up with colleagues they may not have seen in quite some time!

From ticket sales and a well-stocked raffle, we were able to raise £400 to support their work towards making sure that one day everyone will breathe clean air with healthy lungs. Find out more about their work at asthmaandlung.org.uk.

Competition Winners

We are very pleased for Enya Greer at University Hospitals Coventry and Warwickshire and James Pratt at Oxford University Hospitals NHS Foundation Trust who won Gold and Silver prizes on our prize wheel.

Enya won a £50 Amazon voucher and James won the Fitbit Versa 3 Smartwatch.

New Starters

Firstly, we would like to introduce Chris Williamson, our new UK Service Manager. Chris comes to us with a wealth of service management experience and will focus on ensuring Vitalograph customer service and support is the best possible for our customers.

Secondly, we have added Lynton Elcocks to our service team, a name well known to many ARTP members. Lynton has nearly 15 years' experience in pulmonary function device service and maintenance and is a welcome addition to the UK Healthcare service department.

Enquiries and Updates

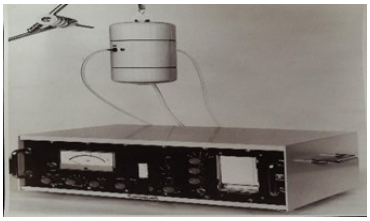
Contact us on 01280 827110 or sales@vitalograph.co.uk for further information on our respiratory solutions.

70 Celebrating 70 Years of Queen Elizabeth II 70

Lung Function Visual Snippets: *How things have changed during her Reign!*

Spotlight on British Manufacturing

1950s

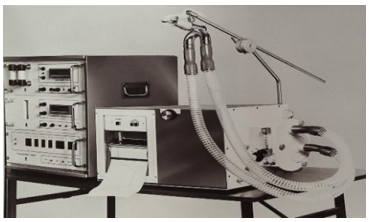


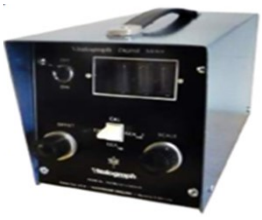
In the 1950s a young respiratory technician set up a new company (PK Morgan) to sell equipment new in the UK. LEFT: Philip Morgan travels the country with the Capnograph RIGHT: Godart Capnograph introduced to the UK representing a major change for anaesthetic medicine by measuring carbon dioxide on the operating table & helping to prevent anaesthetic deaths.

1960s

The 1960s brought further advances from another UK company (Vitalograph) with the iconic wedge spirometer (LEFT) developed to screen coal miners for the MRC Pneumoconiosis panel. This was the birth of 'portable' spirometry. MIDDLE: The world's first portable ventilator (Barnett) was rushed to the bed side of Elizabeth Taylor after she developed double pneumonia whilst filming Cleopatra. RIGHT: New Invention from PK Morgan (Respirameter) reported in the Lancet (1965) which allowed the measurement of Spirometry, Lung Volumes and Transfer Factor. All developed and built in the UK.

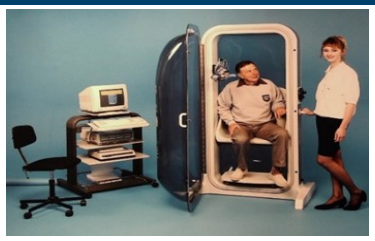
1970s





During the 1970s, new electronic circuitry allowed the equipment to become smaller and easier to use. LEFT: PK Morgan Limited designed and developed the next generation, the TRANSFER TEST device, this was available in multiple models affectionately known as the Models A, B, C, D. RIGHT: Vitalograph Digital Meter – electronics introduced into spirometers. FEV_1 and FVC & % ratio shown on a neon tube array display.

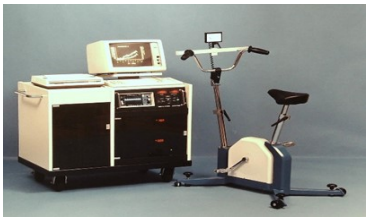
1980s



The 1980s added new tests to the repertoire including very portable equipment especially useful in primary care. LEFT: The next generation Body Plethysmograph by Autolink following Morgan's MK1 cabin. RIGHT: A range of portable spirometers introduced by Micro Medical.

1990s

Vitalograph 'S' with PC and Spirotrac Software



Further advances in the 1990s allowed classical equipment to be linked to micro-computers. LEFT: Vitalograph S Spirometer software alongside the wedge bellows of the 1960s RIGHT: Exercise test equipment representing the advancements in fast gas analysis breath-by-breath resulting in increasingly smaller kit.

2000s

The new century brought further developments from Vitalograph; COPD 6, to include Bluetooth and energy smart technology. RIGHT Vitalograph Spirotrac – The first pure PC Spirometer by the manufacturer.

2010s

LEFT: Vitalograph – a range of devices representing increasingly advanced and portable measuring solutions. RIGHT: Vitalograph aerosol inhalation monitor.

2020s

LEFT: Thora-3Di® system that measures lung function without the need to breathe into a machine. RIGHT: Exovent negative ventilation "hood" that could ease breathing for COVID sufferers.

With many thanks to Kevin Hogben, Adrian Fineberg and Trefor Watts for your contributions to this timeline.

Edited by

Dr. James Stockley

ARTP Chair of Research and Innovation

FRESH AIR

Dear Reader, welcome back to **'Fresh Air'**. These articles are written or sourced by the ARTP Research & Innovation Committee. They are designed to communicate novel physiological research, innovation and clinical practice from the respiratory and sleep sciences. We aim to provide an interesting and informative read that may aid the development of new ideas and improved practice within the ARTP community.

For this issue, we are delighted that **Dr Karl Sylvester** has written a fantastic article centred around sickle cell disease, with an introduction to its pathophysiology and a summary of a recent meta-analysis that addressed the impact of sickle cell disease on respiratory physiology. Dr Sylvester is the Head of Joint Respiratory Physiology Services at Cambridge University Hospitals NHSFT & Royal Papworth NHSFT and is, of course, well known within the ARTP as its former Chair. He is currently the Chair of Group 9.01 (Respiratory function technologists/scientists) for the European Respiratory Society.

James Stockley

Pulmonary function abnormalities in children with sickle cell disease – a meta-analysis

Introduction

Sickle cell disease (SCD) is an inherited blood disorder, which affects millions worldwide. The sickle cell gene is mainly found in the sub-Saharan African population but is also prevalent in those of Mediterranean origin, such as people from Greece, Turkey and Italy and in populations from Northern Africa, Saudi Arabia and some parts of India. Due to migration from these areas, SCD is now one of the commonest inherited disorders worldwide. In the USA, approximately 1 in 500 African-Americans are born with SCD[1], whilst in the UK between 0.11-0.14 per 500 affected infants are born each year[2].

SCD is an autosomally recessive inherited condition, with the gene affected located on chromosome 11[3]. The genetic abnormality leads to alterations in the amino acid sequence of the beta-globin chain of haemoglobin, with various point mutations resulting in the substitution of glutamic acid for other amino acids.

Whilst oxygenated, the solubility of normal haemoglobin and sickle haemoglobin are the same. However, when deoxygenated the solubility of sickle haemoglobin falls dramatically to 10% of normal adult haemoglobin. This is the result of unusual binding between sickle haemoglobin chains when deoxygenated, which results in the formation of rod-like polymers within the red blood cell. The extent of this polymerisation depends on a number of factors, including: haemoglobin concentration, the presence of other forms of haemoglobin (such as foetal haemoglobin) that may inhibit polymerisation, pH, temperature and the level of deoxygenation. Polymerisation results in the red blood cell losing its usual bi-concave shape and a decrease in its deformability. This decreased deformability, in turn, reduces the ability of the red blood cell to pass through small diameter blood vessels. Polymerisation is initially reversible, but, over time, it leads to an increase in cation permeability, resulting in a loss of water from the red blood cell. Dehydration results in an increased haemoglobin concentration, which accelerates polymerisation. The process continues until the red blood cell becomes irreversibly sickled and is removed from the circulation. Continued removal of sickled red blood cells from the circulation results in the anaemia associated with SCD. The average lifespan of a sickle red blood cell is 10 to 12 days compared to the 120 days of a normal red blood cell. However, the reduced haemoglobin levels of 6-9g/dL, that occur in steady state SCD, are partly compensated for by an increase in the reticulocyte count. This, along with the lower oxygen affinity of sickle haemoglobin, results in oxygen delivery to the tissues being near normal.

A major cause of mortality in SCD patients are pulmonary complications (acute chest syndrome (ACS) and sickle chronic lung disease(SCLD)), with incidences in the literature ranging from 21% to 85%[4-6]. ACS is the second most common cause of hospitalisation[7,8] and commonly develops after a vaso-occlusive episode[7,9] outside the lung. As such, ACS is a major pre-disposing risk factor for SCLD, which is thought to develop after repeated lung damage caused by vaso-occlusive episodes[4].

Acute Chest Syndrome

The incidence of ACS is highest in children aged between two and five years[8,10]. Children under two years of age may still have relatively high levels of foetal haemoglobin, which reduces the incidence of ACS episodes[10]. At two years of age or older, SCD children may be exposed to certain infectious agents for the first time by attending playgroups or pre-school. Infection is a major cause of ACS[10] and this may, therefore, explain why the incidence of ACS is higher in the 2 to 5 year old age group. More than 20% of children have at least one ACS episode. Approximately 50% of SCD patients experience one episode of ACS, with 80% of patients having at least one further episode. Repeated ACS episodes cause irreversible lung damage leading to chronic lung disease and premature death[4]. There is a seasonal incidence of ACS in all age groups, with a greater occurrence in the winter compared to the summer months, but this variation is more marked in children, with three times as many ACS episodes occurring during the winter rather than the summer months[8]. These data originate from North America where there may be a higher incidence of infection, particularly RSV, during the winter than the summer months due to a cooler climate, which are likely to lead to episodes of ACS in SCD children. It is not clear whether there is a seasonal incidence of infection in equatorial Africa, but it is plausible to suggest that, as the climate in equatorial Africa stays relatively stable all year round, the incidence of ACS episodes may not vary during the year. Other risk factors for developing ACS include a low concentration of foetal haemoglobin and a higher steady state haemoglobin concentration. An increase in haemoglobin from 8 to 12 g/dL results in an increase in the ACS rate from approximately 0.06 to 0.14 episodes per patient years. A high white blood cell count is also a risk factor for developing ACS[10], which is probably a consequence of greater numbers of leukocytes available for adhesion to the endothelium and, therefore, a greater incidence of vaso-occlusion.

Pathophysiology of ACS

The aetiology of ACS includes: fat embolisation secondary to bone marrow necrosis, infection, hypoventilation atelectasis due to rib infarction, and thromboembolism. Pulmonary fat embolism has been demonstrated to be the cause of ACS in almost half of SCD patients[11] and is associated with a reduction in haemoglobin levels, a decrease in the platelet count and an increase in circulating nucleated red blood cells, suggesting bone marrow injury[11]. Neurological symptoms such as seizures, headaches and confusion are associated with pulmonary fat embolism-related ACS and pulmonary fat embolism itself may affect the respiratory system by the release of free fatty acids from the emboli[12], which subsequently damage cell membranes and lead to injury of the pulmonary vasculature. The inflammatory mediator, secretory phospholipase A2 (sPLA2), releases free fatty acids and has been demonstrated to be elevated in SCD patients with an ACS episode, but not in SCD patients with vaso-occlusion or in steady state[13]. The levels of sPLA2 correlate with disease severity[13]. Recent evidence has shown that raised levels of sPLA2 predict the onset of ACS[14], with the levels increasing 24-48 hours before any clinical signs are present. Chronic restrictive lung disease in subjects with SCD may be secondary to lung injury caused by pulmonary fat embolism[11].

Approximately 30% of ACS episodes are caused by infection[9]. There is an even distribution of infection by bacteria, viruses and mycoplasma, although Chlamydia pneumoniae is the most common isolate and is associated with an increased rate of vaso-occlusion[9,15] compared to the second most commonly found mycoplasma infections.

Infection with parvovirus B19 is associated with bone marrow necrosis and a particularly severe form of ACS[16]. In young children, the most common infectious pathogens are Mycoplasma pneumoniae, Mycoplasma hominis and parvovirus, respiratory syncytial virus and rhinovirus[9]. The onset of an acute chest episode by infectious agents is likely to be precipitated by inflammatory cytokines. An infectious agent will raise the levels of cytokines such as TNF-α or IL-1β and, therefore, increase the expression of adhesion factors, causing more vaso-occlusion, local tissue hypoxia, tissue damage and pulmonary oedema. A vicious circle of adhesion and hypoxia then ensues resulting in an episode of ACS.

When no infection or pulmonary embolus is identified, then primary pulmonary infarction is assumed to be the

cause of an ACS episode[17]. Infarction of bone has been demonstrated to be caused by vaso-occlusion and results in soft tissue swelling. It is possible that rib infarction leads to soft tissue swelling in the chest resulting in pleuritic pain. Breathing is painful when this occurs, so the patient will tend to hypoventilate. Hypoventilation leads to atelectasis and hypoxaemia, which in turn causes increased sickling of erythrocytes.

Pulmonary function

It is likely that the highlighted lung complications associated with SCD will have an impact on lung function outcomes. The severity of such detectable abnormalities may be associated with a greater incidence of sickle complications, such that, those with more incidences of ACS have the worst lung function outcomes. Recently, a systematic review and meta-analysis was published detailing the common pulmonary function abnormalities detectable by performing spirometry, single breath gas transfer and static lung volume measurements[18]. The PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) guideline (*Figure 1*) was used to report this study[19]. Using a number of search terms the authors conducted analysis of a number of eligible studies. To be considered eligible for this meta-analysis, studies considered had to be case-controlled and concerned with any alteration in pulmonary function in children with SCD.

Inclusion criteria:

I. Studies meeting the PECO-S criteria [defined as: population-children (age range: 3-18 years) with SCD, exposure-sickle cell anaemia (SCD), comparator-children without SCD, outcomes-pulmonary function parameters, study design-case-control or comparative study] were included.
II. Studies where main outcomes evaluated were Forced Expiratory Volume in 1 second (FEV_1), Forced Vital Capacity (FVC), FEV_1/FVC ratio and Total Lung Capacity (TLC). FEV_1, FVC and TLC were expressed as percent (%) predicted. FEV_1/FVC ratio was expressed as an absolute value.

Exclusion criteria:

I. Studies with no control group
II. Studies not performed in human participants
III. Case series, reviews, letters, commentaries and editorials
IV. Studies with insufficient data, abstracts, adult studies, conference abstracts and duplicate publications.

Statistical analysis:

The mean differences of various parameters of pulmonary function test results were synthesized using a random-effects meta-analysis between the SCD children and control included FEV_1 (unit in predictive percentage), FVC (unit in predictive percentage), FEV_1/FVC (unit in the original ratio), PEFR (unit in predictive percentage), TLC (unit in predictive percentage) and DLCO (unit in predictive percentage). The Software Review Manager 5.3 (The Nordic Cochrane Centre, Copenhagen, Denmark) was used to conduct meta-analyses for the outcome measures, reported as the mean difference with 95% confidence interval (CI). Heterogeneity was defined as low, moderate, or high according to I2 values (25%, 50%, or 75%, respectively). A Forest plot was used to display the results of the meta-analysis. Data analysis was performed using the fixed-effects model when the results showed low heterogeneity (I2 ≤25%) and the random-effects model when the results showed moderate or high heterogeneity (I2 >25%). Publication bias was assessed by viewing the symmetry of the Forest plot. Reasons for heterogeneity were investigated by fitting meta-regression models. High-resolution Forest plots, with random effects, were separately created.

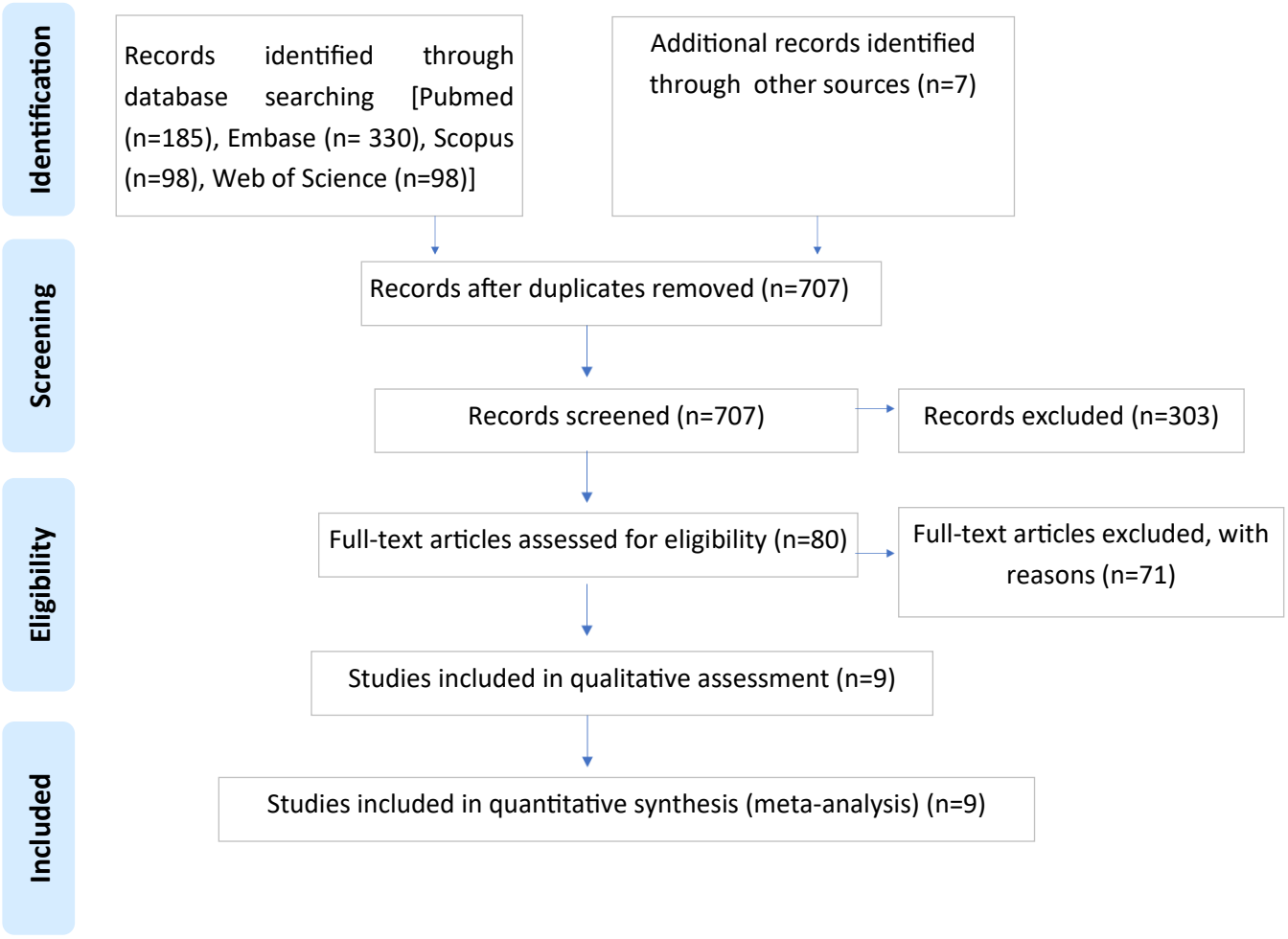


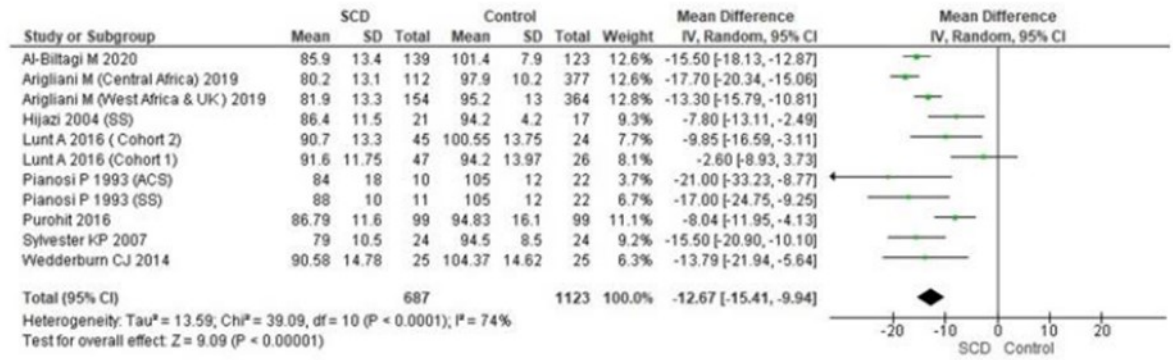
Figure 1. PRISMA flow chart diagram describing process of identification and selection of studies for inclusion in the review[18].

Included study characteristics:

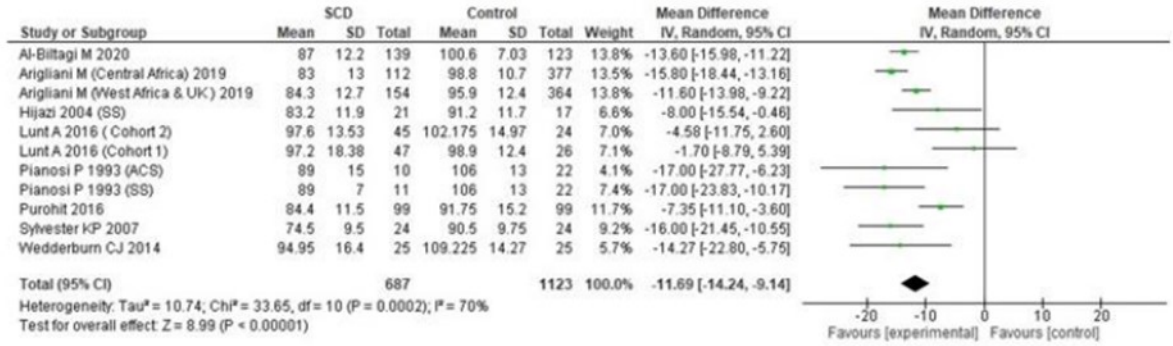
Nine studies with a combined study population of 1889 were included in this meta-analysis. Included were 788 children with SCA and 1101 normal controls. Studies were conducted in six countries, and they were published between 1993 and 2020. The sample size of individual studies ranged from 38 to 518 participants. Participant's age ranged from 3 to 18 years of age and included both male and female children. Although spirometry is an effort-dependent test, all studies explicitly stated that they had performed lung function tests in accordance with international guidelines set forth jointly by the American Thoracic Society (ATS) and the European Respiratory Society (ERS), thus facilitating spirometry manoeuvre standardisation.

Results

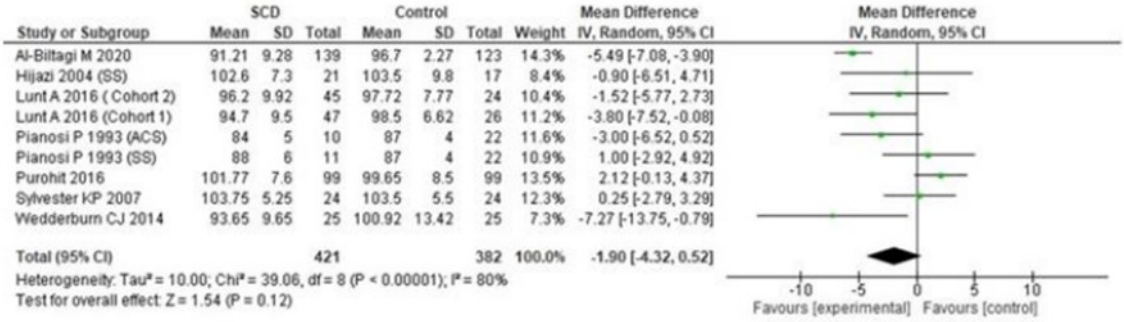
FEV1



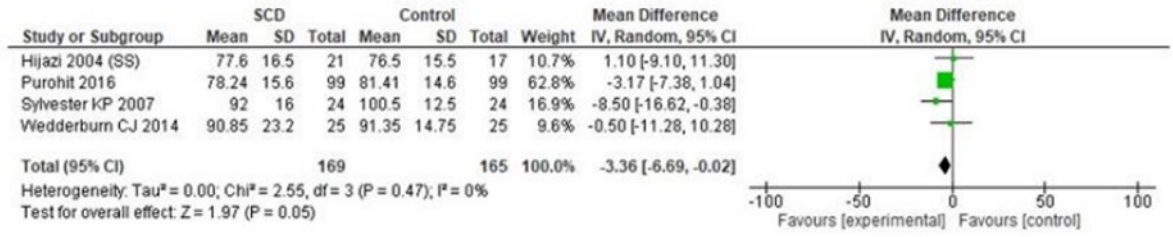
FVC



FEV1/FVC



PEFR



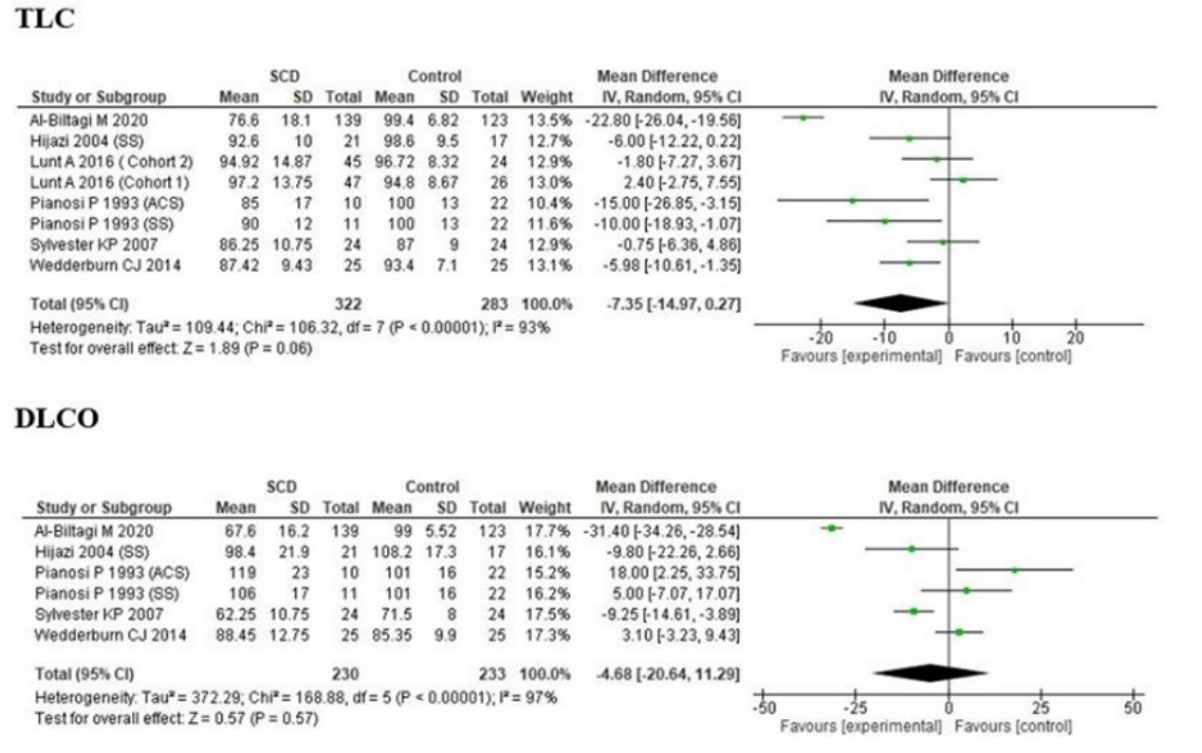


Figure 2. Forest plots for FEV_1, FVC, FEV_1/FVC, PEFR, TLC & DLCO. The pooled result of all studies included is represented by the diamond. Only FEV_1 and FVC were significantly lower overall compared to the healthy control groups (demonstrated graphically by diamonds to the left of the vertical line of no effect with no overlap and statistically by an overall p-value < 0.0001 for both)[18].

Summary

There have been a number of studies investigating the pulmonary function abnormalities in children with SCD. Some identified an obstructive pattern, others a restrictive pattern. From the meta-analysis performed in this study, the only parameters that demonstrated a significant difference from the control group were FEV_1 and FVC ($p < 0.0001$ for both), suggesting that in children with SCD the primary lung function abnormality is an early restrictive defect. In support of this, TLC was lower overall in children with SCD compared to healthy controls, although the comparison did not quite achieve statistical significance ($p = 0.06$). Previous studies have identified that SCD children who have ACS episodes have worse pulmonary function than age-matched children with SCD who have not experienced ACS episodes[20]. There is also evidence of a higher prevalence of airway hyperresponsiveness (AHR) among children with SCD[21-24].

There is still more investigation required in a longer prospective study investigating the pulmonary complications in SCD from childhood through to adulthood, especially determining the greatest risk factors associated with poorer respiratory outcomes.

References

1. Farber MD, Koshy M, Kinney TR. Cooperative Study of Sickle Cell Disease: Demographic and socioeconomic characteristics of patients and families with sickle cell disease. J Chronic Dis 1985; 38: 495-505.
2. Hickman M, Modell B, Greengross P, Chapman C, Layton M, Falconer S, Davies SC. Mapping the prevalence of sickle cell and beta thalassaemia in England: estimating and validating ethnic-specific rates. Br J Haematol 1999; 104: 860-867.
3. Weatherall DJ, Clegg JB. Recent developments in the molecular genetics of human hemoglobin. Cell 1979; 16: 467-479.
4. Powars D, Weidman JA, Odom-Maryon T, Niland JC, Johnson C. Sickle cell chronic lung disease: prior morbidity and the risk of pulmonary failure. Medicine (Baltimore) 1988; 67: 66-76.
5. Gray A, Anionwu EN, Davies SC, Brozovic M. Patterns of mortality in sickle cell disease in the United Kingdom. J Clin Pathol 1991; 44: 459-463.
6. Gray A, Anionwu EN, Davies SC, Brozovic M. Patterns of mortality in sickle cell disease in the United Kingdom. J Clin Pathol 1991; 44: 459-463.
7. Platt OS, Brambilla DJ, Rosse WF, Milner PF, Castro O, Steinberg MH, Klug PP. Mortality in sickle cell disease. Life expectancy and risk factors for early death. N Engl J Med 1994; 330: 1639-1644.
8. Vichinsky EP, Styles LA, Colangelo LH, Wright EC, Castro O, Nickerson B. Acute chest syndrome in sickle cell disease: clinical presentation and course. Cooperative Study of Sickle Cell Disease. Blood 1997; 89: 1787-1792.
9. Vichinsky EP, Neumayr LD, Earles AN, Williams R, Lennette ET, Dean D, Nickerson B, Orringer E, McKie V, Bellevue R, Daeschner C, Manci EA. Causes and outcomes of the acute chest syndrome in sickle cell disease. National Acute Chest Syndrome Study Group. N Engl J Med 2000; 342: 1855-1865.
10. Castro O, Brambilla DJ, Thorington B, Reindorf CA, Scott RB, Gillette P, Vera JC, Levy PS. The acute chest syndrome in sickle cell disease: incidence and risk factors. The Cooperative Study of Sickle Cell Disease. Blood 1994; 84: 643-649.
11. Vichinsky E, Williams R, Das M, Earles AN, Lewis N, Adler A, McQuitty J. Pulmonary fat embolism: a distinct cause of severe acute chest syndrome in sickle cell anemia. Blood 1994; 83: 3107-3112.
12. Weil JV, Castro O, Malik AB, Rodgers G, Bonds DR, Jacobs TP. NHLBI Workshop Summary. Pathogenesis of lung disease in sickle hemoglobinopathies. Am Rev Respir Dis 1993; 148: 249-256.
13. Styles LA, Schalkwijk CG, Aarsman AJ, Vichinsky EP, Lubin BH, Kuypers FA. Phospholipase A2 levels in acute chest syndrome of sickle cell disease. Blood 1996; 87: 2573-2578.
14. Styles LA, Aarsman AJ, Vichinsky EP, Kuypers FA. Secretory phospholipase A(2) predicts impending acute chest syndrome in sickle cell disease. Blood 2000; 96: 3276-3278.
15. Dean D, Neumayr L, Kelly DM, Ballas SK, Kleman K, Robertson S, Iyer RV, Ware RE, Koshy M, Rackoff WR, Pegelow CH, Waldron P, Benjamin L, Vichinsky E, Acute Chest Syndrome Study Group. Chlamydia pneumoniae and acute chest syndrome in patients with sickle cell disease. J Pediatr Hematol Oncol 2003; 25: 46-55.
16. Lowenthal EA, Wells A, Emanuel PD, Player R, Prchal JT. Sickle cell acute chest syndrome associated with parvovirus B19 infection: case series and review. Am J Hematol 1996; 51: 207-213.
17. Rucknagel DL, Kalinyak KA, Gelfand MJ. Rib infarcts and acute chest syndrome in sickle cell diseases. Lancet 1991; 337: 831-833.
18. Taksande A, Jameel PZ, Pujari D, Taksande B, Meshram R. Variation in pulmonary function tests among children with sickle cell anemia: a systematic review and meta-analysis. Pan Afr Med J 2021; 39: 140.
19. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JP, Clarke M, Devereaux PJ, Kleijnen J, Moher D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ 2009; 339: b2700.
20. Caboot JB, Allen JL. Pulmonary complications of sickle cell disease in children. Curr Opin Pediatr 2008; 20: 279-287.
21. Shilo NR, Alawadi A, Allard-Coutu A, Robitaille N, Pastore Y, Bérubé D, Jacob SV, Abish S, Dauletbaev N, Lands LC. Airway hyperreactivity is frequent in non-asthmatic children with sickle cell disease. Pediatr Pulmonol 2016; 51: 950-957.
22. Leong MA, Dampier C, Varlotta L, Allen JL. Airway hyperreactivity in children with sickle cell disease. J Pediatr 1997; 131: 278-283.
23. Field JJ, Stocks J, Kirkham FJ, Rosen CL, Dietzen DJ, Semon T, Kirkby J, Bates P, Seicean S, DeBaun MR, Redline S, Strunk RC. Airway hyperresponsiveness in children with sickle cell anemia. Chest 2011; 139: 563-568.
24. Boyd JH, Macklin EA, Strunk RC, DeBaun MR. Asthma is associated with acute chest syndrome and pain in children with sickle cell anemia. Blood 2006; 108: 2923-2927.

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Great Ormond Street Hospital for Children NHS Foundation Trust

Summarising the most popular topics in the ARTP forum since April Inspire.

Top Forum

The best of the ARTP Forum

Title: Digital referral and results management

Question: This physiologist was exploring the process and practicalities of implementing an electronic signed prescription element within an updated referral and appointment system. They also raised concerns surrounding the practicalities of its management.

Replies: The first physiologist to reply stated that requests generated electronic signatures and by the system only being accessible via smart card and pin, all requests are considered legally e-signed. Moreover, modifications to the systems code can allow for reduced access, which may enhance security.

Another physiologist indicated that their system allocated reversibility as a separate procedure, with compulsory indication of drug, dose, and delivery options, defaulting to their standard method of delivery. They also stated that only prescribers can make such requests and all such requests are electronically signed, which meets legal criteria.

Title: CPAP Museum?

Question: A physiologist had the delight of receiving a 24+ year old CPAP machine in very good condition from a patient who hadn't received a follow-up appointment in all those years! The author of the original post was keen to donate the machine to a museum of an interested party

Replies: Although there were no offers to rehome, it did offer an opportunity for our more senior physiologists to reminisce and to summarise by saying "*how well the old tech lasts*". I think a point on which, from time-to-time, we can all agree.

Title: KOG mouthpiece and filter packs

Question: There was some concern raised about difficulty receiving orders for mouthpieces and filter packs and whether this was reflected in our community.

Replies: Numerous replies all stated issues with suppliers and advised shopping around to avoid supply issues. Indeed, one physiologist highlighted their own validation on different brands of filters, finding no difference in QC data between them.

Title: Custom CPAP masks

Question: A senior physiologist highlighted the difficulty in getting a good mask fit with standard issue CPAP masks on patients with facial deformities. They indicated that some centres used to make custom-moulded masks in the early days of CPAP and were enquiring about whether this is still possible.

Replies: This post received many replies, with recommendations spanning the spectrum from nasal pillows to full face masks. One physiologist highlighted the good work at Sheffield Children's Hospital who presented an abstract on custom face masks at the BSS last year as a potential contact. The original poster emphasised the need for established specialised mask fitting services nationally. They also agreed to follow up on several suggestions and report back on the patient's progress in the forums interest.

Title: Relative contraindications

Question: This physiologist was faced with the prospect of testing a patient with a 6.5cm ascending aortic aneurysm (AAA). They were curious to know if reproducible FEV_1 and submaximal FVC would be sufficient for diagnostic purposes but also reduce risk. Moreover, they were also hoping that others would share their risk assessments and consenting process in this unique scenario.

Replies: There were many responses to this question, with the majority indicating the need to speak to the referrer to ascertain their reasons behind the request. In a separate post, a physiologist highlighted the need for physiologists to explain the risks to patients to enable informed consent when undertaking a possibly risky procedure. Recurrently, responders highlighted that evidence suggests that performing spirometry on AAA patients has a low mortality and complication rate overall.

Title: Saving [the] planet one step at a time

Question: This physiologist posed an interesting question – What is the energy consumption of a lung function machine and suggested methods to improve sustainability?

Replies: The first reply discussed the feasibility of wholesale changes, which can result in false economy. Instead, they highlighted the significance of smaller changes within our departments, which was emphasised in a subsequent reply, who recommended a switch in test gas from the potent greenhouse gas methane to helium. Further responses exhibited solutions such as single-use consumables, in their case cardiology catheters, which are sent to companies who remanufacture and repurpose those items to reduce waste. The respondent also highlighted the encouragement of DPI use in their trust, which has roughly 1/25th the carbon cost of MDIs.

Title: CPET ICs

Question: A question for physiologists who perform IC measurements during CPET. This physiologist was looking for advice on the number of IC measurements performed and when.

Replies: The first physiologist to reply suggested an IC measurement at the end of each stage when looking at hyperinflation. This led to the next physiologist suggesting an IC measurement in the early phases of exercise to avoid disruption to metabolic traces, with another near the end and a peak IC, if possible, with a minute to go to termination. The first physiologist emphasised the accuracy of information that can be obtained by taking measurements at the end of each minute. In their case, they recommend two tests, the standard test and then a hyperinflation test to obtain quality data and help answer the clinical question at hand. This was found to be in agreement with another physiologist, who also suggested performing the IC measurement after reaching the ventilatory threshold to avoid skewing data.


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#	Author(s)	Title
O1	**Short C**	The Agreement of Spirometry Controlled-Computed Tomography (SC-CT) Scans With Multiple Breath Washout With Short Extension (MBWshx)
O2	**Smith L**	The impact of airway dysanapsis in patients with asthma and/or COPD on 129Xe ventilation MRI
O3	**Cramp C**	Impact of adopting Global Lung Initiative (GLI) regression equations on the interpretation of lung volume measurements.
O4	**Appleby G**	Evaluating the Efficacy of a Virtual CPAP Service During the Covid-19 Pandemic
P1	**Hayter J**	Is there significant correlation between gas transfer and ventilatory equivalent measurements in a West Midlands hospital cohort?
P2	**McArthur S**	Varying spirometry results for a patient with known bronchiectasis and emphysema
P3	**Wallbanks S**	Reversibility: 6% or 12%?
P4	**Jakymelen D-J**	Differentiating COPD and asthma using 129Xe ventilation MRI, lung clearance index, and spirometry
P5	**Elson C**	Rheumatoid Arthritis and associated risk of developing Idiopathic Interstitial lung disease- the progressive combination: A case report
P6	**Coenegrachts T**	Artificial intelligence powered spirometry enables early detection of interstitial lung disease
P7	**Lomas A**	A National Survey of the utility and usefulness of pulse oximetry spot-checks
P8	**Dobson E**	Retrospective review of home oxygen provision and outcomes for patients with COVID-19 requiring supplementary oxygen at hospital discharge
P9	**Pring J**	Can patient demographics and physiological parameters predict the requirement for in-flight supplemental oxygen determined by hypoxic challenge testing?
P10	**Riley M**	"We carry the ventilator with us anyway": Learning from a modified hypoxic challenge test in children at risk of hypoventilation
P11	**Gregory B**	D-lactate Encephalopathy as a Cause of Acute Hypercapnic Respiratory Failure

P12	**Belcher M**	Audit of GP practices utilising a community 'drive through' adult spirometry service during the COVID19 pandemic
P13	**Burns P**	Diagnostic Pathway and Management of Exercise-Induced Laryngeal Obstruction in a Children's Hospital
P14	**Cartwright D**	Aggressive nonspecific interstitial pneumonia and inflammatory/necrotising myositis secondary to antisynthetase syndrome: a case report
P15	**Hughes M**	Respiratory muscle weakness in a patient with Guillain-Barre Syndrome and a significant cardiovascular history – a single case report
P16	**Clavaud F**	A comparison of C-Check fixed pressure and auto-titrating CPAP on OSA therapy management
P17	**Leach R**	How accurate are equations for calculating a fixed pressure prescription in CPAP therapy?
P18	**James-Morley E**	Continuous positive airway pressure for obstructive sleep apnoea: supporting adherence using telemedicine
P19	**Belcher M**	Developing a virtual sleep clinic pathway
P20	**Purcell H**	The implementation of an acute ventilation practitioner (AVP) role within a newly established acute respiratory care unit (ARCU)
P21	**Davies M**	Paediatric Home Sleep Apnoea Testing: Service Audit
P22	**Fettes E**	Assessing the impact of GLI TLCO 2020 on a paediatric population
P23	**Coss P**	Monitoring patients with COVID-19 in the home. An experience of providing 24hr access to pulse oximetry and symptom monitoring
P24	**Smith A**	A retrospective audit to determine adherence to pulmonary function testing standards, pre and post-COVID-19
P25	**Jamieson P**	COVID-19 Pandemic: Infection control strategies during pulmonary function testing and associated rates of infection in physiology staff
P26	**Minhas S**	Evaluating the reliability and accuracy of NuvoAir home spirometry and its efficiency in reducing aerosol generating procedures (AGPs) during COVID-19
P27	**Thomas M**	Cardiopulmonary Exercise Testing (CPET) Service Utilisation: Backlog to the Future
P28	**Dodsworth H**	Is seated –supine VC assessment necessary if sniff nasal pressure is normal?
P29	**Burns P**	Comparison of two fractional exhaled nitric oxide (FeNO) measuring devices in the paediatric population
P30	**Rogers K**	Comparison of two devices for the measurement of Nasal Nitric Oxide
P31	**Johal G**	Nebuliser assessment service post COVID pandemic—a comparison study
P32	**Mir H**	How COVID-19 has impacted the Lung Function service at Royal Free Hospital between 2020-2021
P33	**Burge J**	Is quality assured spirometry achievable in a clinical cohort of patients with ACHD: retrospective analysis of a single centre experience

P34	**Almeshari M**	Altered lung volumes in relationship to airflow obstruction and small airways dysfunction in asthma
P35	**Bonham-Carter A**	Idiopathic subglottic stenosis as a differential diagnosis for Asthma: a case report demonstrating the potential for fixation errors
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P41	**Stockley J**	Is a Second Baseline Walk Required for Ambulatory Oxygen Assessments?
P42	**Rai T**	The Use of Remote Monitoring for Identifying CPAP non-Compliers and Reclaiming Unwanted Devices
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P44	**Storey M**	WatchPAT One vs NOX – An audit to compare the DNA rate, cost efficiency, staff time and patient time
P45	**Harrison A**	Assessing the communication requirements of patients attending a non-invasive ventilation multidisciplinary outpatient clinic

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THE AGREEMENT OF SPIROMETRY CONTROLLED-COMPUTED TOMOGRAPHY (SC-CT) SCANS WITH MULTIPLE BREATH WASHOUT WITH SHORT EXTENSION (MBWSHX)

Mr Christopher Short[1,2], Dr Thomas Semple[1,2], Ms Mary Abkir[1,2], Ms Clare Saunders[1,2], Dr Dominic Hughes[1,2], Dr Paul McNally[3,4], Dr Harm Tiddens[5], Professor Jane C Davies[1,2]

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Background: Recently we published a short extension to the MBW (MBWShX) which acquires signal from previously overlooked under/unventilated lung units (UVLU)[1]. We sought to compare MBWShX parameters with Spirometry controlled (SC)-CT.

Methods: 16 CF subjects performed MBWShX, spirometry and SC-CT on the same day as part of a real-world study of elexacaftor-tezacaftor-ivacaftor. This study was approved by the London City & East Research Ethics Committee. MBWShX provides a marker of global lung health termed LCIShX as well as a specific marker termed UVLU. SC-CT images were acquired at both total lung capacity and residual volume with images scored according to the CF-CT system. All parameters apart from age were normally distributed. T-test was used to assess the difference between LCI2.5 and LCIShX, with linear regression used to determine the relationship between lung function and SC-CT parameters.

Results: CF subjects had a median age of 20 months (Range 12-57), mean LCI2.5 14.1 (SD±4.4), LCIShX 17.9 (5.5), ppFEV1 81.2% (14.5) and ppFVC 92.0% (14.3). Whilst LCIShX was significantly different to LCI2.5 ($P<0.001$) the extent of UVLU was variable 3.9 (SD± 1.9, range 0.7-7.3) and was not predictable based on LCI2.5 ($R2$ 0.24; $P> 0.05$). Both LCI2.5 and LCIShX had good agreement with CT total lung score (R 0.78, $R2$ 0.61, $P<0.001$; R 0.80, $R2$ 0.64, $P<0.001$), hyperinflation score ($R2$ 0.53, $P<0.05$; $R2$ 0.62, $P<0.001$) and all other scores apart from parenchymal score. The extent of UVLU also had a significant relationship with CT total lung score ($R2$ 0.30, $P=0.03$), hyperinflation score ($R2$ 0.38, $P=0.01$) and peribronchial thickening score ($R2$ 0.28, $P=0.03$).

Conclusion: This data suggests that MBWShX and SC-CT are complementary markers of CF lung disease and that MBWShX can be a radiation-free assessment of UVLU. The heterogeneity of UVLU between CF subjects may suggest MBWShX provides clinically relevant and phenotypical information.

Reference:

1. Short et al, JCF 2022; 21(1):146-154

THE IMPACT OF AIRWAY DYSANAPSIS IN PATIENTS WITH ASTHMA AND/OR COPD ON 129XE VENTILATION MRI

Dr Laurie Smith[1], Helen Marshall[1], Demi-Jade Jakymelen[1], Alberto Biancardi[1], Guilhem J Collier[1], Ho-Fung Chan[1], Paul J C Hughes[1], Martin L Brook[1], Joshua R Astley[1], Ryan Munro[1], Smitha Rajaram[1], Andrew J Swift[1], David Capener[1], Jody Bray[1], James Ball[1], Olly Rodgers[1], Ian Smith[1], Bilal A Tahir[1], Madhwesha Rao[1], Graham Norquay[1], Nick D Weatherley[1], Leanne Armstrong[1], Latife Hardaker[2], Titti Fihn-Wikander[3], Rod Hughes[4], Jim M Wild[1]

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Introduction: Airways dysanapsis is a spirometric pattern of debated clinical significance, where there is airflow obstruction (forced expiratory volume in 1 second (FEV_1)/forced vital capacity (FVC) < the lower limit of normal (LLN)), but FEV_1 within the normal range. ^{129}Xe ventilation magnetic resonance imaging (V-MRI) provides a functional assessment of ventilation abnormalities that may provide context to dysanapsis.

Methods: Patients (pts) with a physician-assigned diagnosis of asthma and/or chronic obstructive pulmonary disease (COPD) in the NOVELTY study (NCT02760329) were assessed with post-bronchodilator V-MRI and spirometry on the same day. Ventilation defect percentage (VDP), the proportion of non-ventilated lung, and heterogeneity index (VHI), ventilation heterogeneity within ventilated lung, were calculated from V-MRI. Airways dysanapsis was defined as $FEV_1/FVC<LLN$ (z score -1.64) and $FEV_1>LLN$. Data were described as median (IQR). Mann-Whitney tests compared pts with airways dysanapsis and pts with normal spirometry.

Results: Of 164 pts, 44 had dysanapsis (39% female, age 62.6 years [16.6]), comprising 14 with asthma, 21 with asthma+COPD, and 9 with COPD. 83 pts had normal spirometry (55% female, age 57.2 years [23.3]). Despite both groups having a $FEV_1>LLN$, the dysanapsis group had lower FEV_1 ($p<0.001$). VDP and VHI were raised/ worse ($p<0.001$) in pts with dysanapsis (VDP, 6.5% [9.6]; VHI, 12.4% [7.0]) compared with those without (VDP, 2.2% [2.6]; VHI, 9.1% [3.0]) (Figure). Ventilation abnormalities were prevalent in both groups; 86% of the dysanapsis group had elevated VDP (>2%) vs 52% of the normal spirometry group (Figure).

Conclusion: V-MRI demonstrated ventilation abnormalities in most pts with physician-assigned asthma and/or COPD despite normal FEV_1. Pts with airways dysanapsis had more marked ventilatory defects and heterogeneity and may represent a population with significant pathology, rather than just a physiological variant.

Sponsor: AstraZeneca.

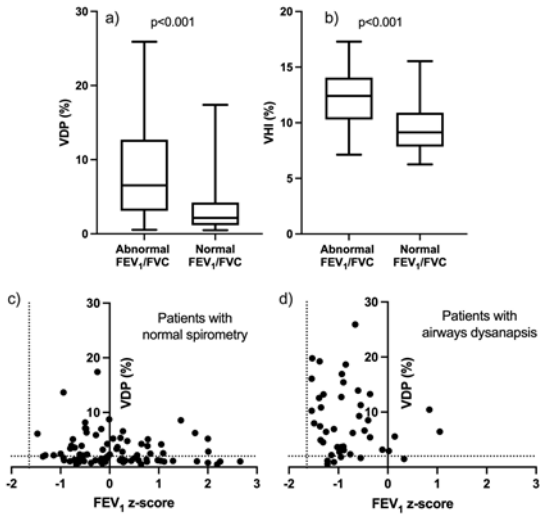

Figure. Comparison of patients with normal FEV_1, between those with airways dysanapsis and those with normal FEV_1/FVC

Box-and-whisker plots (a) and (b) show the group difference in 129Xe MRI VDP and VHI and that patients with airways dysanapsis had significantly worse VDP and VHI than those without. Scatter plots (c) and (d) highlight the relationship between FEV1 and VDP in patients with normal spirometry (c) and those with airways dysanapsis (d). Dashed lines indicate the lower limit of normal for FEV1 and the upper limit of normal for VDP

IMPACT OF ADOPTING GLOBAL LUNG INITIATIVE (GLI) REGRESSION EQUATIONS ON THE INTERPRETATION OF LUNG VOLUME MEASUREMENTS

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Background. Interpretation of Pulmonary Function Tests (PFT's) can only be clinically valid if reliable predicted values are used to provide an estimate of normality[1]. The Global Lung Initiative (GLI) equations for spirometry and gas transfer have been widely adopted, replacing the European Community for Coal and Steel (ECCS)[2] values which had significant limitations. GLI equations for lung volumes were published in 2021 enabling departments to have a complete GLI reference data set[3].
Aims. To assess the impact of adopting the GLI equations for lung volume measurements on our local population.

Methods. Retrospective data from 200 patients (94M) attending the Respiratory Physiology Department between January 2020 and January 2022 were analysed. Predicted values and standardised residuals (SR) for identified patients were calculated for both ECCS and GLI equations for Functional Residual Capacity (FRC), Residual Volume (RV) and Total Lung Capacity (TLC). Wilcoxon signed-rank test was used to identify differences between predicted values.

Results. There was a statistically significant difference between the predicted values for RV and TLC (***Table 1***). Clinically 24/200 (12%) patients changed severity status for TLC and 34/200 (17%) for FRC when moving from ECCS to GLI. RV predicted demonstrated the greatest impact on clinical interpretation with 78/200 (39%) changing severity status.

Conclusion. The impact of changing to GLI predicted values for lung volumes measurements has statistical and clinical significance. GLI predicted values result in more patients being classified as either normal or less severely impaired than ECCS. This may be due to the use of a more representative population. Clinicians interpreting for clinical decision making should be aware of the predicted values being utilised and how a change can affect serial monitoring.

References.

1. Cooper et al. Breathe 2017; 13: 56-64
2. Degens and Merget. European Respiratory Journal 2008; 31: 687-688
3. Hall, G. L., Filipow, N., Ruppel, G., Okitika, T., Thompson, B., Kirkby, J., Steenbruggen, I., Cooper, B. G., et al. (2021) 'Official ERS technical standard: Global Lung Function Initiative reference values for static lung volumes in individuals of European ancestry.' Eur Respir J, 57(3), Mar, 2021/03/13

N=200	ECCS Predicted	GLI Predicted	p	ECCS SR	GLI SR	p
TLC *L*	5.57 (4.88 – 6.80)	5.76 (4.98 – 6.87)	***	-0.63 (-2.05 – 0.57)	-0.78 (-2.12 – 0.30)	*
FRC *L*	2.90 (2.68 – 3.53)	2.99 (2.65 – 3.47)	ns	-0.66 (-1.68 – 0.57)	-0.57 (-1.49 – 0.57)	ns
RV *L*	2.01 (1.87 – 2.39)	1.80 (1.64 – 2.09)	***	-0.42 (-1.44 – 1.29)	0.27 (-0.54 – 1.28)	**

Table 1. Data expressed as median and interquartile range (IQR); L = litres; *** = p <0.0001; ** = p <0.001; * = p <0.05; ns = Nonsignificant

EVALUATING THE EFFICACY OF A VIRTUAL CPAP SERVICE DURING THE COVID-19 PANDEMIC

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Methods: We studied differences between patients trialling continuous positive airway pressure (CPAP) for obstructive sleep apnoea before and during the Covid-19 pandemic. 1,221 subjects (780 male; mean age 52yrs, standard deviation 13.5) trialled CPAP after a face-to-face initiation (F2F) in April-November 2019 (N=656) or by post in 2020 (N=565) and were reviewed by phone every 4 weeks until trial completion. Variables collected from a clinical database included: body mass index; diagnostic sleep disordered breathing (SDB) and Epworth Sleepiness Score (ESS) [1]; treatment apnoea-hypopnoea index (AHI) and ESS; average nightly use, percentage of nights used, how patients felt on CPAP, and if they continued with CPAP. T-tests and Mann-Whitney U assessed differences between F2F and postal groups. Logistic regression identified predictors of continuing therapy. Ethics approval was obtained from RI department.

Results: There was no significant difference in the number of patients continuing with CPAP for the F2F (66%) and postal (64%) trials (p=0.71). Average hourly use was less for the postal group (median 4:54hrs, interquartile range (IQR) 2:30-6:18) than F2F (median 5:12hrs, IQR 3:00-6:24, p=0.04). There was less improvement in AHI on CPAP for postal (median 22.4/Hr, IQR 13-39.8) than F2F (25.1/Hr, IQR 12.7-47, p=0.04). There were no other significant differences. In a logistic regression of diagnostic variables, patients less likely to continue with CPAP were young (17-29yrs, odds ratio (OR): 0.42, 95% confidence interval (CI): 0.20-0.87) and old (>69yrs, OR: 0.49, 95% CI: 0.29-0.85). This was not significant in the full model and predictors of continuing CPAP are shown below.

Conclusion: Postal trials are effective for initiating therapy though may reduce patients' compliance. Patients with high diagnostic SDB and who gained symptomatic benefit were more likely to continue with CPAP. Further research is needed to assess long-term differences between the groups.

Reference.

1. Johns, M.W., Sleep 1991; 14(6), pp.540-545.

Summary of Significant Predictors of Continuing with CPAP Therapy

Variable *(reference)*	Odds Ratio *(95% Confidence Interval)*
Postal Trial *(F2F)*	1.72 (0.92-3.29)
Moderate diagnostic SDB *(mild)*	2.65 (1.22-6.44) *
Severe diagnostic SDB *(mild)*	5.03 (2.22-11.78) **
Moderate-severe treatment AHI *(normal)*	0.06 (0.02-0.17) **
Missing treatment AHI *(normal)*	0.08 (0.02-0.34) **
Lower treatment ESS *(same/higher)*	2.80 (1.25-6.24) *
Missing treatment ESS *(same/higher)*	0.06 (0.02-0.16) **
Felt Better on CPAP *(same/worse)*	35.00 (16.70-77.72) **

*SDB = Sleep Disordered Breathing; AHI = Apnoea-Hypopnoea Index; ESS = Epworth Sleepiness Score; * p<0.05; ** p<0.01*

IS THERE SIGNIFICANT CORRELATION BETWEEN GAS TRANSFER AND VENTILATORY EQUIVALENT MEASUREMENTS IN A WEST MIDLANDS HOSPITAL COHORT?

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Table 1. – Pearson's correlation between gas transfer and VEq

	$Log_{10}TL_{CO}$	K_{CO}
Resting V_E/V_{CO2}	-0.42 * †	-0.54 * †
Log_{10}Resting V_E/V_{O2}	-0.40 * †	-0.51 * †
V_E/V_{CO2} @AT	-0.62 * †	-0.69 * †
$Log_{10}V_E/V_{O2}$ @AT	-0.54 * †	-0.63 * †
$Log_{10}V_E/V_{CO2}$ @Peak	-0.56 * †	-0.59 * †
$Log_{10}V_E/V_{O2}$ @ Peak	-0.36 * †	-0.41 * †
$Log_{10}V_E/V_{CO2}$ slope	-0.62 * †	-0.61 * †
$Log_{10}V_E/V_{CO2}$ slope intercept	-0.13	-0.11

* = P Value < 0.05

† = P < 0.05 when Bonferroni correction is performed for multiple comparisons

Methods: Correlation between gas transfer measurements examined that included transfer factor for carbon monoxide (TL_{CO}) and carbon monoxide transfer coefficient (K_{CO}) and ventilatory equivalent (VEq) measurements that included VEq for O_2 and CO_2 at rest, anaerobic threshold, peak and minute ventilation over carbon dioxide output slope (V_E/V_{CO2} slope). This study was approved by Manchester Metropolitan University research ethics and governance team and Worcester Acute Hospital research and development team. Data was collected retrospectively from 1st January 2014 to 31st December 2017 with subjects required to have their cardiopulmonary exercise test (CPET) and Pulmonary function test (PFT) performed within 3 months of each other and comply with international guidelines. Non-parametric data was transformed in order for parametric tests to be performed, such as Pearson's correlation coefficient and multiple regressions.

Results: Baseline characteristics of the 73 patients (25 females and 48 males) identified that 75.34% of these patients were classified as having an unhealthy body mass index (<18.5 and >25). 49 out of the 73 subjects had diagnosed comorbidities, most common were chronic obstructive pulmonary disease (30.14%) and cardiovascular disease (26.03). K_{CO} had a larger correlation with all VEq variables apart from V_E/V_{CO2} slope and its intercept when compared to TL_{CO}. The largest linear correlation was found between VEq of CO_2 at anaerobic threshold (V_E/V_{CO2} @AT) and K_{CO} (r=-0.69, p<0.001). Multiple regression found that Log10 TL_{CO} = 0.028(√86-Age) – 0.015(V_E/V_{CO2} @AT) + 1.045 (Height) - 0.657 (r= 0.833, p<0.001) and 69.4% of variance in TL_{CO} was predicted from this equation.

Conclusion: The significant correlation between these two sets of parameters clearly identifies the overlap between gas transfer and VEq measurements. This means that gas transfer results could be estimated from VEq measurements or vice versa, if a subject can't perform the relevant tests. The use of retrospective data has caused limitations regarding investigation protocol, composition of participants and equipment consistency. However, this study should be used as a benchmark for future research to further validate and expand these findings.

VARYING SPIROMETRY RESULTS FOR A PATIENT WITH KNOWN BRONCHIECTASIS AND EMPHYSEMA

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Patient background

A male patient with bilateral lower lobe bronchiectasis and emphysema regularly attended for spirometry testing. The patient had a background of hypertension, Type 2 diabetes, an abdominal aortic aneurysm, chronic kidney disease, peripheral vascular disease and previous Bell's palsy with residual deficit. Breathlessness and cough were the main ongoing symptoms.

Results:

Over a four year period spirometry results varied: FEV_1=2.18-4.51L, FVC=3.18-4.10L, VC=3.40-4.58L, PEF=218-451L/min.

Ventilatory capacity was noted to be very variable between visits and a number of reasons were hypothesised. Did the patient have any pharmaceutical or surgical intervention? Was the patient compliant with his medication? Was there any other reason for the variability?

It was noted that the results were lower during visits where the patient attended the department as part of a clinic visit with the consultant, whilst higher when attending for further in-depth testing.

Due to the patients known previous Bells palsy it was hypothesised that the patient may be experiencing leaks whilst undergoing spirometry using the fluted mouthpiece. The patient agreed to perform spirometry using a fluted mouthpiece then a flanged mouthpiece.

There would be inherent built in errors within each piece of equipment used (Vitalograph Alpha compared to Medical Graphics plethysmograph) which may partly explain the change in values.

Conclusion:

Throughout testing via the fluted mouthpiece there was likely a leak that was unnoticed. This underestimated the patients ventilatory capacity and made longditudinal trends difficult to compare. New guidance stating that spirometers should have the capacity to perform tidal breathing first may have meant that the physiologist assistant would have noticed this easier by identifying drift from baseline in the tidal breathing traces [1]. Patient will now always be tested on the plethysmograph with a flange mouthpiece

Reference.

1. Graham BL, Steenbruggen I, Miller MR, et al. Standardization of spirometry 2019 update. An official American thoracic society and European respiratory society technical statement. Am J Respir Crit Care Med. 2019 Oct 15;200(8):e70–e88. PMID: 31613151; PMCID: PMC6794117.

Comparison of spirometry result using a fluted verses a flanged mouthpiece

	Month 47 (fluted)	SR	Month 47 (flange)	SR	Variation noted (%)
Age (years)	78		78		
Height (m)	1.73		1.73		
Weight (Kg)	87		87		
BMI (Kg/m2)	29.1		29.1		
FEV1 (L)	2.28	-0.76	2.84	0.33	19.7
FVC (L)	2.70	-1.46	4.03	0.72	55.1
VC (L)	3.07	-0.85	4.41	1.34	30.4
Ratio	74.3	0.17	64.4	-1.21	
PEF (L/min)	235	-2.88	406	-0.52	42.1
SpO2 (%)	97		97		

REVERSIBILITY: 6% OR 12%?

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Introduction

Whilst traditional ERS guidelines recommend ≥12% and ≥200 mL change in FEV_1 to constitute a 'significant' reversibility post-bronchodilator[1], recent ARTP guidance suggests a lower threshold of ≥6% may be more appropriate, in the context of a compatible clinical history[2]. This study evaluates the diagnostic implications of using these thresholds.

Methods

Three months of reversibility assessments were analysed. Spirometry was performed pre- and post-2.5 mg nebulised salbutamol. Exclusion criteria: 1) non-diagnostic referral and 2) poor baseline spirometry technique. Analysis of change in FEV_1 was performed for 6%, 12% and 20% cut-offs, with sub-analysis for obstructive (FEV_1/FVC < LLN) and non-obstructive groups. All data were tested for normality. Tests of difference between groups were performed using independent samples t-tests (continuous data) and chi-squared (categorical data). Correlations between variables were tested using Pearson's r.

Results

63 reversibility assessments were included. The number of positive reversibility cases doubled when the ≥6% cut-off was used instead of ≥12% change in FEV_1. In patients with obstructive baseline spirometry, small effect sizes were identified showing increased numbers of positive tests at the level of ≥12% and ≥20% change in FEV_1 (d=0.235 and 0.247, respectively), but not at the ≥6% cut-off level where the frequency of positive cases was similar between obstructive and non-obstructive groups. There was a small positive correlation between FeNO and %change in FEV_1 post-bronchodilator (r=0.34, p =0.04).

Discussion

Reversibility cut-off thresholds of ≥12% and ≥20% change in FEV_1 appear to be more closely linked with elevated FeNO and obstructive baseline spirometry when compared to the lower ≥6% change criteria. Further research is needed to explore whether the increased number of positive cases identified at ≥6% change in FEV_1 correspond with increasing clinical benefit.

References

1. Pellegrino et al. ERJ, 2005.
2. Sylvester et al. BMJ, 2020.

Table 1. Descriptive characteristics and pulmonary function results of patients in this study.

Measures	Whole cohort (n = 63)	Baseline FEV_1: FVC		p-values	Effect size
		Obstructive (n = 30)	Non-obstructive (n = 33)		
Males, n (%)	26.0 (41.3)	16 (53)	10 (30.3)	0.064	0.234 $^{\phi}$
Age, years (SD)	53.9 (16.9)	60.0 (15.2)	48.4 (16.8)	0.006 *	0.724 ^{d}
Oral steroids, n (%)	7 (11.1)	5 (16.7)	2 (6.1)	0.176	0.169 $^{\phi}$
FeNO (ppb)	37.5 (49.3)	51.8 (63.9)	24.7 (26.9)	0.101	0.552 ^{d}
Baseline FEV_1/FVC, % (± SD)	66.8 (15.2)	54.5 (11.9)	78.1 (6.7)	< 0.001 *	2.443 ^{d}
Baseline FEV_1, L (SD)	2.1 (0.9)	1.9 (0.9)	2.3 (0.9)	0.034 *	0.444 ^{d}
Baseline FVC, L (SD)	3.1 (1.1)	3.3 (1.2)	3.0 (1.0)	0.292	0.271 ^{d}
Post FEV_1, L (SD)	2.3 (1.0)	2.1 (1.0)	2.5 (0.8)	0.081	0.441 ^{d}
Post FVC, L (SD)	3.3 (1.2)	3.6 (1.3)	3.1 (1.0)	0.134	0.431 ^{d}
Δ FEV_1, % (SD)	11.3 (15.1)	13.3 (12.3)	9.5 (17.3)	0.318	0.253 ^{d}
Δ FVC, % (SD)	8.0 (13.0)	9.6 (6.8)	6.7 (16.3)	0.408	0.232 ^{d}
Δ FEV_1 ≥ 6%, n (%)	40 (63.5)	21 (70.0)	19 (57.6)	0.306	0.129 $^{\phi}$
Δ FEV_1 ≥ 100 mL, n (%)	43 (68.0)	21 (70.0)	22 (67.0)	0.777	0.036 $^{\phi}$
Δ FEV_1 ≥ 12%, n (%)	22 (34.9)	14 (46.7)	8 (24.2)	0.062	0.235 $^{\phi}$
Δ FEV_1 ≥ 200 mL, n (%)	27 (43.0)	14 (46.7)	13 (39.0)	0.560	0.073 $^{\phi}$
Δ FEV_1 ≥ 20%, n (%)	9 (14.3)	7 (23.3)	2 (6.1)	0.046 *	0.247 $^{\phi}$
Δ FEV_1 ≥ 400 mL, n (%)	9 (14.3)	7 (23.3)	2 (6.1)	0.046 *	0.247 $^{\phi}$

*Denotes statistical significance at an alpha level of $p < 0.05$. Effect sizes determined using phi (ϕ) for chi-squared and Cohen's d for t-tests. Cohens d = 0.2, 0.5 and 0.8 indicate small, medium, and large effect sizes, respectively. ϕ = 0.1, 0.3 and 0.5 indicate small, medium, and large effect sizes, respectively.

DIFFERENTIATING COPD AND ASTHMA USING ^{129}XE VENTILATION MRI, LUNG CLEARANCE INDEX, AND SPIROMETRY

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Background: Spirometry in asthma and/or chronic obstructive pulmonary disease (COPD) is nonspecific and insensitive to mild/early lung disease. ^{129}Xe ventilation MRI (V-MRI) and lung clearance index (LCI) assess ventilation heterogeneity and may aid diagnostic specificity.

Methods: Patients (pts) diagnosed with asthma, asthma+COPD, or COPD from primary care were assessed (NOVELTY study NCT02760329; ethics committee approved) with V-MRI, LCI, and spirometry on the same day and post bronchodilator.

From V-MRI, ventilation defect percentage (VDP; amount of non-ventilated lung), defect count and median coefficient of variation of signal intensity (CV; ventilation heterogeneity) were calculated.

Physician-assigned diagnosis groups were compared using Kruskal-Wallis analysis with Dunn's multiple comparison. Spearman's correlations were performed between metrics. A sub-analysis assessed pts with FEV_1 z score >-1.64. Data are expressed as median (IQR).

Results: Pts (n=160) with asthma+COPD and COPD had worse (P<0.05) forced expiratory volume in 1 second (FEV_1), FEV_1/forced vital capacity (FVC) z score, VDP, CV, and LCI than pts with asthma (***Table***). There was no difference between asthma+COPD and COPD, except in VDP (P=0.02). The asthma group had significantly more ventilation defects than the other groups, but they were smaller in volume. VDP, CV, and LCI correlated with both FEV_1/FVC and FEV_1 z-score.

78 pts with asthma, 37 with asthma+COPD, and 10 with COPD had FEV_1 z score ≥1.64. In these pts, VDP, CV, and LCI were significantly worse in the asthma+COPD (VDP, 6.5% [8.1]; CV, 15.9% [5.1]; LCI, 11.5 [3.9]) and COPD groups (VDP, 8.0% [11.2]; CV, 17.5% [2.2]; LCI, 11.3 [1.1]) vs the asthma group (VDP, 2.2% [16.9]; CV, 12.2% [6.0]; LCI, 9.5 [2.9]).

Conclusion: Patients with asthma had better lung function than patients with asthma+COPD and COPD. In patients with normal FEV_1, V-MRI and LCI were sensitive to mild/early disease and differentiated between disease groups.

Table. Patient demographics, lung function, and ^{129}Xe ventilation MRI metrics for the three diagnostic groups

	All patients	Asthma	Asthma+COPD	COPD
N	160 (83=F, 77=M)	82 (44=F, 38=M)	54 (22=F, 32=M)	24 (17=F, 7=M)
Age (years)	60.3 (20.75)	53.9 (±13.8)	63.2 (±10.4) ^	66.5 (±8.4)$^{\#}$
Height (cm)	168.2 (±10.2)	168.8 (±9.5)	170.0 (±10.4)	162.0 (±10.4)*$^{\#}$
Weight (kg)	80.7 (±17.4)	83.9 (±17.0)	81.4 (±17.4)	68.4 (±13.5)*$^{\#}$
FEV_1 z score	-0.6 (1.6)	-0.1 (1.4)	-1.3 (±1.2)$^{\wedge}$	-1.9 (±1.6)$^{\#}$
FVC z score	0.3 (0.76)	0.5 (±0.8)	0.05 (1.2)	0.1 (±1.3)
FEV_1/FVC z score	-1.5 (1.9)	-1.0 (1.4)	-2.3 (±1.3)$^{\wedge}$	-3.0 (±1.2)$^{\#}$
VDP (%)	4.4 (9.0)	2.2 (2.9)	8.1 (9.5)$^{\wedge}$	17.8 (±9.7)*$^{\#}$
Median CV (%)	14.8 (6.1)	12.3 (4.2)	17.3 (±4.0)$^{\wedge}$	20.5 (±4.1)$^{\#}$
Defect count	14.0 (10.0)	16 (7.0)	11.7 (±6.1)$^{\wedge}$	5.5 (8.5)$^{\#}$
LCI	10.7 (3.64)	9.5 (3.1)	12.3 (±2.8)$^{\wedge}$	12.5 (5.0)$^{\#}$

Data are given as mean (±SD) and median (IQR) unless otherwise specified. COPD, chronic obstructive pulmonary disorder; CV, coefficient of variation of signal intensity; F, female; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; IQR, interquartile range; LCI, lung clearance index; M, male; SD, standard deviation; VDP, ventilation defect percentage. $^{\#}$indicates significant difference (*P*<0.05) between asthma and COPD. $^{\wedge}$indicates significant difference between asthma+COPD and asthma.

RHEUMATOID ARTHRITIS AND ASSOCIATED RISK OF DEVELOPING IDIOPATHIC INTERSTITIAL LUNG DISEASE- THE PROGRESSIVE COMBINATION: A CASE REPORT

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Background

Rheumatoid arthritis (RA) is a systemic inflammatory disorder of the joints which is associated with significant lifetime risk of interstitial lung disease (ILD) development. There is a 10% prevalence of ILD in patients with RA, and the combination of these two morbidities escalates mortality rate. RA-ILD is uncurable, with only preventative medication available to slow the progression of symptoms. There are some concerns over treatment such as TNFα antagonist drugs which are given to RA patients and which may accelerate the pulmonary disease pathway.

Case presentation

A 71-year-old woman was transferred from another hospital to the trust. She has RA-ILD with a history of smoking over 20 years ago. Previous chest x-rays marked background changes in keeping with her diagnosis of ILD, which was known to be stable. Pulmonary function tests showed a restrictive pattern with TLco severely reduced, loss of gas exchange efficiency and alveolar volume. Medication prescribed for RA included 40mg Humira every 2 weeks for the past 2 years for her ankle pain. Doctors reviewing the patient clearly wrote she should not be using Humira but due to stable ILD continued with the treatment. A year on she had progressive symptoms of pain and inflammation linked to RA. Two years later she was admitted to hospital and had a CT pulmonary angiogram (CTPA) which demonstrated evidence of ILD progression. Lung function had declined further and results suggested an usual interstitial pneumonia (UIP) pattern. A bronchoscopy showed no fungal/atypical infections. Her C-reactive protein (CRP) and Erythrocyte sedimentation rate (ESR) were very high at 10 mg/l and 55 mm/hr respectively. O_2 therapy was prescribed and then revised after progressive breathlessness and saturation levels between 88-92% on 1 l/min O_2.

Conclusion

RA patients need to be monitored regularly, due to the associated risk of developing ILD. Once the patient is suspected to have RA-ILD, the NICE guidelines should be followed to diagnose the patient and a medication review should be conducted. Follow up lung function tests should be performed every 6 months to map progression. A review of treatment options should take place promptly if their condition starts to deteriorate.

Key words: Rheumatoid arthritis, Interstitial lung disease, TNFα antagonist

ARTIFICIAL INTELLIGENCE POWERED SPIROMETRY ENABLES EARLY DETECTION OF INTERSTITIAL LUNG DISEASE

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Rationale

Because diagnosing interstitial lung disease (ILD) is challenging, patients are often lately diagnosed. As current treatment options slow down the disease progression without curing it, earlier treatment may result in improved survival and quality of life. We investigate how an Artificial Intelligence (AI) algorithm can help practitioners to early diagnose ILD based on a spirometry measurement to allow patients having access to the best treatment.

Methods

From the UK Biobank dataset, 109 subjects were selected satisfying those inclusion criteria: 1- ILD as a cause of death, 2- acceptable spirometry seven years prior to death, 3- no ILD diagnosis prior to the spirometry.

The AI computer-aided diagnosis software (ArtiQ.PFT v1.3) takes spirometry data and demographic information (gender, age, height, weight, race, smoking status) as inputs to give a probability for several diagnosis (normal lung function, asthma, COPD, ILD, other obstructive disease, or unidentifiable respiratory disease (Topalovic, 2019)).

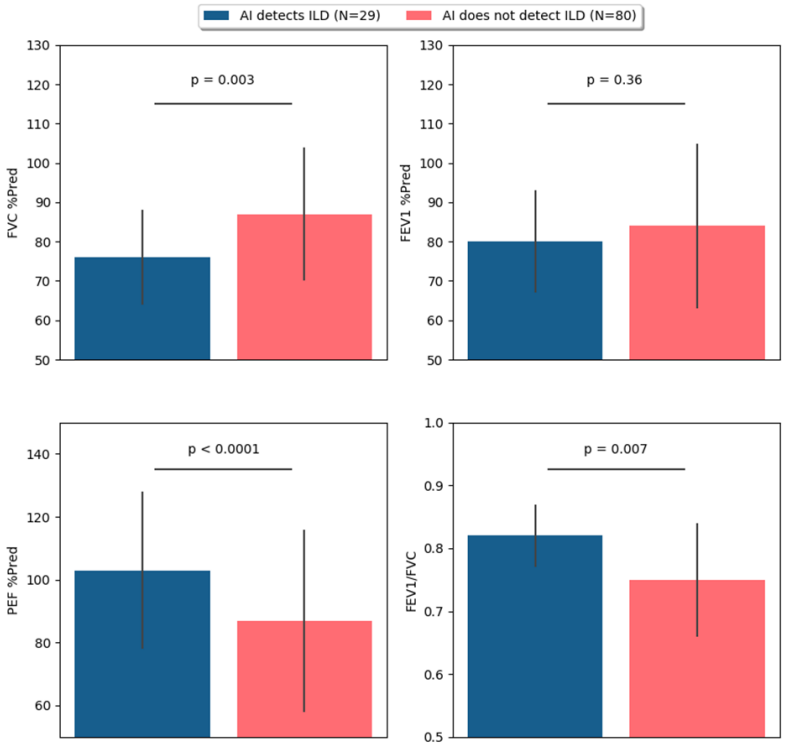
Results

The AI has detected ILD for 27% of subjects (N=29). According to the standard interpretation guidelines (Pellegrino, 2005), 66% (N=19) of these subjects have a normal spirometry. Three spirometry parameters are significantly different (>5%) in the group where AI identified ILD (Figure 1: FVC % pred 76±12 vs. 87±17 (p=0.003), PEF % pred 103±25 vs. 87±29 (p<0.0001) and FEV_1/FVC 0.82±0.05 vs. 0.75±0.09 (p=0.007)). Mortality and survival time are similar for both groups (4.1 years, range: 0.2–6.8 years).

Conclusion

AI software detected possible ILD up to 6.8 years prior to diagnosis by a clinician through standard care in 27% of patients who died because of ILD in the UK Biobank. Most of these subjects also exhibited normal lung function, suggesting that the AI software may detect ILD prior to standard spirometry interpretation. These results show that incorporating spirometry in primary care with AI-supported interpretation could lead to improving the diagnostic pathway for ILD.

Figure 1



A NATIONAL SURVEY OF THE UTILITY AND USEFULNESS OF PULSE OXIMETRY SPOT-CHECKS

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Introduction

Within our department pulse oximetry spot-checks are routinely performed for GP referrals and Pre-operative assessments. This abstract is to assess the clinical usefulness of this practice and understand how other departments perform these checks. If oxygen saturation (SpO_2) is ≤92%, capillary gas analysis is performed. We sought to review this practice within our own department and perform a survey within the ARTP community to compare practices and gather opinions on the utility of SpO_2 spot-checks.

Methods

All GP/Pre-operative referrals within our department over a 6 month period were screened. A total of 100 patients had SpO_2 data. Patients were between 22 and 90 years of age with a range of diagnoses.

A short survey was distributed by email within the ARTP community. The hospital Trust, job role, and Band of each responder was noted. The survey included questions relating to the use of spot-checks, performance of capillary gases in relation to an SpO_2 threshold, and the responder's general opinion on the usefulness of oximetry spot-checks.

Results

Out of the 100 patients included in our analysis, only one patient required a blood gas. This patient subsequently proceeded to a formal long-term oxygen therapy assessment.

Form our survey, a total of 88 responses were received from 64 different trusts. 5 of these were removed from final report due to incomplete data. Nearly all responders (93%) were Band 6 or above. The results of our survey are summarised in ***Figure 1***.

Conclusion

Oximetry spot-checks are widely used and the majority of Trusts perform them in every patient despite being considered only somewhat useful by most. General screening may help identify hypoxaemic patients but our data suggest these may be very few. This may be important to consider if departments are planning to purchase pulse oximeters for this purpose.

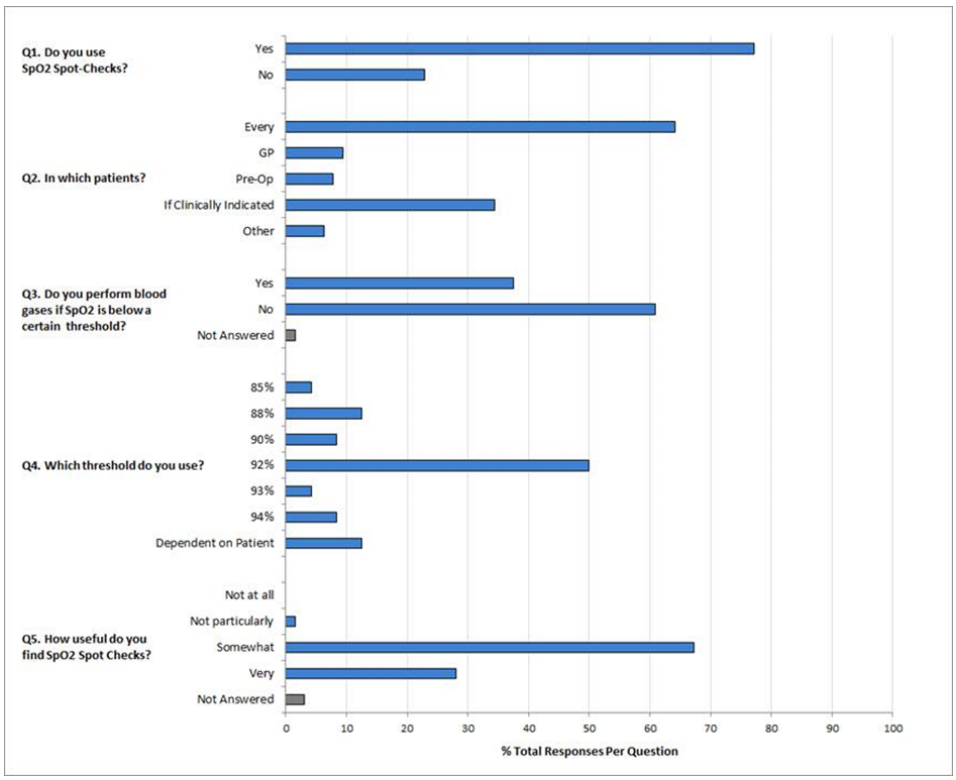

Figure 1: A summary of the findings from our pulse oximetry spot-check survey. The practice is widely used, although the majority of Trusts do not perform capillary gas analysis if pulse oximetry is suggestive of hypoxaemia. Spot-checks are generally considered somewhat useful, although a significant proportion consider them very useful. Results are displayed as a percentage of the total number of answers for each question.

RETROSPECTIVE REVIEW OF HOME OXYGEN PROVISION AND OUTCOMES FOR PATIENTS WITH COVID-19 REQUIRING SUPPLEMENTARY OXYGEN AT HOSPITAL DISCHARGE

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Introduction: COVID-19 infection can cause acute hypoxaemia. Hospitalised patients may continue to require supplementary oxygen at discharge generating a new cohort of patients for home oxygen services to manage. We reviewed the initial and ongoing requirement for home oxygen in patients discharged from a large tertiary hospital following COVID-19 infection.

Methods: Patients discharged with home oxygen following COVID-19 infection April 2020-June 2021 were included. Type (ambulatory, long-term, palliative) and flow rate of oxygen was reviewed. Home oxygen provision at 6, 12 and 24 weeks post-discharge was recorded. Characteristics of patients discharged with oxygen were compared with total population discharged following COVID-19 in the study period.

Results: Home oxygen was prescribed for 27 inpatients (1.2% of the cohort of COVID-19 inpatients, described in the table below): 10 long term oxygen therapy (LTOT; 0.5-4 L/min); 8 palliative oxygen therapy (1-15 L/min); 6 ambulatory oxygen (AOT; 1-4 L/min) 3 LTOT and AOT. After 24 weeks oxygen had been removed from 6 patients (22%) and 9 patients (33%) had died. Mean length of hospital stay (LOS) was greater in patients requiring oxygen at discharge compared to those who didn't and a higher proportion of patients requiring home oxygen had been admitted to Critical Care.

Conclusion: A relatively small proportion (1.2%) of hospitalised patients with COVID-19 required home oxygen at discharge. Ongoing oxygen requirement was associated with increased LOS and higher rates of admission to Critical Care. Home oxygen remained in place for the majority of surviving patients 24 weeks post-discharge. While COVID-19 infection rates may rise as restrictions are eased, new variants and vaccination have led to milder disease symptoms. Demand for home oxygen as a result of COVID-19 was relatively small at hospital discharge and we might reasonably expect there to be little increase in demand going forward.

	Patients discharged with home oxygen post COVID-19	All patients discharged post-COVID-19
	N = 27	N = 2283
Mean age (years)	71 (SD 12)	63 (SD 20)
Male sex	16 (59%)	1155 (51%)
Mean length of hospital stay (days)	34 (SD 19)	12 (SD 16)
Number requiring admission to Critical Care	10 (37%)	179 (8%)
Mean length of stay in Critical Care (days)	13 (SD 9)	11 (SD 12)

Table 1. Demographic, length of stay and critical care admissions of patients discharged from hospital following COVID-19 infection April 2020-June 2021. SD = standard deviation.

CAN PATIENT DEMOGRAPHICS AND PHYSIOLOGICAL PARAMETERS PREDICT THE REQUIREMENT FOR IN-FLIGHT SUPPLEMENTAL OXYGEN DETERMINED BY HYPOXIC CHALLENGE TESTING?

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Background: Commercial aircraft have a cabin pressure equivalent to an altitude of up to 8000 feet[1], reducing the partial pressure of inspired oxygen. Factors influencing altitude PaO_2 remain unknown, resulting in the potential requirement for hypoxic challenge testing (HCT) before flying.

Methods: This retrospective study assessed the correlation of demographical and physiological parameters to altitude PaO_2, measured via HCT. University of the West of England ethical approval and North Bristol NHS Trust approval was obtained for this study. Data of 97 adult patients with Interstitial Lung Disease (ILD) (41 females, 56 males) was analysed. Multiple regression analysis assessed the correlation of each parameter to altitude PaO_2. Forward selection and backward elimination analysis determined the most correlated parameters to altitude PaO_2.

Results: Multiple regression analysis demonstrated that bound oxygen and total oxygen content were most correlated to altitude PaO_2 ($p \leq 0.001$). However, multicollinearity was observed for these parameters (VIF > 5), which is explained by their physiological relationship. Forward selection analysis demonstrated the desaturation-distance ratio (DDR) index from a six minute walk test and sex were significantly correlated to altitude PaO_2 ($p < 0.05$). The DDR index is stated to be a better predictor of functional capacity[2] thus, would be of clinical significance when assessing in-flight supplemental oxygen requirements. Backward elimination analysis demonstrated bound oxygen content, total oxygen content and sex were significantly correlated to altitude PaO_2 ($p < 0.05$).

Conclusions: Total oxygen content, bound oxygen content, the DDR index and sex have potential roles in predicting altitude PaO_2 for patients with ILD. However, due to a small patient cohort and poor model fit for all analyses completed, HCT remains the gold standard.

References:

1. Ahmedzai et al. Thorax 2011; 66: 1-30.
2. Baldi et al. Clinical Science 2010; 65(9): 841-846.

Table 1: Table of key results from all analyses completed. Bound oxygen content, total oxygen content, the DDR index and sex parameters all showed significant correlation to altitude PaO_2 with p-values below a significance level of 0.05

Parameter	Coefficient	Standard error	T-value	*P*-value	Variance inflation
Bound oxygen content	-12.94	2.33	-5.55	≤0.001	2770.02
Total oxygen content	12.91	2.33	5.54	≤0.001	2764.50
DDR index	-2.55	1.03	-2.47	0.02	1.07
Sex	0.51	0.18	2.90	0.01	1.07

"WE CARRY THE VENTILATOR WITH US ANYWAY": LEARNING FROM A MODIFIED HYPOXIC CHALLENGE TEST IN CHILDREN AT RISK OF HYPOVENTILATION

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Introduction: In children at risk of hypoventilation, supplementary ventilation (SV) during air travel may be better physiologically and logistically than use of supplemental oxygen (O_2). This study assessed the feasibility of using modified hypoxic challenge testing (HCT) with this group, including SV and O_2 response. Participants were interviewed about their experience.

Methods: A body plethysmograph (***Figure 1***) was used in which ambient oxygen was decreased to simulate aircraft cabin cruising level ("in-flight"). Arterial oxygen saturation (SpO_2) and transcutaneous carbon dioxide ($TcCO_2$) were monitored during two stages, 'conventional', where O_2 was titrated for SpO_2, and 'modified', where SV was used, with O_2 introduced if required. Families were interviewed immediately post-test and by telephone 3-4 months later. Interviews were recorded and analysed thematically.

Results: Twenty children on nocturnal ventilation (mean age/years= 8.7; range 1.6-18.0) were studied, 10 with neuromuscular weakness and 10 central hypoventilation. In the conventional stage, 13 participants demonstrated desaturation below threshold (90%), indicating need for in-flight O_2. During the modified stage, 11 of these 13 participants maintained SpO_2>90%, with a lower $TcCO_2$ ($p<0.05$) by using their ventilator. Interview data revealed potential test difficulties including limited space for wheelchair users. Participants suggested improved pre-test information regarding temperature and duration, wider choice of seating and a computer tablet for distraction. Eight of the 20 had no experience of flying and the test increased confidence about flying. Those with prior air travel experience indicated it as challenging, particularly arranging aircraft O_2, although felt the inconvenience was outweighed by the benefits of travel experienced as a family.

Conclusion: Children with complex health needs can provide valuable information to respiratory function studies. Use of ventilatory support may improve travel opportunities for this population.

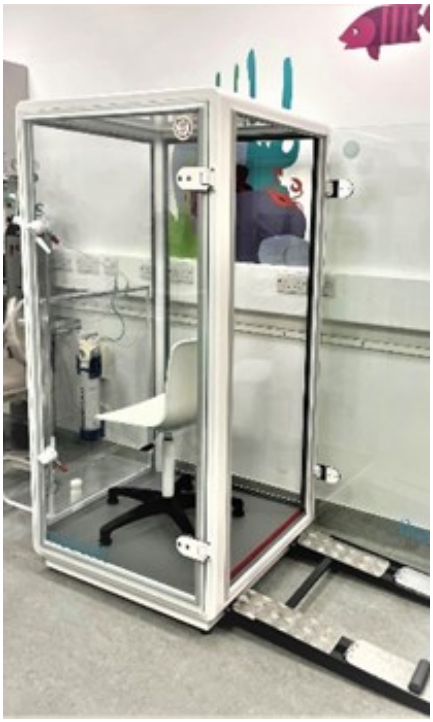

Figure 1. Wheelchair accessible plethysmograph

D-LACTATE ENCEPHALOPATHY AS A CAUSE OF ACUTE HYPERCAPNIC RESPIRATORY FAILURE

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Introduction: Acute hypercapnic respiratory failure (AHRF) is caused by an imbalance between respiratory capacity, load and drive. The most common cause is COPD exacerbation, with other indications including obesity, neuromuscular disease, chest wall disease, pneumonia and cardiogenic pulmonary oedema.

A 75yr lady with significant kyphosis and on long term TPN due to short gut syndrome was referred to the Acute Respiratory Care Unit by the Intestinal Failure team with AHRF. NIV was initiated within 60 minutes on a CWD protocol, and acidosis resolved within 6 hours, with NIV weaned with 48 hours. The lack of chronic bicarbonate retention was explained by a renal tubular acidosis, and was treated with supplementary intravenous HCO_3. However, thereafter she suffered repeated episodes of AHRF each associated with a decrease in GCS, and similarly managed with NIV.

Transcutaneous CO_2 monitoring was instituted and established that changes in GCS preceded the rise in $TcCO_2$ by > 2 minutes. Subsequently D-lactataemic encephalopathy was diagnosed.

D-lactic acidosis is a rare metabolic complication in humans. D-lactate is produced by bacteria in the colon if exposed to a high carbohydrate load. Humans lack D-lactate dehydrogenase and so it accumulates systemically. When production exceeds renal clearance, acidosis can occur. TPN feeding allowed for the delivery of this carbohydrate load – bypassing its usual area site of metabolism in the proximally GI tract. Serum D-lactate concentration can not be measured in most biochemistry laboratories.

In this case, empiric treatment was enacted; TPN was withheld and rifaximin treatment commenced, with subsequent clinical improvement and discontinuation of NIV.

Conclusion: Here, physiological monitoring facilitated the diagnosis of a treatable cause of respiratory failure. This case demonstrates the need for understanding of the load-capacity-drive paradigm, and the interplay of metabolic and ventilatory pathologies which may contribute to a clinical picture

	NIV →		Late deterioration	IV HCO_3	GCS drop 5/15
Date	26/01/22 11.30	26/01/22 15.50	29/01/22 09.00	03/02/22 15.20	04/02/22 23.00
pH	7.233	7.456	7.281	7.449	7.33
pCO_2	8.07	4.43	7.27	6.27	7.09
pO_2	6.85	8.35	9.01	7.80	7.13
HCO_3	22.3	24.2	23.4	31.1	30.5
Lactate	0.3	0.7	0.2	0.8	0.6

AUDIT OF GP PRACTICES UTILISING A COMMUNITY 'DRIVE THROUGH' ADULT SPIROMETRY SERVICE DURING THE COVID19 PANDEMIC

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Aim: Audit of GP practices utilising a community 'drive through' adult spirometry service during the COVID19 pandemic

Background: Following an Audit of GP surgeries performing spirometry in 2018, it was estimated that the area provided approximately 2000 spirometry tests per year. A pilot was commissioned by the CCG for the trust to provide community based spirometry service. The pilot started in one GP practice in July 2019, increased by January 2020 to 4 GP practices with the intention of rolling out to the remaining practices in April 2020. Unfortunately COVID19 suspended all community based spirometry services in March 2020. In July 2020 we looked at an alternative service and in Jan 2021, following many unforeseeable delays the 'Drive through' service was launched.

Method: Approval was obtained from the trust and CCG to commission the drive through spirometry service as a temporary option during the COVID19 pandemic. Portable spirometers were purchased and a portacabin with a canopy rented. The service was spirometry only and did not offer any reversibility testing. Appointment letters were generated with pre-test information and directions.

Results: The CCG has 33 GP practices divided into 7 PCN's (Primary Care Networks). All practices were commissioned to use the service. However 40 surgeries referred into the service with 7 being from outside of the CCG area accounting for 119 additional patients, this was likely due to the changeover to ICPs. 1251 appointment slots were booked in total, 897 (72%) attended, 143 (11%) failed to attend without notice and 212 (17%) cancelled.

The range of results from the spirometry can be seen in ***Figure 1***. They showed that 53% were within the normal range; however 19% were classed as restrictive which does appear to be on the high side; however these were performed pre-bronchodilator and therefore further testing was required.

Conclusion: The service provided a quick baseline spirometry service, however in many cases further investigations are required to confirm a diagnosis. The service has moved to within the hospital for an interim period until the community diagnostic hubs are opened, when it will revert back to testing with reversibility.

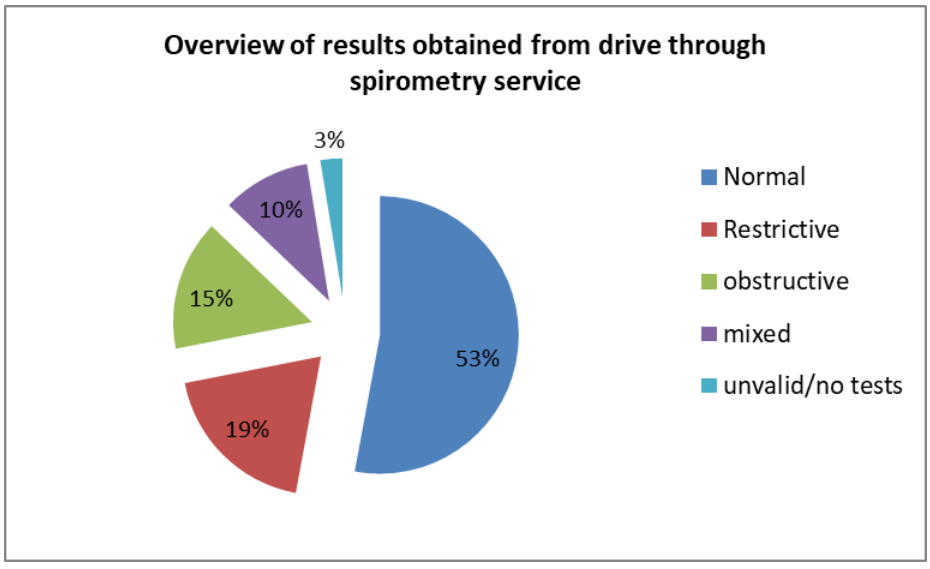

Figure 1: Overview of spirometry results

DIAGNOSTIC PATHWAY AND MANAGEMENT OF EXERCISE-INDUCED LARYNGEAL OBSTRUCTION IN A CHILDREN'S HOSPITAL

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Background: Exercise induced laryngeal obstruction (EILO) is a condition thought to affect 6-8% of the adolescent population. EILO has a higher prevalence in high-performance athletes. It can be wrongly diagnosed as Exercise-induced bronchospasm. It may be a more common and underreported cause of dyspnoea during exercise than currently thought.

Aims/Objectives: Our aim was to evaluate and present results from our diagnostic pathway when there is a query of EILO in children and adolescents.

Methods: Patients were referred from Ear Nose & Throat (ENT) or Respiratory clinics for investigation by our team, consisting of Respiratory Physiologists and ENT Surgeons. They underwent pulmonary function tests and cardiopulmonary exercise testing using an incremental protocol on a cycle ergometer. Subsequent to this, suitable patients underwent Continuous Laryngoscopy during high intensity exercise. EILO was confirmed if there was collapse of the supraglottic structures during exercise.

Results: 17 patients (8 female) with a mean age of 12.7 years have been investigated to date. 15 were performed successfully with two unable to tolerate the scope. Seven were found to have evidence of EILO and four have been offered surgical management. 15 of the patients referred were on treatment for asthma due to their reported symptoms. Only one of these had evidence of reversible airflow obstruction on baseline PFT's. One patient has had a supraglottoplasty so far and reported an improvement in her athletic performance.

Conclusion: Two of the main issues affecting the Paediatric population are mental health and obesity. Exercise has been shown to improve quality of life for patients suffering from either condition. EILO is an underreported cause for exercise induced dyspnoea which is reversible. We have shown this is often misdiagnosed and treated as asthma. In patients where asthma therapy does not improve symptoms, there should be a referral to a specialist centre for investigation of EILO.

AGGRESSIVE NONSPECIFIC INTERSTITIAL PNEUMONIA AND INFLAMMATORY/NECROTISING MYOSITIS SECONDARY TO ANTISYNTHETASE SYNDROME: A CASE REPORT

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Background: Antisynthetase syndrome (ASS) is a rare idiopathic autoimmune disease commonly featuring skeletal muscle degradation and interstitial lung disease (ILD)[1]. ASS is frequently misdiagnosed, with cases of secondary ILD advancing rapidly before detection leading to poor prognosis. There is a paucity of evidence -based guidance for the diagnosis and management of patients with ASS-driven ILD.

Case Presentation: A 52-year-old Caucasian female non-smoker with no comorbidities was hospitalised with severe fatigue, myalgia and dyspnoea two weeks post initial presentation with mild symptoms. Spirometry identified a significant restrictive defect and nonspecific interstitial pneumonia (NSIP) was confirmed with high-resolution computed tomography (HRCT). Serum creatine kinase (CK) levels were significantly elevated with anti-Jo1 positivity confirmed by myositis immunology panel. Electromyography, magnetic resonance imaging and muscle histology confirmed inflammatory myositis with necrotising components, forming an overall diagnosis of ASS with secondary NSIP and myositis. After stabilisation with intravenous methylprednisolone, pulmonary function tests revealed progressive loss of lung volumes and diffusion capacity (***Table 1***) indicating that the initial immunosuppressive regime of oral prednisolone and mycophenolate mofetil was insufficient despite several dose elevations. Rescue therapy of intravenous cyclophosphamide and methylprednisolone restabilised CK and C-reactive protein levels with improvements to alveolar perfusion and reduced ground-glass opacity but persistent basal fibrosis.

Conclusion: This case provides valuable evidence for the management of aggressive ILD secondary to ASS. Chest imaging and pulmonary function monitoring is critical as front-line corticosteroid and immunosuppressant maintenance regimes may be insufficient. Early diagnosis and collaboration between pulmonologists and rheumatologists is of critical importance.

References:

1. Witt, L. J., Curran, J. J. and Strek, M. E. (2016) 'The Diagnosis and Treatment of Antisynthetase Syndrome.' Clinical pulmonary medicine, 23(5) pp. 218-226.
2. Cooper, B. G., Stocks, J., Hall, G. L., Culver, B., Steenbruggen, I., Carter, K. W., Thompson, B. R., Graham, B. L., et al. (2017) 'The Global Lung Function Initiative (GLI) Network: bringing the world's respiratory reference values together.' Breathe (Sheff), 13(3), Sep, 2017/09/29, pp. e56-e64.
3. Hall, G. L., Filipow, N., Ruppel, G., Okitika, T., Thompson, B., Kirkby, J., Steenbruggen, I., Cooper, B. G., et al. (2021) 'Official ERS technical standard: Global Lung Function Initiative reference values for static lung volumes in individuals of European ancestry.' Eur Respir J, 57(3), Mar, 2021/03/13
4. Pellegrino, R., Viegi, G., Brusasco, V., Crapo, R. O., Burgos, F., Casaburi, R., Coates, A., van der Grinten, C. P., et al. (2005) 'Interpretative strategies for lung function tests.' Eur Respir J, 26(5), Nov, 2005/11/03, pp. 948-968.
5. Sylvester, K. P., Clayton, N., Cliff, I., Hepple, M., Kendrick, A., Kirkby, J., Miller, M., Moore, A., et al. (2020) 'ARTP statement on pulmonary function testing 2020.' BMJ Open Respir Res, 7 (1), Jul, 2020/07/08.

	21 days post discharge Value (% predicted/z score)	84 days post discharge Value (% predicted/z score)	136 days post discharge Value (% predicted/z score)	259 days post discharge (post rescue therapy) Value (% predicted/z score)
Resting SpO_2 (%)	-	95	96	96
SPIROMETRY				
PEF (L/sec)	4.79 (74/-1.66)	6.23 (105/0.33)	5.66 (95/-0.30)	5.40 (90/-0.63)
FEV_1 (L)	1.41 (56/-3.15)	1.47 (58/-2.95)	1.35 (54/-3.26)	1.26 (50/-3.52)
FVC (L)	1.62 (51/-3.69)	1.67 (53/-3.50)	1.50 (48/-3.95)	1.45 (46/-4.11)
FEV_1/FVC	0.87 (108/+1)	0.88(109/+1.09)	0.90 (112/+2)	0.87 (108/+1)
DIFFUSION				
TLco (mM/min/kPa)	-	4.00 (61/-3.07)	3.29 (50/-4.43)	3.91 (60/-3.28)
Kco (mM/min/kPa/L)	-	1.39 (68/-1.30)	1.33 (65/-1.43)	1.53 (75/-1.02)
VA (L)	-	2.88 (64/-3.33)	2.48 (55/-4.46)	2.56 (57/-4.29)
LUNG VOLUMES				
SVC (L)	-	-	-	1.49 (47/-4.01)
FRC (L)	-	-	-	1.46 (56/-2.23)
RV (L)	-	-	-	1.40 (82/-0.86)
TLC (L)	-	-	-	2.88 (62/-2.87)
RV/TLC	-	-	-	0.48 (131/+2)

FEV_1 = forced expiratory volume in the first second; FRC = functional residual capacity; FVC = forced vital capacity; K_{co} = carbon monoxide transfer coefficient; PEF = peak expiratory flow; RV = residual volume; SpO_2 = oxygen saturation; SVC = slow vital capacity; TLC = total lung capacity; TL_{co} = transfer capacity of carbon monoxide; VA = alveolar volume. Dashes indicate data unavailability.

Table 1 Pulmonary function test results over time. Severity grades of impairment to spirometry and lung volume parameters based on z-score (<-1.645 = mild impairment; <-2 = moderate; <-2.5 = moderately severe; <-3 = severe; <-4 = very severe)[5]. Severity of diffusion impairment was based on percentage of predicted value (80-120% = normal; 60–79% = mild impairment; 40–59% = moderate; <40% = severe)[4].Reference values derived from GLI[2,3].

RESPIRATORY MUSCLE WEAKNESS IN A PATIENT WITH GUILLAIN-BARRE SYNDROME AND A SIGNIFICANT CARDIOVASCULAR HISTORY – A SINGLE CASE REPORT

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Background: Guillain-Barre Syndrome (GBS) is an autoimmune disease[1] that can lead to significant respiratory muscle weakness and subsequent lung function impairment in a subset of patients[2].

Case presentation: A male in his 70s with a prior history of hypertension, left ventricular hypertrophy and hospital admissions with PEs. Initially, the patient was admitted to hospital with multiple PEs and pneumonia following hip surgery; requiring three weeks on a high-dependency unit with ventilatory support.

The patient reported continued shortness of breath on exertion (SOBOE) following discharge but subsequent pulmonary function tests (PFTs) did not identify any significant abnormalities. Computed Tomography Pulmonary Angiogram (CTPA) also showed no evidence of chronic thromboembolic disease or significant ECG findings.

The patient was again admitted to A&E in April 2019 with SOB and upon investigation showed rapidly declining vital capacity (VC) on consecutive days (1.86L; 1.56L; 1.03L respectively) and was treated with a course of intravenous immunoglobulins for suspected GBS. PFTs in November 2020 (delayed due to COVID-19) revealed restrictive spirometry with gas transfer approaching the lower limit of normal (VC 2.86; TLCO 6.9). PFTs were repeated in February and March 2021: despite variable technique, there was a consistent reduction in maximal inspiratory and expiratory pressures suggesting respiratory muscle weakness (***Table 1***). Of note, peak expiratory flow (PEF) was still normal in contrast to other muscle weakness studies[3] and only reduced upon repeat testing 6 months later. Despite significant symptomatic burden, chest investigations remained relatively stable over time. A subsequent home polygraphy sleep study indicated severe obstructive sleep apnoea (AHI of 47) and nocturnal hypoventilation as suggested by low SpO_2 throughout the study and evidence of mild T2RF on a morning blood gas (pO_2 8.56kPa; pCO_2 6.42kPa). Decision not to treat with NIV or CPAP due to lack of efficacy.

Conclusions: This case highlights the potential increased risk of poor long-term outcomes for patients diagnosed with GBS, especially those with a significant cardiovascular history. It also suggests the potential impact of pulmonary embolisms exacerbating respiratory symptoms in these patients.

References:

1. Pritchard, J. & Hughes, R. A. C. Guillain-Barré syndrome. Lancet 363, 2186–2188 (2004).
2. Fokke, C. et al. Diagnosis of Guillain-Barré syndrome and validation of Brighton criteria. Brain 137, 33–43 (2014).
3. Suárez, A. A. et al. Peak flow and peak cough flow in the evaluation of expiratory muscle weakness and bulbar impairment in patients with neuromuscular disease. Am. J. Phys. Med. Rehabil. 81, 506–511 (2002).

Table 1: Results of maximal inspiratory and expiratory pressures

Date	MIP Peak (kPa)	MEP Peak (kPa)
Reference value	*7.93*	*12.85*
February 2021	3.38	2.76
March 2021	3.23	2.63

Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP) results show the peak pressure reached during the test measured in kilopascals (kPa).

A COMPARISON OF C-CHECK FIXED PRESSURE AND AUTO-TITRATING CPAP ON OSA THERAPY MANAGEMENT

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Introduction: CPAP therapy has been a well-established treatment method for management of Obstructive Sleep Apnoea (OSA) since its first inception in the early 1980s. The relative merits and limitations of fixed pressure and auto-titrating CPAP (APAP) have been widely debated. The new NICE guidelines published in 2021[1] recommend fixed pressure as the preferred CPAP option. C-Check is a mode of CPAP available on Philips Respironics devices which will allow the device to automatically adjust the fixed pressure by ± 3cmH_2O dependent on the level of control. The aim of this study was to compare the effectiveness of the C-Check mode against APAP on AHI control, mask leak and patient compliance.

Methods: In this non-blind study, we compared 55 patients (Males= 39) on an average of 20-days APAP and 31-days C-Check fixed pressure CPAP. The mean diagnostic AHI (31.91/hr ± 3.10) and ODI (29.01/hr ± 2.77), with a mean age (Age = 53 years, range 24-73). Patients were set up on an A-trial – a mode whereby patients complete a set time on APAP and the machine then flips to C-Check modes using the 90% pressure to set the C-Check pressure. All patients were new to CPAP therapy and were followed up remotely with telephone reviews, as well as additional face to face appointments as required.

Results: The results are shown in ***Table 1***. AHI was significantly lower with C-Check compared to APAP (P=0.007). No significant difference was seen in the other variable.

Conclusion: C-Check mode appears to provide better AHI control compared to APAP, with no difference in compliance, length of use or control of mask leak, suggesting, in these patients at least, that C-Check provides a sufficient control of OSA without compromising patient usage and compliance. This supports recent NICE guidelines for the use of fixed CPAP for treating OSA. However, patients with significant postural differences in AHI or very severe OSA were excluded from the study.

Reference:

1. Obstructive sleep apnoea/hypopnoea syndrome and obesity hypoventilation syndrome in over 16s. NICE guidelines (2021)

	% Usage	% Compliance	Average time used minutes	Average Leak L/min.	Average AHI ev/hr	APAP 90% pressure cmH_2O	C-check Pressure cmH_2O
C-Check	89.61 ± 2.18	73.65 ± 3.63	349.90 ± 13.59	5.76 ± 1.37	**2.97 ± 0.32***	NA	11.88 ± 0.41
APAP	93.98 ± 1.72	76.79 ± 3.23	351.28 ± 16.38	7.66 ± 1.67	**4.98 ± 0.64***	11.91±0.42	NA

Table 1. Mean ± SE C-check v APAP *

HOW ACCURATE ARE EQUATIONS FOR CALCULATING A FIXED PRESSURE PRESCRIPTION IN CPAP THERAPY?

Ms Rachael Leach[1], Mrs Sara Parsons[1]
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Introduction: The current supply shortage of CPAP machines has had a significant impact on all respiratory sleep centres across the UK[1]. As such, sleep centres are currently being advised to employ the clinical risk stratification tool published by BTS in 2021[2] when triaging patients requiring CPAP and BiPAP therapy.

Prior to 2020, our service routinely used auto-adaptive CPAPs in the C-Check mode (+/- 3cmH_2O). The prescription could be manually changed by a qualified physiologist at the patients' face-to-face follow up appointments depending on symptom control, AHI level, and comfort. Due to the short supply and unpredictable delivery of auto-adapting CPAPs the service was required to use fixed pressure devices. This resulted in a change in the service protocol to determine the fixed pressure required to treat the patient. As we did not have the inpatient facilities to manually titrate the settings, the pressure prescription was determined using an algorithm derived from the patients' neck circumference and OSA (obstructive sleep apnoea) severity[4]. But how accurate is this method in achieving optimal treatment in CPAP therapy?

Methods: Between mid-September 2021 and mid-January 2022, 96 CPAP devices were issued to patients with OSA. Using remote monitoring, follow-up appointments were conducted via telephone consultation. Patients who met the anecdotal minimum compliance rate of 70%, averaging 4 hours usage per night[3], were included in the comparative analysis. The results are displayed in ***Table 1***.

Results: The prescription of the fixed pressure devices ranged from 6.0cmH_2O to 13.4cmH_2O. The minimum pressure of the auto adaptive CPAPs ranged from 4.0cmH_2O to 10.0cmH_2O, and the maximum pressure ranged from 13.0cmH_2O to 20.0cmH_2O.

Conclusion: The data demonstrates that auto-adaptive CPAPs are more reliable at normalising the AHI, however, with a success rate of 81%, the data also demonstrates that, when required, an equation can be used as a substitution for manual titration.

References:

1. British Sleep Society (2022) UK CPAP delays for OSA treatment – survey results 9th February 2022. Available at: https://www.sleepsociety.org.uk/uk-cpap-delays-for-osa-treatment-survey-results-9th-february-2022/ (Accessed: 09 March 2022).
2. British Thoracic Society (2021) National Patient Safety Alert: Philips Ventilator, CPAP And BiPAP Devices. Available at: https://www.brit-thoracic.org.uk/news/2021/national-patient-safety-alert/ (Accessed: 09 March 2022).
3. National Institute for Health and Care Excellence (2021) Obstructive Sleep Apnoea/Hypopnea Syndrome and Obesity Hypoventilation Syndrome in Over 16s. Available at: https://www.nice.org.uk/guidance/ng202/evidence/n-adherence-pdf-331360008664 (Accessed 10 March 2022).
4. Stradling, J.R., Hardinge, M., Paxton, J., Smith, D.M. (2004) 'Relative Accuracy of Algorithm-Based Prescription of Nasal CPAP In OSA'. Respiratory Medicine. 98(2), pp. 152-154. Available at: https://doi.org/10.1016/j.rmed.2003.09.009 (Accessed: 09 March 2022).

	Auto-Adaptive CPAP	Fixed Pressure CPAP
Total Number of Patients	30	27
Male: Female	19:11	20:7
Mean age (years)	52	41
Mean pressure (cmH20)	10.6	8.7
Number of patients with an AHI<5/hr at F/U	27	22
Success rate (%)	90	81
Mean AHI if AHI>5/hr	6.8	12.7

Table 1. Data displaying the success rate of achieving an AHI≤5 with auto-adapting and fixed CPAP devices.

CONTINUOUS POSITIVE AIRWAY PRESSURE FOR OBSTRUCTIVE SLEEP APNOEA: SUPPORTING ADHERENCE USING TELEMEDICINE

Mr Edward James-Morley[1,2], Mrs Claire Wood[1], Mrs Tracey Fleming[1], Dr Kai Lee[1,3], Prof Sonia Corrêa-Müller[2]
[1]King's College Hospital Nhs Foundation Trust, London, United Kingdom, [2]Manchester Metropolitan University, Manchester, United Kingdom, [3]King's College London, London, United Kingdom

Introduction: Obstructive sleep apnoea (OSA) is a sleep breathing disorder that can carry a significant symptom burden and insidious consequences to life, productivity and society[1]. Success of the primary therapy, continuous positive airway pressure (CPAP), relies on regular usage[2]. However, CPAP can be onerous and entail lengthy acclimatisation, leading many to struggle with treatment adherence. Telemedicine (TM) may provide an avenue to improve and streamline CPAP adherence. This study assessed differences in CPAP treatment indices with the use of TM.

Aim: To compare CPAP adherence, CPAP therapy efficacy and practitioner time between standard care (SC) and TM pathways for CPAP treatment.

Method: Retrospective single-centre observational study examining CPAP treatment in two OSA groups: SC and TM. Measurements included adherence to CPAP therapy at several timepoints up to 1 year post CPAP set-up, contact time with CPAP practitioners and treatment efficacy. Mann Whitney U and Chi-square tests were used for groupwise comparisons.

Result: 272 patients (30% female) were evenly split into SC and TM groups. Measures of CPAP adherence largely did not differ significantly between groups. Median contact time (cumulative over a 1-year period) was 140 minutes with TM and 130 minutes with SC, which was not statistically significantly different (p=0.431). There was no statistically significant difference in treatment efficacy between groups: median change in Epworth sleepiness score with CPAP treatment in TM was -5.0 and -5.5 in SC (p=0.944).

Conclusion: TM achieved comparable CPAP adherence and management of excessive daytime sleepiness in OSA to SC in a similar amount of time. Isolated differences in CPAP adherence indices may suggest early potential for TM. Further work would be useful to improve the understanding of different TM protocols in more populations.

References:

1. Gottlieb DJ & Punjabi NM. JAMA 2020; 323(14): 1389-1400.
2. Weaver TE et al. Sleep 2007; 30(6): 711-719

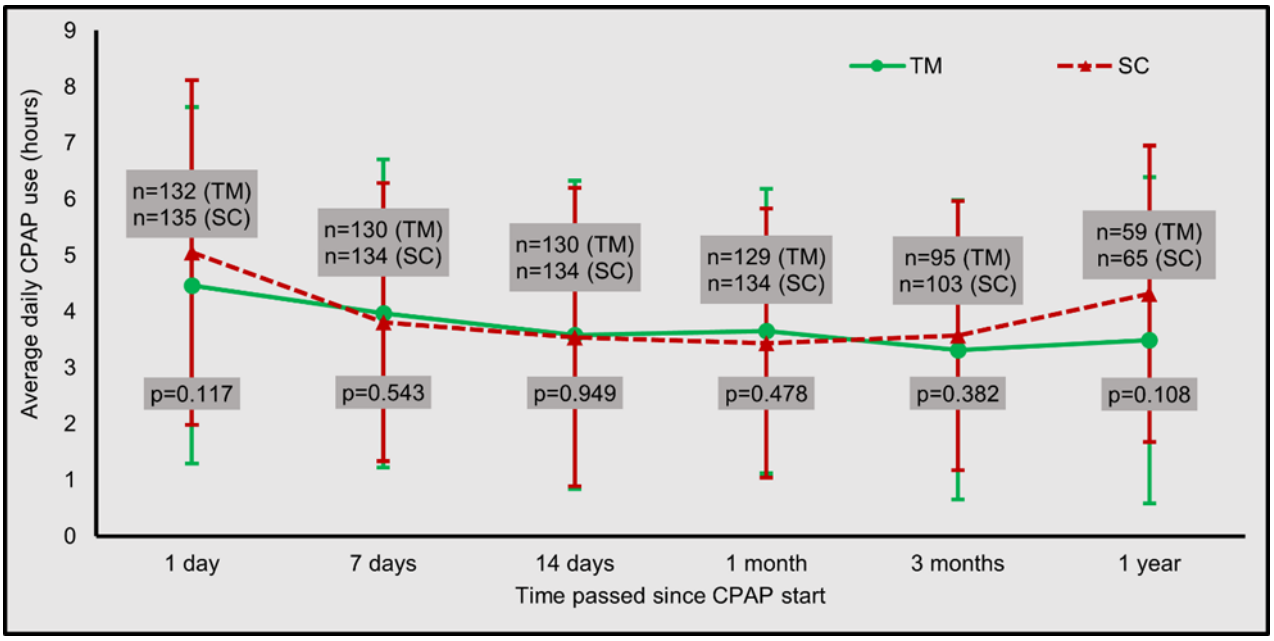

Figure 1. Average daily CPAP hours after CPAP initiation (mean ± standard deviation)

DEVELOPING A VIRTUAL SLEEP CLINIC PATHWAY

Mrs Marie Belcher[1], Dr Aravind Ponnuswamy
[1]*Countess Of Chester Nhs Trust, Chester, United Kingdom*

Aim: To develop the current sleep service pathway from GP referral to outcome post diagnostics, therefore improving the patient experience.

Method: Due to increasing waitlists and pressures on diagnostic and consultant appointments following COVID 19 the sleep pathway was reviewed with the aim of reducing patient visits to the hospital and avoiding long delays in relaying the results back to the patient. Previously the patient would see a consultant prior to any diagnostics being requested. It was decided that this visit could be omitted and the patient sent straight for diagnostics following triage. Currently the first line diagnostics used for screening of obstructive sleep apnoea (OSA) is overnight oximetry (ONO). Alongside this appointment the patient is issued a sleep questionnaire comprised of 4 screening questionnaires (ESS, STOPBANG, Swiss Narcolepsy Score and RBD screening questionnaire) plus lifestyle questions, The questionnaire is used in conjunction with the ONO at the virtual clinic when deciding the next patient pathway, omitting the second consultant appointment, The 2021 NICE guidelines for OSA are used to review the results. The virtual clinics are held on a monthly basis and all ONO tests undertaken that month are reviewed by the lead physiologist and sleep consultant. Example pathways below, in ***Figure 1***.

Results: During 2021, 408 ONO results were reviewed in the virtual sleep clinic, from these 111 (27%) were referred straight to CPAP, 155 (38%) required further investigation and sent for limited sleep study and 50 (12%) discharged back to the referrer. 33 of the tests were for review to check response to therapy or update following weight loss. The remainder of tests were for patients already under consultant care or not for assessment of OSA

Conclusion: The new pathway has allowed the reduction of at least one and in some cases two patient hospital visits, without compromising care, this also feeds into the Trust's green policy to reduce the carbon footprint. The new pathway has furthermore eliminated the potential for missed results when returned to different disciplines to review in clinic and reduced wait times. As all results are observed this omits any missed diagnosis and they are referred to the relevant pathway

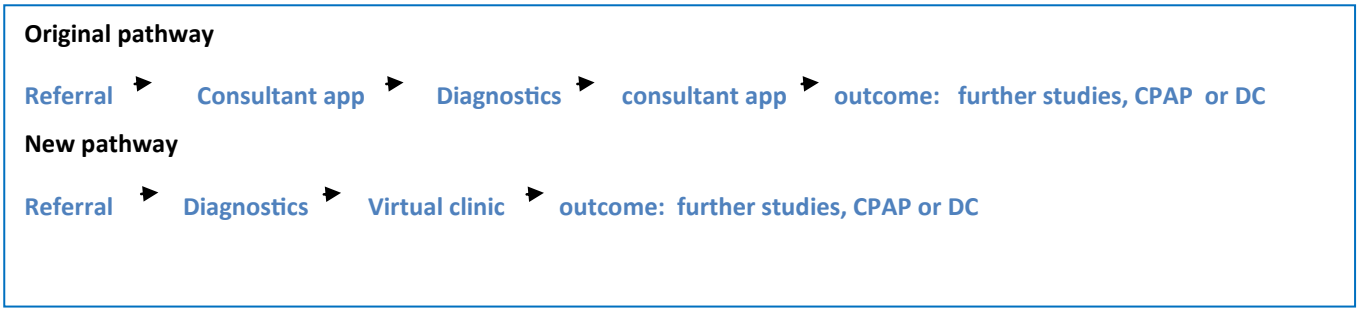

Figure 1. Example pathways for sleep service

THE IMPLEMENTATION OF AN ACUTE VENTILATION PRACTITIONER (AVP) ROLE WITHIN A NEWLY ESTABLISHED ACUTE RESPIRATORY CARE UNIT (ARCU)

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Introduction: The 2017 NCEPOD review of acute non-invasive ventilation (NIV) documented the poor quality of care provided to patients in acute hypercapnic respiratory failure. In the 2019 BTS audit our Trust performed poorly in quality domain '*NIV within 60mins of blood gas*' (38%), and length of hospital stay was longer than the national average (11 days vs 9 days). We hypothesised that an on-call specialist practitioner highly skilled in NIV provision would decrease the delay in NIV initiation. Secondary aims included increased proportion of NIV prescription prior to initiation, and decreased length of hospital stay.

Methods: A care model (***Figure 1***) was devised in which an 'outreach' acute ventilation team (AVT) would provide on-call urgent care assistance at the bedside within 15 minutes of referral, and support initial management of the patient and initiation of NIV prior to transfer to ARCU. The AVT was physiology led, comprising respiratory physiologists, clinical scientists and clinical nurse specialists. The team operated 8am-8pm weekdays and 9am-4pm at weekends. A referral pathway was designed and NIV (device and theory) and capillary blood gas (CBG) training was provided to all senior ward nursing staff.

The ARCU pathway was implemented for a fixed term; 24th January to 31st March 2022.

Results: To date, 15 patients have passed through the pathway. The number of patients who received NIV within 60 minutes of an appropriate blood gas was 13 (86%, median 49 mins). The number of patients that had NIV prescribed was 14 (93%). Median hospital length of stay was 7 days.

Conclusion: The establishment of an AVP role led to a decrease in the time from blood gas analysis to NIV initiation. The AVP was directly involved in implementing the quality standards outlined in the BTS statement[1] and likely contributed to a decreased length of stay.

References:

1. Davies M, Allen M, Bentley A, et al. British Thoracic Society Quality Standards for acute non-invasive ventilation in adults. BMJ Open Resp Res 2018;5:e000283. doi:10.1136/ bmjresp-2018-000283

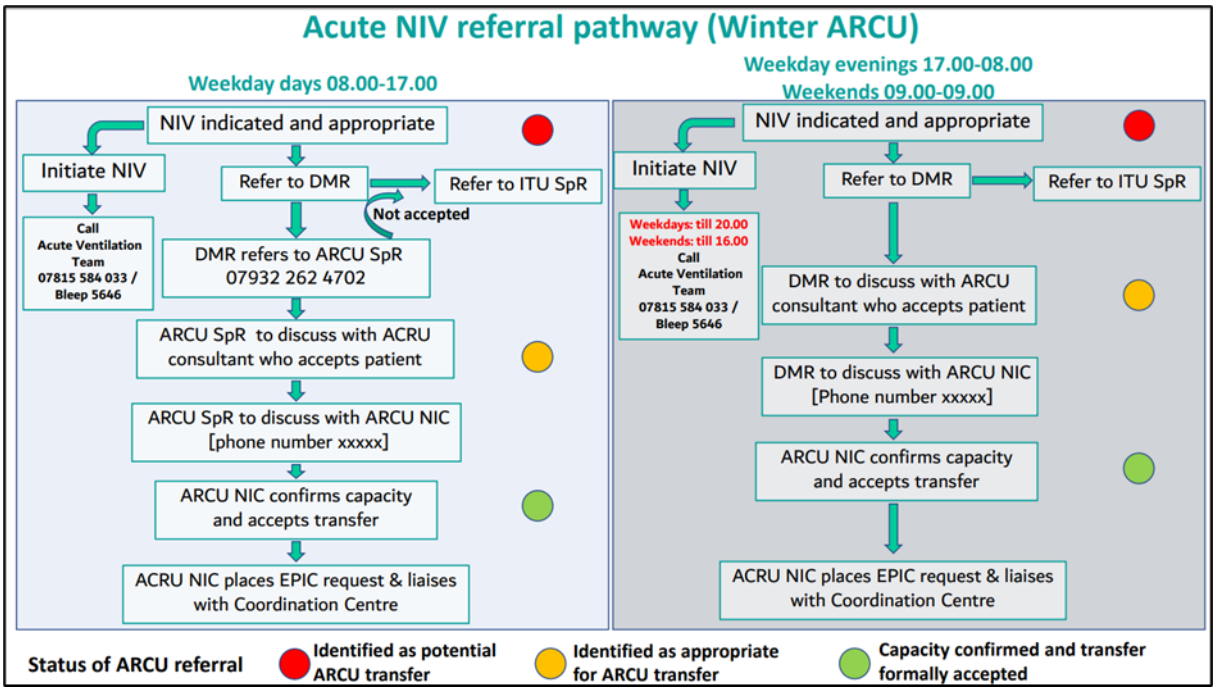

Figure 1. Acute NIV referral pathway detailing the AVT role

PAEDIATRIC HOME SLEEP APNOEA TESTING: SERVICE AUDIT

Mr Matthew Davies[1], Mr Aidan Laverty[1]
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Background: Home Sleep Apnoea Testing (HSAT) for the diagnosis of Obstructive Sleep Apnoea (OSA) in children has recently gained momentum. Technical quality of HSAT is paramount to interpretability, with published data indicating wide variation in quality (46-87%[1,2]). This audit aimed to assess the technical quality of HSATs performed at our Paediatric Trust.

Standards: HSAT was performed in line with published American Academy of Sleep Medicine (AASM) standards[3]. Referral criteria specify non-syndromic children (2-17yrs) with clinical suspicion of OSA. In-laboratory quality standards were implemented to assess interpretability of each study. Minimum requirements were: total sleep time (TST) ≥ 4hrs, artefact-free SpO_2 recording for ≥ 4hrs of TST, and signals required to score respiratory events (nasal flow and/or respiratory effort bands) for ≥ 4hrs of TST. Target interpretability score is ≥ 75%.

Methods: All consecutively recorded HSATs between 03/12/2019-01/03/2022 were retrospectively evaluated for meeting referral criteria and their interpretability.

Results: 97 HSATs were performed. Mean age 7.7 ± 4.3yrs (59% male). 80% of HSATs performed met referral criteria. Total interpretability was 76.3% with only a small difference identified between those performed on patients meeting referral criteria and those not (76.9% vs 73.7% respectively). Primary causes of uninterpretable studies were: intolerance of all sensors (26.1%), absence of SpO_2 (26.1%), and insufficient signals required to score respiratory events (34.8%).

Conclusion: Interpretability score met our predefined target. Majority of HSATs were performed in patients meeting referral criteria. Recommendations to address uninterpretable HSATs include: improved parental teaching, modify SpO2 sensor attachment policy, and implement psychosocial support techniques.

References:

1. Gudnadottir, G. et al. Respiratory polygraphy in children with sleep-disordered breathing. Journal of sleep research 2019; 28(6), p.e12856
2. Michelet, M. et al. Successful home respiratory polygraphy to investigate sleep-disordered breathing in children. Sleep Medicine 2020; 68, pp.146-152
3. Berry, R.B. et al. The AASM manual for the scoring of sleep and associated events: rules, terminology and technical specifications, version 2.6.0. American Academy of Sleep Medicine, Darien, Illinois; 2020.

ASSESSING THE IMPACT OF GLI TLCO 2020 ON A PAEDIATRIC POPULATION

Mrs Emma Fettes[1], Ms Mollie Riley[1], Mr Benjamin Griffiths[1], Mr Aidan Laverty[1], Dr Paul Aurora[1]
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Introduction: In September 2020 the Global Lung Function Initiative (GLI) recalculated their carbon monoxide (CO) transfer factor reference values because exceptionally low calculated z-scores were found in females with low TLco values using GLI 2017[1]. GLI advised the difference in the recalculated values applied primarily to adult females[1]. Errors in reference values could lead to incorrect interpretation so corrective action was required, changes communicated and the impact on previously reported results assessed. Our aim was to audit the difference in our paediatric population.

Methods: All CO transfer factor results originally reported at our Trust using GLI 2017 (01/03/20-29/12/21) from patients (aged 5-18 years) were recalculated using GLI 2020. Bland-Altman plots were used to quantify agreement between the two variables and mean differences calculated in Microsoft Excel.

Results: 443 results were recalculated, 58% female, mean (SD) age 12.8 (2.8) yrs. The difference between the calculated reference values (GLI 2020-2017) for TLco z-score was mean (SD) 0.00 (0.19)z and for TLco % predicted(%pred) -0.56 (2.23)%. For females only TLco z-score; mean (SD) 0.02 (0.24)z and TLco %pred -0.65 (2.86)%. 12/443 patients (2.7%) were identified as having a change move them in or out of the normal range (-1.64 z-score). 10/12 were female, mean age 14.3 (range 10–17) yrs. 3/12 had an improvement in z-score, all 12 had Kco in the normal range using both GLI 2017 and 2020. ***Figure 1***.

Conclusion: These paediatric setting results found mean %pred change in females similar to that reported for adult females[1]. Although mean TLco z-score was 0.02, Bland-Altman shows individual differences up to 0.85z, highlighting the need to recalculate previous data for correct longitudinal tracking. This audit has been circulated to referring clinicians including flagging patients where classification in the normal range changed.

References:

1. Stanojevic, S et al. European Respiratory Journal 2020 56: 1750010; DOI: 10.1183/13993003.50010-2017

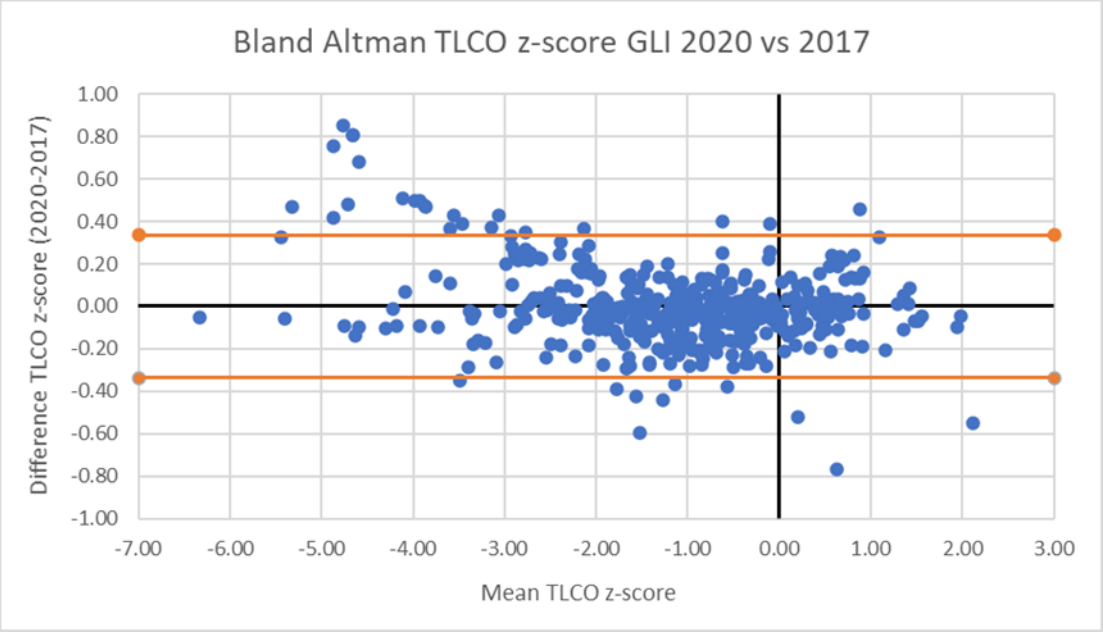

Figure 1. Bland Altman TLCO z-score, orange lines represent +/-2SD (7% outside, all female)

MONITORING PATIENTS WITH COVID-19 IN THE HOME. AN EXPERIENCE OF PROVIDING 24HR ACCESS TO PULSE OXIMETRY AND SYMPTOM MONITORING

Mr. Peter Coss[1], Dr. Parthiban Nadarajan[1], Dr Ciaran Bannan[1], Prof Anne Marie Mc Laughlin[1]
[1]*St. James's Hospital, James's Street,, Ireland*

Introduction: COVID-19 has had a significant impact on healthcare systems worldwide, placing a tremendous burden on hospital bed capacity. In certain countries it has overwhelmed the entire healthcare system, contributing to significant mortality rates. We developed an alternative digital pathway to support patients with COVID-19 in the home through 24hr access to pulse oximetry and symptom monitoring. Our new patient pathway achieved integration of a digital solution (the HSE's remote oximetry monitoring platform) with a consultant-led virtual ward to achieve safe patient care and monitoring away from the hospital.

Objectives: To develop a new digital pathway to support patients with COVID-19 in the home. We developed a Standard Operating Procedure (SOP) to ensure we achieved this safely through the coupling of a smartphone-based monitoring app with a virtual ward. We aimed to safely and continuously monitor patients suitable for '*early hospital discharge*'. Additionally, patients or hospital staff where an admission could be avoided could be enrolled and those showing signs of deterioration readily identified for escalation of care.

Implementation, Tactics and Strategy: We assembled a large MDT group to develop and support our solution over several iterations. The MDT included Consultant leadership from Respiratory Medicine, Infection Medicine and Occupational Health, further supported by staff from Respiratory Physiology; Nursing; Management and IT including: Chief Clinical Information Office; Director of Informatics and Engagement and Delivery Lead. The SOP ensured a standardised approach to safe management of patients on the pathway. The SOP included inclusion and exclusion criteria, and medium to high level instructions documenting specific tasks such as: patient selection; a patient information leaflet; consent; monitoring and procedures for managing patient alerts (low oxygen levels) plus escalation of care. MDT member roles and responsibilities were clearly identified.

Critical Success Factors underpinning this pathway included:

1. Innovation: Use of a new digital health solution. The 'patientMpower' COVID-19 phone app combined with Bluetooth oximeter enabled patients with COVID-19 to be monitored away from the hospital.
2. Stakeholder involvement: The assembly of a large MDT.
3. Data and Information: St. James's hospital was Ireland's first to implement an electronic patient record (EPR), facilitating a safer assessment of patients on a virtual ward as there was access to digital health data.
4. Well-defined work streams: The SOP provided for 24hr monitoring facilitated by Respiratory Physiology Staff., who used a phone to monitor scheduled check-ins, receive patient alerts and, where indicated, to escalate care to the Consultant on call (24/7).
5. Leadership: Hospital consultants, management, finance, nursing, allied health and IT.

Outcomes: On March 9th 2020, the office of Digital Transformation and Open Innovation at the Health Service Executive (HSE) announced the new digital solution for the remote oxygen and symptom monitoring of patients with COVID-19. St. James's Hospital immediately set out to implement this solution and assembled an MDT to work on the new pathway. The first patient consented and enrolled to the monitoring dashboard just 4 days later, on March 13, at 6:28pm, thus demonstrating the rapid response and success of the implementation strategy deployed. By July 2021, 240 patients and staff with COVID-19 were successfully registered and managed on the dashboard for an average of 14 days per patient. The patients were reviewed twice daily with scheduled check-ins at 10am and 4pm and invited to check-in anytime outside of these hours if feeling unwell. During this period the system generated 415 alerts/alarms (oxygen level <=92%). Those persistently hypoxic were referred to the on-call consultant call for initial telephone review. The service demand tracked the community disease prevalence while the service was furloughed in the period between May and August 2020. A surge of cases in January saw a peak in users added to the dashboard, the highest volume of alerts processed during the pandemic and more frequent MDT meetings, when a contingency for a physical triage area in the hospital was proposed (to receive patients for physical assessment by the Consultant on-call safely away from other emergency department patients if required). As the wave abated, this pathway was stood down. Detailed analysis of the first 71 patients enrolled showed readmission rate to hospital of 4.2%[1] and no deaths recorded. Average initial length of hospital stay was 1.9 days and average number of consultant phone calls to patients was 1.1 calls per patient.

Summary: A rapid response MDT group developed a robust new digital pathway for monitoring and assessment of patients at home with COVID-19. As an early discharge pathway it is a safe discharge option that significantly reduces hospital length of stay, thus helping to protect the healthcare system during this pandemic.

Reference:

Nadarajan et al. CoViD-19 at home: A Safety Study for the Remote Home Monitoring of Patients with Novel SARS-CoV-2. Irish Thoracic Society Annual Scientific Meeting 2020. (2021). Irish journal of medical science, 190 (Suppl 1), 1–60

A RETROSPECTIVE AUDIT TO DETERMINE ADHERENCE TO PULMONARY FUNCTION TESTING STANDARDS, PRE AND POST-COVID-19

Dr Adam Smith[1]
[1]*University Hospitals Birmingham Nhs Foundation Trust, Birmingham, United Kingdom*

Background: Pulmonary function tests (PFTs) aid respiratory diagnosis and monitoring. Standard Operating Procedures (SOPs), guided by national/ international guidelines (Sylvester et al., 2020), outline how PFTs should be performed. PFT technical reports include any SOP deviations and, with PFT data, can indicate PFT standards. It is currently unclear if testing standards have changed due to COVID-19.

Aims: To establish adherence of the Lung Function & Sleep Department (Good Hope Hospital) to PFT SOPs based on achievement of key criteria and technical comments, and use this as an indicator of PFT standards. To determine if standards changed from pre- to post-COVID.

Methods: A list of patients attending for full PFTs (spirometry, gas transfer, N_2 washout) or reversibility studies between 01/03/19-28/02/20 (pre-COVID) and 01/07/20-30/06/21 (post-COVID) was obtained, and a sample drawn by random number generator (Urbaniak and Plous, 2013). PFTs were scored based on the achievement of key criteria outlined in SOPs, or whether an appropriate technical comment was made. Data were analysed using GraphPad Prism 7 (Version 7.00, GraphPad Software, Inc.). Statistical significance was determined by Mann-Whitney test.

Results: Overall PFT quality increased significantly from pre to post-COVID (11.46 ± 1.34 vs 12.2 ± 1.05, $P<0.0001$), with significant increases observed in spirometry (5.14 ± 0.91 vs 5.64 ± 0.64, $P<0.0001$) and N_2 washout (2.54 ± 0.65 vs 2.72 ± 0.57, $P=0.0005$) tests. Six criteria, whose achievements were ≤95% in both the pre and post-COVID groups, will be targets for improvement prior to re-audit.

Conclusions: Pre and post-COVID PFT testing standards were established. Overall PFT standards significantly increased following COVID-19, suggesting that additional measures implemented due to COVID-19 are unlikely to have negatively impacted PFT standards. Six criteria were identified as targets for improvement. Re-audit will be performed following further staff training and education.

COVID-19 PANDEMIC: INFECTION CONTROL STRATEGIES DURING PULMONARY FUNCTION TESTING AND ASSOCIATED RATES OF INFECTION IN PHYSIOLOGY STAFF

Mr Patrick Jamieson[1], Mr Paul Burns[2], Mrs Jill MacLeod[3], Mrs Laura Jess[4], Mr Andrew Morley[5], Mrs Gillian Toole[6], Mrs Jacki O'Neill[8], Mr Kevin Hay[7], Mrs Rose Ross[9], Mr Austin Ramage[10]

[1]Hairmyres Hospital, East Kilbride , Scotland, [2]Royal Hospital for Children, Glasgow, Scotland, [3]NHS Lothian, Edinburgh, Scotland, [4]Royal Hospital for Children & Young People, Edinburgh, Scotland, [5]NHS Greater Glasgow & Clyde, Glasgow, Scotland, [6]NHS Ayrshire & Arran, Ayr, Scotland, [7]Forth Valley Royal Hospital, Larbert, Scotland, [8]Raigmore Hospital, Inverness, Scotland, [9]Ninewells Hospital, Dundee, Scotland, [10]Borders General Hospital, Melrose, Scotland

Introduction: Coronavirus disease 2019 (COVID-19) and the ensuing pandemic caused suspension of most routine health services. Respiratory Physiology laboratories were particularly affected due to the theoretical risks of tests being aerosol generating procedures (AGPs). A four nations approach was adopted by the infection control governing bodies in the UK, who produced guidance in May 2020. This did not include pulmonary function tests (PFTs) or cardio-pulmonary exercise testing (CPET) on their list of AGPs therefore only droplet precautions were advised. Despite this, the ARTP and ERS issued statements recommending that airborne precautions should be taken.

Objectives: Our primary objective was to evaluate the precautions taken in Scottish respiratory laboratories, the number of patients tested during the pandemic and the rate of COVID infection in staff that was linked to performing tests. Our secondary aim was to look at the impact of COVID-19 on testing numbers.

Methods: A questionnaire was emailed to the heads of service within each respiratory laboratory in Scotland to collate testing numbers prior to and during the pandemic, audit infection control procedures of each department during the pandemic and incidence of COVID-19 in staff which were traced to performing face-to-face tests.

Results: 10 hospitals replied to the questionnaire. ***Table 1*** shows a summary of IPC precautions. A total of 77989 PFTs and 1920 CPETs were performed from July 2020 to December 2021. There were no reports of staff acquiring COVID-19 related to testing. Of the labs that used only droplet precautions, 74866 PFTs and 1914 CPETs were performed. Overall, there has been a 35% reduction in testing numbers during the pandemic compared to the same period pre pandemic.

Precaution	% of Labs using
FRSM	80
FFP3	20
Eye Protection	60
Fallow times	40

Table 1

Conclusion: This audit shows there is minimal risk of staff acquiring COVID-19 during respiratory laboratory testing when basic PPE is combined with community testing, social distancing and face coverings. The pandemic has had a measurable detrimental effect on Scottish respiratory laboratory services testing capacity.

EVALUATING THE RELIABILITY AND ACCURACY OF NUVOAIR HOME SPIROMETRY AND ITS EFFICIENCY IN REDUCING AEROSOL GENERATING PROCEDURES (AGPS) DURING COVID-19

Miss Sonica Minhas[1], **Mrs Janina Mallari-Sagayun[2]**, Dr Caroline Pao[2]
[1]Barts And The London School Of Medicine And Dentistry, Queen Mary University Of London, London, United Kingdom, [2]The Royal London Hospital, Barts Health NHS Trust, London, United Kingdom

Background: During the COVID-19 pandemic, reduction in face-to-face clinic visits limited opportunities for lung function testing (LFT) for cystic fibrosis (CF) patients, especially as it is an aerosol generating procedure (AGP). In response to this, The Royal London Children's Respiratory Team introduced NuvoAir; an app-based home spirometry service, to ensure continuity of LFT at home by parents and children, to inform clinical care.

A retrospective audit was conducted to evaluate the reliability and accuracy of NuvoAir and its efficiency in reducing the need for AGPs.

Methods: All paediatric patients aged ≤16 years with CF diagnosis under the Royal London Hospital (RLH) (n= 38) and the Colchester General Hospital (CGH) (n=8) with NuvoAir spirometry data between September 2020 to October 2021 were analysed and compared to the number of in-hospital spirometry testing. In instances where spirometry was repeated in hospital within 1 week following a NuvoAir session, a sub-analysis of the reasons was also conducted.

Results: For the cohort at RLH, the use of NuvoAir led to a reduction of hospital spirometry by 76 spirometry sessions (14%) and a reduction of 41 spirometry sessions (36%) was observed at CGH. Results demonstrating reasons for repeated hospital spirometry at both sites are demonstrated below (***Figure 1***).

Conclusion: NuvoAir home spirometry ensured continuity of LFT for CF patients during the pandemic and reduced the need for AGPs in hospital and helpful in detecting deterioration. Several areas of improvement have been identified which require troubleshooting for improving reliability and increasing efficiency therefore further reducing the need for AGPs in hospital.

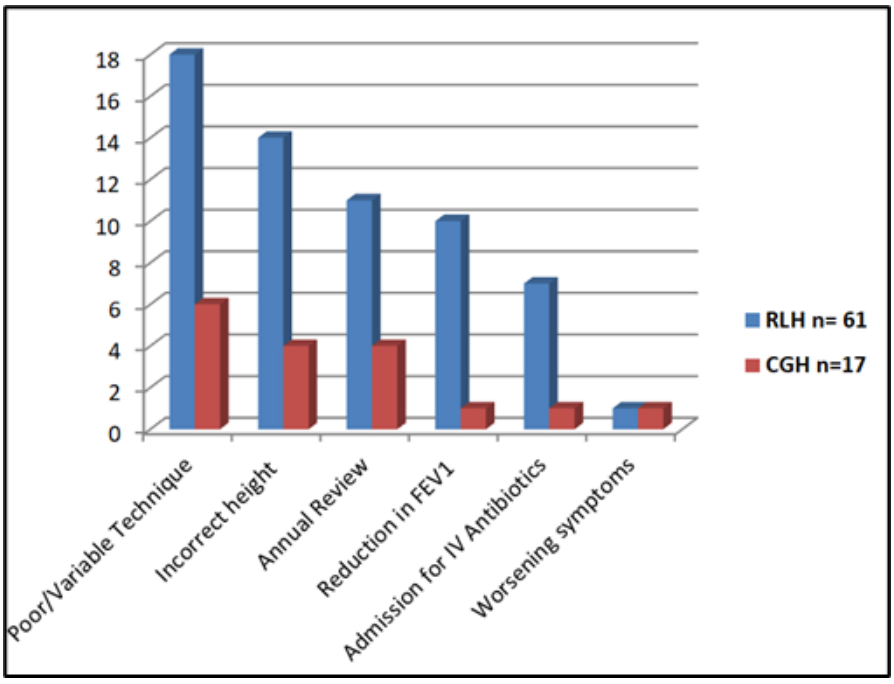

Figure 1

CARDIOPULMONARY EXERCISE TESTING (CPET) SERVICE UTILISATION: BACKLOG TO THE FUTURE

Mr Max Thomas[1]

[1]*University Hospitals Birmingham, , United Kingdom*

Introduction: The pandemic has led to repeated laboratory closures and reduced testing capacity. As a result, diagnostic services are faced with large volumes of outstanding referrals. This backlog is disproportionately affecting services based on urgency or clinical need. Previous work has been aimed at improving the utilisation of the CPET service for diagnostic purposes. The proportion of referrals to evaluate cause of dyspnoea increased from 16% in 2017 to 28% in 2019. The total number of referrals in that period of time had also increased by >30%. This piece of work is aimed at evaluating the impact of the reduced access to diagnostic services over these past two years.

Methods: We conducted a retrospective analysis of CPETs performed in 2019, 2020, and 2021. The source of the referral and clinical indication were recorded. Frequency distribution data for each year was assessed using chi-squared analysis.

Results: Total CPETs performed in 2019 was 456. In 2020, 214 were performed and 207 were performed in 2021 - a 53% and 55% reduction respectively (p= <0.001). Preoperative assessment constituted 71.5% of referrals in 2019 which was not significantly different to 2020 (68.2%) and 2021 (76.3%; p = 0.176). The specialities referring for CPET are shown in ***Figure 1***.

Discussion: The decrease in the utilisation of the service comes as a result of change in laboratory protocols effectively reducing available appointments; redeployment of healthcare scientists to acute medical wards; and changes in guidelines for preoperative assessment when CPET services were inaccessible. Effort needs to be made to engage with cardiology and respiratory clinicians to improve diagnostic utilisation.

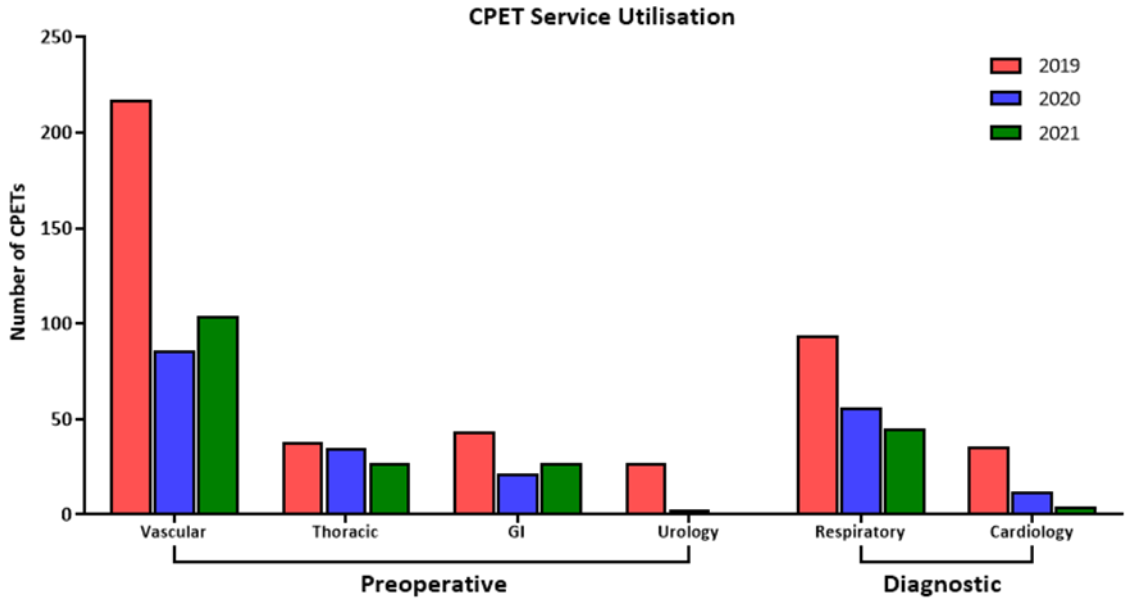

Figure 1

IS SEATED-SUPINE VC ASSESSMENT NECESSARY IF SNIFF NASAL PRESSURE IS NORMAL?

Miss Hayley Dodsworth[1], Mrs Jodie Hunt[1], Dr James A Stockley[1], Prof Brendan G Cooper[1]
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Introduction: Muscle function testing is an integral part of the physiological assessment for the diagnosis and monitoring of respiratory muscle weakness. Our current protocol involves the performance of maximal inspiratory/expiratory pressures, sniff nasal pressure (SNIP) and % change in vital capacity from seated to supine (ΔVCSS). Both SNIP (when performed with a short, sharp manoeuvre) and ΔVCSS assess diaphragmatic strength. We sought to determine if ΔVCSS could be eliminated from the testing protocol, particularly if SNIP is within the normal range.

Methods: Retrospective muscle function data was collected from all patients who attended for muscle function testing within a 12 month period. An initial sample of 83 patients was assessed but 11 were excluded due to missing SNIP and/or ΔVCSS data. A scatter plot was generated and potential correlation was assessed using a Spearman's rank test. Data were divided using published thresholds of normality, which were -70cmH_2O for SNIP and a 15% drop for ΔVCSS, which exclude any ranges that would be considered "suggestive" of abnormality. The number of patients in each group (normal SNIP/normal ΔVCSS, abnormal SNIP/ normal ΔVCSS, normal SNIP/abnormal ΔVCSS, and abnormal SNIP/abnormal ΔVCSS) were recorded.

Results: There was no significant correlation between SNIP and ΔVCSS. However, there were no patients with a normal SNIP that had an abnormal ΔVCSS. 24 patients (33.3%) had a normal SNIP and normal ΔVCSS, 29 patients (40.3%) had an abnormal SNIP and a normal ΔVCSS, and 19 patients (26.4%) had an abnormal SNIP and an abnormal ΔVCSS. The data are displayed graphically in ***Figure 1***.

Conclusions: Our data suggest that, if a patient has a SNIP within normal limits (< -70cmH_2O), then additional ΔVCSS assessment is not required, which would reduce testing time and patient exertion. However, it is still possible for ΔVCSS to be both abnormal and normal if SNIP shows evidence of diaphragmatic weakness.

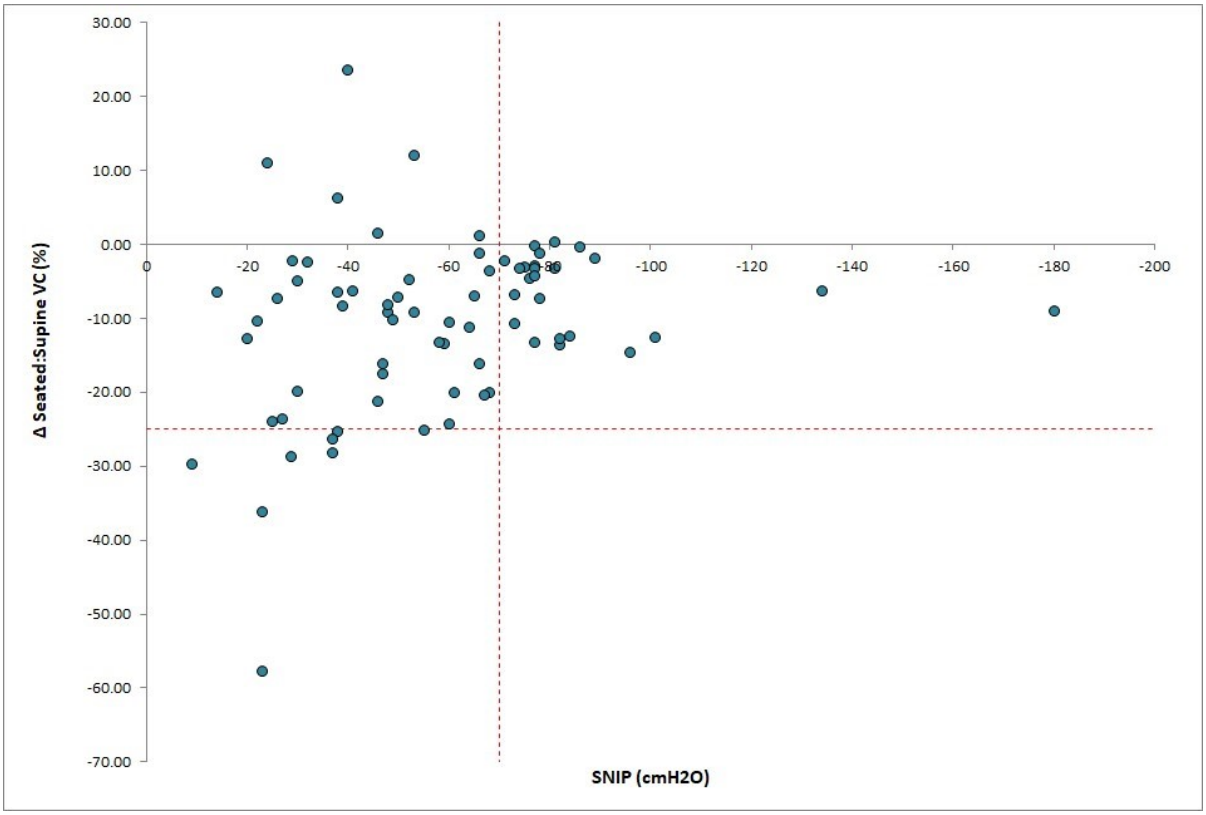

Figure 1: A scatter plot of SNIP versus ΔVCSS in 72 patients referred for respiratory muscle function. There was no correlation between the two indices. The red dotted lines indicate the thresholds of normality (-70 cmH_2O for SNIP and -15% for ΔVCSS). There were no patients with a normal SNIP that also had an abnormal ΔVCSS (bottom right quadrant).

COMPARISON OF TWO FRACTIONAL EXHALED NITRIC OXIDE (FeNO) MEASURING DEVICES IN THE PAEDIATRIC POPULATION

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[1]*Nhs Greater Glasgow & Clyde, Wishaw, United Kingdom*

Objectives: FeNO measurement is widely utilised in the diagnosis, and monitoring of asthma; by providing an objective marker of eosinophilic airway inflammation. The aim of this study was to assess whether 2 devices from different manufacturers provided clinically similar results and could therefore be used interchangeably. We compared FeNO results from two devices which use electrochemical analysers.

Methods: Devices from 2 manufacturers were compared (NIOX VERO®, Circassia, & NObreath®, Bedfont Scientific Ltd) within a paediatric cohort. FeNO was measured pre spirometry and both devices sampled at a flow rate of 0.05L/s ± 10%, in keeping with ATS/ERS guidelines. A sampling time of 10 seconds was used. 30 subjects, who had been referred for pulmonary function tests and FeNO, due to being current asthmatics or suspected asthmatics, performed one trial on each device as part of their visit. NIOX VERO® is used routinely in our clinical practice and was always performed first to ensure consistency of clinic results. A Bland-Altman plot was used to evaluate the agreement amongst the 2 devices. We also looked at the number of patients who had a normal result on one device and an abnormal result on the other.

Results: The mean bias of the 2 devices was 22ppb. The upper and lower limits of agreement were 62 and -18 respectively. See the Bland-Altman plot in ***Figure 1***. The NObreath® measured lower in every subject when compared to the NIOX VERO®. 6 subjects who had an elevated FeNO (>35ppb) on the NIOX VERO®, had a normal FeNO on the NObreath®. The subjects mean age ± SD was 12.4 ± 2.9; with a maximum age of 16 and a minimum age of 6. Z-scores (mean ± SD) for FEV_1 (-1.1 ± 1.5) & FEV_1/FVC% (-1.5 ± 1.3) were calculated from spirometry performed after FeNO.

Conclusion: In children and adolescents, NIOX VERO® and NObreath® cannot be used interchangeably. They produce clinically significant differences with a large mean bias and wide 95% limits of agreement that are clinically unacceptable. All subjects but one reported that the NIOX VERO® was easier to perform the test on; meaning less patient data may be obtained from NObreath® due to the increased difficulty. Future work should look to determine how the devices are calibrated at factory level to help determine which one is giving the most accurate readings.

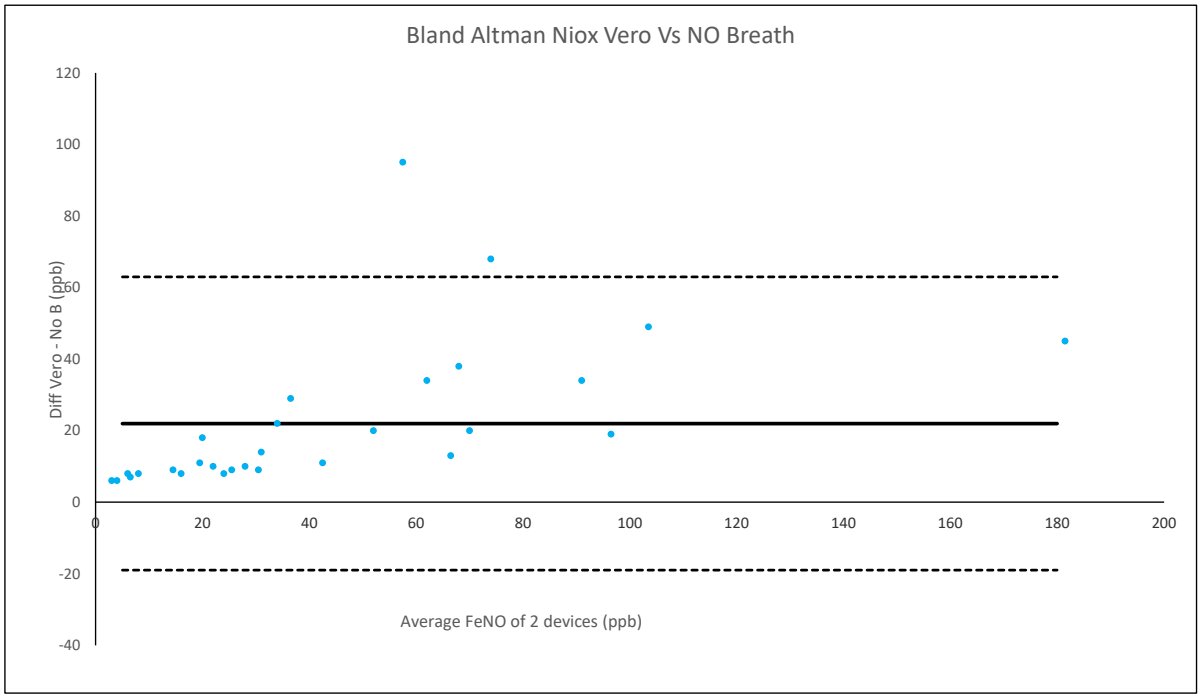

Figure 1. Bland-Altman plot Niox Vero vs NO Breath

COMPARISON OF TWO DEVICES FOR THE MEASUREMENT OF NASAL NITRIC OXIDE

Mrs Kirstie Rogers[1], Mrs Emma Fettes[1], Mr Aidan Laverty[1]
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Introduction: Nasal Nitric Oxide (NNO) measurements are used to screen for Primary Ciliary Dyskinesia (PCD) at our hospital using the gold standard chemiluminescence analyser[1]. In recent years, cheaper, portable electrochemical devices have become available for measuring NNO but are not currently recommended in PCD[1]. We aimed to compare NNO measurements on two devices to assess whether the electrochemical device could be introduced as an alternative for measuring NNO.

Methods: Staff members with no known lung conditions completed measurements of NNO on the Ecomedics CLD88 (chemiluminescence) and Niox Vero (electrochemical) devices. Measurements were taken on the same day for both devices and the test order randomised. For each device 4 reproducible measurements were taken, 2 from each nostril. Mean NNO for each device was calculated and Bland-Altman analysis performed.

Results: Results were obtained from 16 subjects, mean age 34.0 ±10.2 years (9 female; 12 Caucasian). Mean NNO on the Ecomedics CLD88 was 712.2 ± 229.3ppb and on the Niox Vero 1070.8 ± 408.5ppb. NNO measured with Niox Vero was higher for 15 subjects (94%). Bland-Altman analysis showed a large bias between the two devices, with wide limits of agreement outside of clinical reproducibility criteria. There is a trend towards larger differences in those with a higher average NNO.

Discussion: Findings indicate that NNO measurements differ on the two devices, suggesting they cannot be used interchangeably. However, all subjects have NNO above the threshold of normality[1] where greater variability in measurements may be less clinically relevant. Further investigation in subjects with NNO below the threshold of normality is required, as well as study in the paediatric population.

Reference:

1. Shapiro, A.J. et al. 2019. Annals of American Thoracic Society, 17 (2).

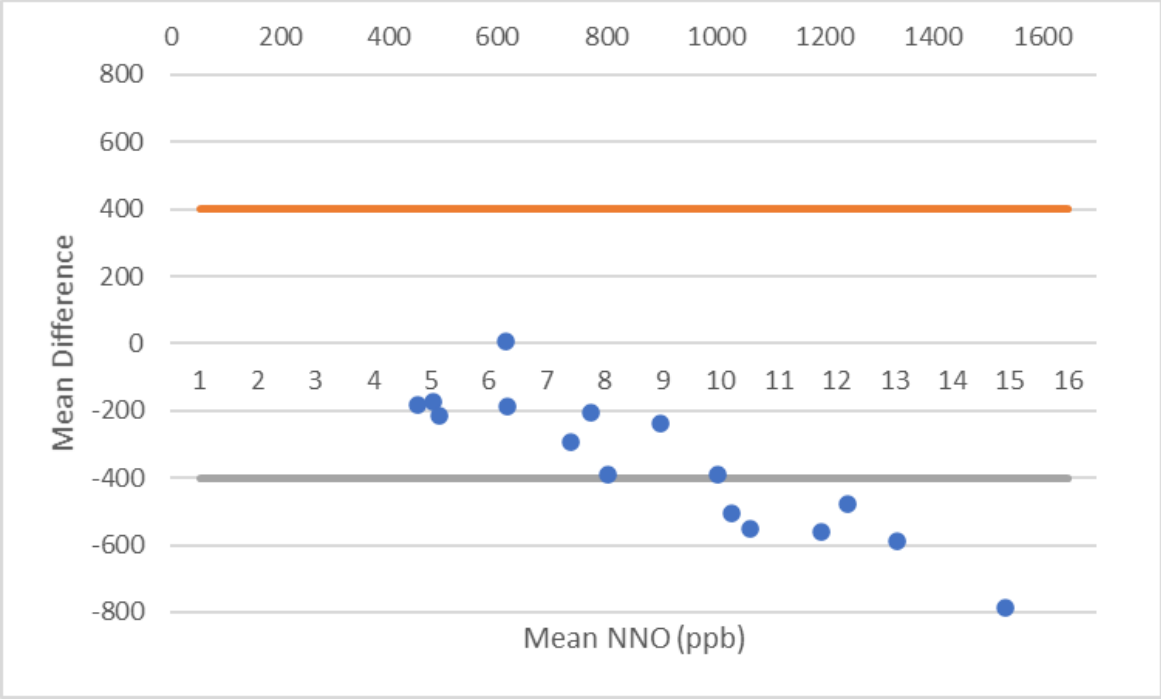

Figure 1. Bland-Altman plot of mean difference in NNO (CLD-Vero) vs average NNO

NEBULISER ASSESSMENT SERVICE POST COVID PANDEMIC - A COMPARISON STUDY

Mrs Geljit Johal[1], Mrs Jodie Hunt[1], Dr James Stockley[1], Prof Brendan Cooper[1]
[1]*University Hospitals Birmingham Nhs Foundation Trust, Stratford Upon Avon, United Kingdom*

Introduction: Nebuliser therapy is recommended for patients who require a high dose of inhaled bronchodilators. Spirometry has traditionally been used to collect objective data as part of the nebuliser assessment. Due to restrictions during the COVID-19 pandemic, spirometry was omitted from the assessment. This study compares our nebuliser assessment service before and after this change with a focus on the need for spirometry.

Methods: For the old nebuliser assessment pathway, spirometry was performed on 3 separate visits planned over a 4 week period. The patient also recorded peak flow (PEF) twice per day and rated their symptoms. Bronchodilator reversibility testing was undertaken using MDI and nebulised drugs on visits 2 and 3, respectively and education on bronchodilator technique was included to optimise drug delivery. Subjective improvement with nebulised bronchodilators was also noted.

The new pathway for nebuliser assessment omitted spirometry, with visits 2 and 3 being undertaken as telephone consultations to reduce patient attendances. We collected retrospective nebuliser assessments data over 12 months both before and after the change in pathway.

Results: More trials were completed with better adherence to completing the nebuliser diary on the new pathway. Subjective improvement was reduced, which is reflected by an increase in negative trials and reduced number of nebulisers issued on the new pathway. Comparative outcomes on both pathways are summarised in ***Figure 1***.

Conclusions: Baseline spirometry can be used to grade the severity of the patient's disease during a nebuliser assessment. However, repeat assessment on visits 2 and 3 adds little to other clinical information available. The evaluation of PEF, symptoms and the subjective response to inhaled nebulised bronchodilator therapy is sufficient to determine the clinical need for nebuliser issue, with the patient's subjective improvement being the dominant factor.

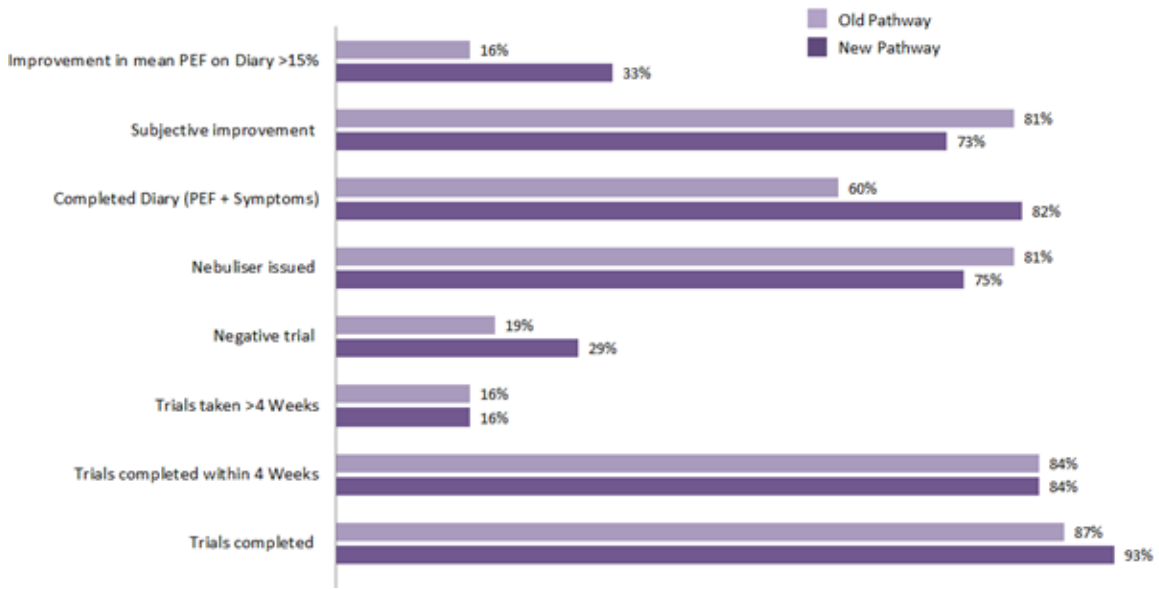

Figure 1: A comparison of nebuliser assessment outcomes with the old pathway (including spirometry) and new pathways (without spirometry)

HOW COVID-19 HAS IMPACTED THE LUNG FUNCTION SERVICE AT ROYAL FREE HOSPITAL BETWEEN 2020-2021

Ms Hina Mir[1], Dr Swapna Mandal, Ms Janet Oliver, Mr Seamus Cox, Ms Luvis Barbacena, Mr Christopher Curnick
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Background: Lung function testing has become an integral tool in the diagnosis, management, assessment, and follow-up of patients with respiratory conditions. This audit was performed to examine the impact of COVID-19 on lung function testing frequency over the last two years.

Method: We analysed Respiratory physiology appointments scheduled using QlikView from the 1st of January 2020 until the 31st of December 2021. From this we were able to compare the patient attended, DNA and cancellation (by hospital or patient) frequency.

Results: Over these annual periods we tested 3,734 patients in 2020, and 5,237 in 2021 – totalling 8971 over two years. The average DNA% rate over the two years was 12.9%.

Prior to COVID the average number of patients seen monthly was 508. ***Table 1*** shows there was a significant decline in patients seen, and significant increases in DNA rates during UK lockdown periods: 23/03/2020 – 23/06/2020, 05/11/2020-02/12/2020, 06/01/2021-22/02/2021.

There were spikes of DNA rates in the two year period that correlated with COVID restrictions – two of the three highest were 24% in March 2020 and 17% in January 2021 – both lockdown periods. The third DNA spike of 19% occurred in December 2021– when there was a surge in COVID cases (daily cases quadrupled in one month, increased from 40,394 cases on the 1st of December to 160,276 cases on the 31st of December).

Conclusion: During the initial stages of the pandemic, our laboratory had to reduce testing to urgent and inpatient only to protect patients and staff. During the first lockdown we had record high cancellations reaching a peak of 704 appointments in April 2020. Over time we adapted with the pandemic and implemented infection control guidelines that allowed us to safely test patients – PCR Swabbing pathway, use of Personal Protective Equipment (PPE), Pre-screening questionnaire, temperature check patients on arrival and regular staff testing. The Royal Free laboratory is now testing near to pre pandemic levels – 94% similarity when comparing November 2021 to February 2020).

2020 -2021	MARCH 20	APRIL 20	MAY 20	JUNE 20	NOV 20	DEC 20	JAN 21	FEB 21	DEC 21	TOTAL between
Patients Seen	338	96	112	182	470	342	281	318	309	8971
DNA %	24.4	7.7	4.3	16.5	13	13.9	17.1	9.4	19.3	12.9%
Total Cancellation	324	704	492	409	299	342	344	289	240	7498

Table 1. Periods with lowest volumes of patient attendance and highest rates of patient DNA between January 2020-December 2021

IS QUALITY ASSURED SPIROMETRY ACHIEVABLE IN A CLINICAL COHORT OF PATIENTS WITH ACHD: RETROSPECTIVE ANALYSIS OF A SINGLE CENTRE EXPERIENCE

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[1]*UHCW, Coventry, United Kingdom*

Introduction: Congenital heart disease (CHD) is diagnosed at birth and often corrected in childhood through surgery. Dyspnoea is a common symptom in adult congenital heart disease (ACHD) related to abnormal cardiac aetiology and lung function. Chest wall surgery (CWS) may impact on chest wall mechanics and respiratory muscle function; this may affect the performance of forced inspiratory and expiratory manoeuvres. Spirometry is an important diagnostic tool in ACHD and used to investigate extrathoracic restriction and ventilatory limitations. If quality assured spirometry (QAS) is not achieved its diagnostic power is compromised.

Aims: The aim of this study was to identify if patients with ACHD who have had previous CWS are able to achieve QAS.

Methods: All patients who performed spirometry and CPET during the ACHD CPET clinic between 2015-22 were reviewed. Spirometry and CPET data were collected. QAS was determined using ARTP 2020 guidelines. Surgical history was recorded from cardiology clinic letters. Data analysis was performed using IBM SPSS.

Results: 77 patient's spirometry results were retrospectively analysed. 1 patient was excluded due to incomplete data. 76 patients were included with a median age of 32 (IQR 23-48) years. 55 (73%) of patients had undergone previous CWS. In total 47 patients (63%) achieved QA spirometry. 24 (51%) of spirometry results were normal and 12 (26%) showed a restrictive ventilatory pattern. 14 (50%) demonstrated early termination of forced vital capacity (FVC). Pearson's chi square analysis demonstrated no association between CWS and QAS (x^2 (1, n=76) = 1.773, p =.183). Fisher's exact test also demonstrated no association between the two variables (p =.280). ***Table 1***.

Conclusion: QAS is achievable in ACHD. Previous CWS should not exclude patients from performing spirometry however poor-quality spirometry should be interpreted with caution. Emphasis should be placed on performing quality assured spirometry to aid clinical decision making in ACHD.

	Median (IQR)
Age (years)	32 (23 - 48)
BMI	27 (23 - 32)
FEV_1 (L)	2.73 (2.24 - 3.26)
FEV_1 % Predicted	85 (71 - 95)
FVC (L)	3.33 (2.68 - 3.94)
FVC % Predicted	84 (73 - 98)
FEV_1/FVC	82 (74 - 88)

Table 1.

ALTERED LUNG VOLUMES IN RELATIONSHIP TO AIRFLOW OBSTRUCTION AND SMALL AIRWAYS DYSFUNCTION IN ASTHMA

Mr Mohammed Almeshari, Mr Nowaf Alobaidi, Dr James Stockley, Professor Robert Stockley, Professor Elizabeth Sapey

[1]*University Of Birmingham, Institute of inflammation and ageing, Birmingham, United Kingdom,* [2]*King Saud University, Rehabilitation Health Sciences, College of Applied Medical Sciences, Riyadh, Saudi Arabia*

Background: Small airways dysfunction (SAD) and airflow obstruction (AO) are prevalent in asthma and lung volumes are also affected due to gas trapping. This study assessed relationships between SAD and AO on lung volumes in patients with asthma.

Methods: Adults with asthma who had a set of full lung function measurements between January 2016 to April 2021 were included from a tertiary hospital in the West Midlands, United Kingdom (UK). Predicted values were calculated using the 2012 Global Lung Initiative equations. AO was defined as a z-score of <-1.645 in FEV_1/FVC. SAD was defined as a z-score of <-1.645 in MMEF.

Results: 208 patients were included, of which 36 (17.3%) and 46 (22.1%) had physiological evidence of AO and SAD, respectively. Residual Volume (RV) % predicted was higher in asthma patients with AO (n=36) compared to patients without AO (n=172), (median[IQR]: 102 [95.8 -108] Vs. 92.3 [84.6-101], (p-value <0.001). The Total Lung Capacity (TLC) was also higher in those with AO compared to without AO (median[IQR]: 102 [95.8-108] Vs. 92.3 [84.6-101], p-value <0.001).

RV was higher in patients with SAD compared to those without SAD, (median[IQR]: 109 [88.6-125] Vs. 85.7 [74.6-98.0], (p-value <0.001). TLC was not different between groups (SAD: 97.7 [87.8-103] Vs. non-SAD 93.9 [86.3-103] , p-value 0.35), see ***Figure 1***.

In a univariate analysis of SAD on the total group (n=208), RV was associated with SAD (Odds ratio (OR) of 1.05 (95% CI: 1.03-1.06, p-value: <0.001).

Conclusion: In patients with asthma, SAD and AO are both associated with a higher RV and RV/TLC, which are suggestive of gas trapping. This may be contributing to the symptomatic burden in these patients and MMEF may be a useful parameter to measure.

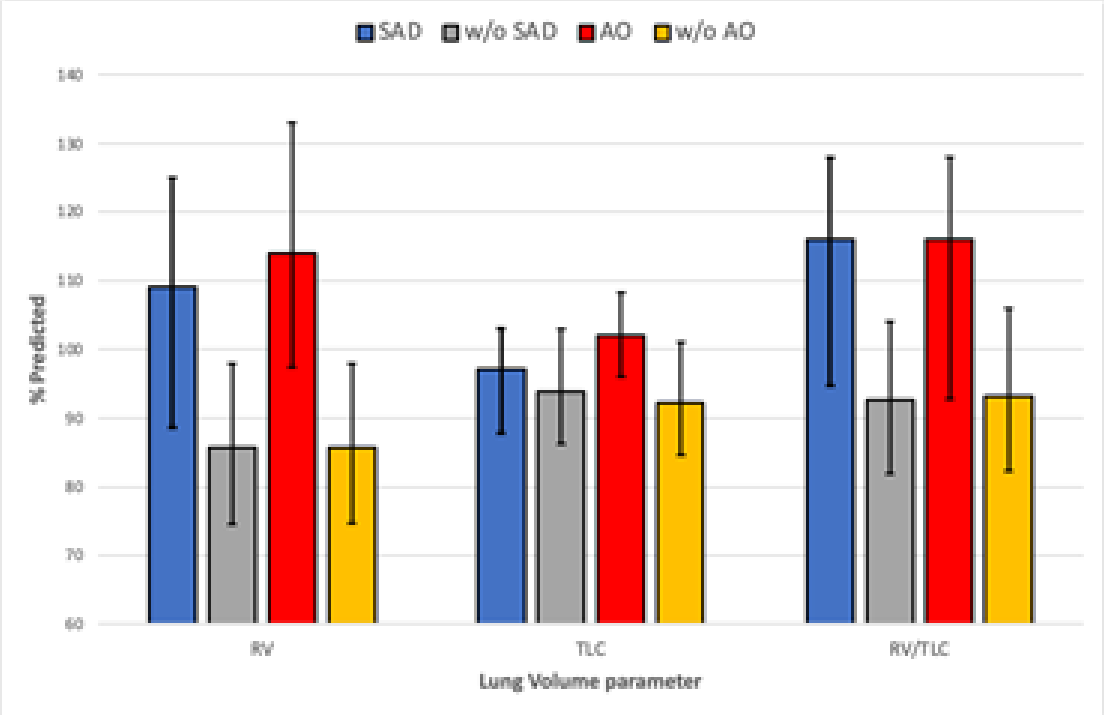

Figure 1. % predicted of the lung volumes in SAD and AO in the whole population. It shows that there was an increase of RV in those with SAD similar to those with AO, although TLC was maintained in the SAD group.

IDIOPATHIC SUBGLOTTIC STENOSIS AS A DIFFERENTIAL DIAGNOSIS FOR ASTHMA: A CASE REPORT DEMONSTRATING THE POTENTIAL FOR FIXATION ERRORS

Miss Alice Bonham-Carter
[1]*Maidstone and Tunbridge Wells NHS Trust, Maidstone , United Kingdom*

Introduction: Dyspnoea, cough, stridor and wheezing, exacerbated by exercise, represent a common symptom presentation, highly suggestive of asthma. However, rarer conditions such as subglottic stenosis also cause such symptoms[1]. The rarity, lack of clear cause, and significant symptom overlap with asthma, means idiopathic subglottic stenosis (ISS) can be misdiagnosed due to fixation errors, where clinicians focus on one element of a case but overlook other relevant aspects. This can have severe impact on treatment.

Case Presentation: A previously healthy 34-year-old woman presented with 2-year history of progressive breathlessness, cough and stridor, exacerbated by exercise. She is a non-smoker, with no significant medical history or allergies. Salbutamol inhaler provided minimal short-term relief. MRI and bronchoscopy showed thickening of distal trachea causing stenosis. However, doctors suspected asthma as the main cause of symptoms. Spirometry showed FVC of 4.36 L (121% of predicted), FEV_1 of 2.91 L (93%), PEF of 4.41 L/s (63%) and FEV_1/FVC of 0.67. Fractional exhaled nitric oxide (FeNO) was 7ppb, not suggestive of eosinophilic airway inflammation. Truncated inspiratory and expiratory limbs of flow-volume loop (***Figure 1***), and Empey index of 11 confirmed fixed upper airway obstruction (UAO). Evidence of induced bronchoconstriction also noted, with reductions in FEV_1, PEF, and FEV_1/FVC with each attempt. Reversibility not performed. The patient was started on a combination inhaler of formoterol and beclomethasone and reversibility tests ordered to assess for comorbid asthma. Regular spirometry planned to monitor UAO. Onward referral for consideration of surgical intervention will be made if indicated.

Conclusions: This case demonstrates how rarer conditions like ISS may be overlooked due to fixation errors and highlights the importance of detailed history taking, thoroughly investigating symptoms, and not assuming a common diagnosis based on similar presentations.

References:

1. Rossi, C. et al. Idiopathic tracheal stenosis: a report of four cases. Jornal Brasileiro de Pneumologia 2007; 33: 101-104.

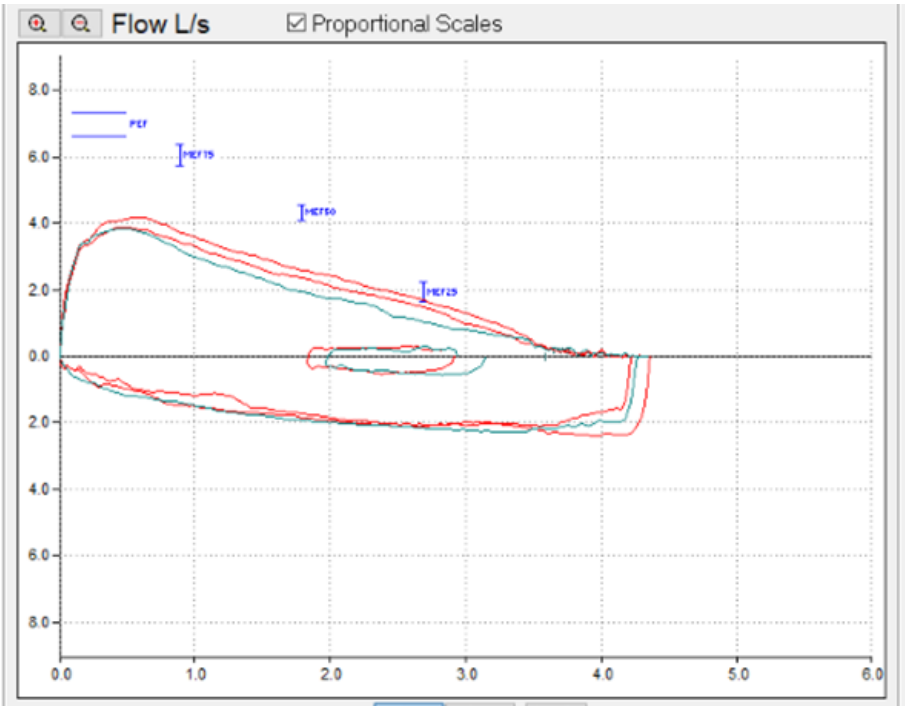

Figure 1. Flow volume loop showing truncated inspiratory and expiratory limbs

CASE REPORT: BIRD FANCIER'S LUNG ON A BACKGROUND OF COPD

Miss Alice Bonham-Carter[1]
[1]*Maidstone and Tunbridge Wells NHS Trust, Maidstone , United Kingdom*

Introduction: Chronic Obstructive Pulmonary Disease (COPD) and Hypersensitivity Pneumonitis (HP) are both associated with symptoms of dyspnoea, cough and weight loss, and they can both exacerbate or mask one another and lead to missed diagnosis. We report a case of suspected HP occurring in the presence of COPD and consider the diagnostic and treatment options.

Case Presentation: A 42-year-old lady with known COPD presented with severe breathlessness, cough and fatigue, after two recent hospital admissions with pneumonia, which were attributed to acute exacerbations and worsening of her COPD. Upon presentation the patient appeared very thin. A detailed history revealed she was a former smoker (30 pack years) and was the carer for her partner and young daughter and kept budgies in her home. CT scans showed patchy consolidation and severe emphysema. Pulmonary function tests were suggestive of severe airflow obstruction. Blood tests were positive for avian precipitins, suggesting an additional diagnosis of Bird Fancier's Lung, a form of HP. The patient was referred for additional tests to confirm diagnosis and will be started on high dose steroids if these results support the diagnosis.

Conclusion: Lesser-known diseases, such as HP, may often be missed when occurring in the presence of a more established disease, such as COPD, leading to delayed treatment and increased chance of negative outcomes. When patients present with exacerbations of previously established respiratory conditions, a detailed history should be taken, including environmental and occupational, to establish any potential comorbidities that could be contributing to the worsening symptoms and treat these in a timely manner, rather than simply attributing symptoms to a worsening of the primary disease.

SUBCUTANEOUS OEDEMA AND DYSPNOEA AS FIRST PRESENTATION OF ANTISYNTHETASE SYNDROME: A CASE REPORT

Mr Ben Streatfield[1]
[1]*University Hospitals Birmingham, Birmingham, United Kingdom*

Background: Antisynthetase Syndrome is a rare autoimmune disorder with a broad clinical presentation, including but not limited to; Myositis, Raynaud's phenomenon, Interstitial Lung Disease, muscle weakness and/or unexplained fevers. Two of the major diagnostic criteria, outside of identifying serum autoantibodies that target aminoacyl-transfer-RNA synthetases, are Polymyositis and pulmonary involvement, with the presence of the latter leading to worsened 5-year outcomes.

Case Presentation: this case report describes an obese 27-year old Asian woman who originally presented to the accident and emergency department in December 2020 for a knee injury, but was subsequently discovered to be mildly tachycardic. In April 2021, she again presented with sinus tachycardia, chest-tightness and exertional dyspnoea which progressively worsened over the course of 4-months, eventually being prescribed bisoprolol in August 2021. She was readmitted in September 2021 with oedema affecting her limbs, face and eyelids; originally believed to be an allergic reaction to bisoprolol. However, her creatine kinase levels were >23000u/L (normal = 22-198u/L), she was experiencing muscle weakness in all limbs and significant subcutaneous oedema was seen via magnetic resonance imaging, all presenting features of Polymyositis. She was initiated on prednisolone (60mg/d) in October 2021 and follow-up high resolution computed tomography was requested, considering pulmonary involvement alters treatment options. Subsequent imaging in October 2021 confirmed signs of mild, bi-basilar fibrotic changes and pulmonary function tests indicated a restrictive lung defect with reduced gas transfers, consistent with underlying interstitial lung disease - but also highlighting an additional constrictive contribution which may in part be obesity related. This patient was submitted to autoimmune screening which highlighted anti Jo-1 antibodies and thus the diagnosis of Antisynthetase Syndrome was confirmed. She is currently in the process of deciding initial treatment for this disorder, as well as undergoing treatment for her newly diagnosed mild obstructive sleep apnoea. Conclusions; Antisynthetase syndrome is a rare diagnosis which, aside from a diverse clinical presentation, also requires specific serological investigations for official diagnosis. The presence of pulmonary involvement often gives a worsened prognosis.

Keywords: Interstitial lung disease, anti-Jo-1 antibodies, Polymyositis, Antisynthetase syndrome

CPET RESULTS IN A PREOPERATIVE VASCULAR SURGERY PATIENT: REAL RESPONSE OR TECHNICAL FAULT?

Mrs Sara McArthur[1], Mr Shaun Baxter
[1]*NHS Lothian, Musselburgh, United Kingdom*

Presentation: A female patient aged 72 presented with unexplained weight loss (>70kg) over 3 years in conjunction with abdominal swelling, vomiting and abdominal pain. Patient was investigated by gastroenterology then referred to vascular surgery with suspected mesenteric ischaemia . She denied purposeful weight reduction. She was active attending gym regularly. Patient attended for pre-operative risk assessment.

Investigations: Bloods, ECG, ECHO, pulmonary functions test, x-ray and CPET. CPET results showed that although a good workload was achieved (179% pred), VO_2peak and AT appeared low. As patient was apparently fit for her age a technical issue during test was considered. A second CPET test was performed 9 days later and results compared. The first test used a 15W ramp whilst the second was a 10W ramp.

CPET summary of results: Reduced VO_2peak, Shallow VO_2/work rate slope and also shallow VCO_2/work rate slope, flattening of O_2 pulse curve after AT, mild ST depression and hypertension was consistent with both peripheral vascular disease pattern and/or cardiac disease.

Pre-operative risk evaluation: AT <10ml/min/kg on both tests places patient in increased surgical risk category. VO_2peak <15ml/min/kg and possible ischaemic changes also suggestive of increased risk.

Technical issues and comments: Technical issues were suspected due to low VO_2peak at 179% predicted peak work load. Repeat test results were similar with a slight learned effect and lower work rate ramp, allowing for a longer test. RER >1.1 on both tests indicated maximal effort. Pred load was 53W using Wasserman equations resulting in 179% predicted and 164% predicted. If Glaser (SHIP) equations (2013) were used, predicted load would be 108W, 87% predicted and 80% predicted which is more in keeping with the test results. Wasserman maximal age range is up to 70 years old while Glaser (SHIP) is up to 85 years.

Patient journey to date: Patient underwent mesenteric re-vascularisation using the right iliac as a conduit to the superior mesenteric artery, which went well with good post-op recovery. At 5 months post-op her symptoms had improved and regained 25.5kg in weight. 2 years after surgery the patient died (not attributed to her surgical intervention).

Learning point: Ensure correct predicted equations are used for the patient population that is being tested.

EXERCISE-INDUCED BRONCHOCONSTRICTION ASSOCIATED WITH ANXIETY AND PSYCHOSOMATIC RESPONSE IN PAEDIATRIC PATIENT

Miss Katie Caria-Preen[1]
[1]*Royal London Hospital, Whitechapel, United Kingdom*

Background: Exercise induced bronchoconstriction (EIB) refers to airway narrowing and inflammation occurring due to mast cell degranulation and release of mediators in the airway, such as histamine and leukotrienes, in response to exercise[1]. This is seen in asthmatics and non-asthmatics, with associated physical and emotional burdens[1].

Case History: An 11-year-old female underwent exercise challenge testing (ECT) following history of dyspnoea and urticaria in response to exercise, resulting in exercise avoidance. A reduction in FEV_1 of 24% was indicative of EIB. In response, patient's salmeterol dosage was optimised to control underlying asthma and sodium cromoglycate (SCG) was prescribed to attenuate mast call degranulation and reduce bronchoconstriction during physical activity. Improvement in exercise-related symptoms was reported in consequent follow-up consultations. Repeat ECT was performed after 4 months to assess presence of bronchoconstriction following medical optimisation. Heightened anxiety and panic were noted in response to exercise, with apparent absence of respiratory symptoms. A conditioned psychosomatic response is suspected with recommendations for patient to seek psychological support in decoupling process between exercise and asthma symptoms.

Discussion and Conclusions: Studies indicate that asthma patients can perceive asthma symptoms when expecting to experience them or by being in a context where symptoms have previously occurred[2]. This patient's heightened anxiety response to exercise suggests that physical activity is a trigger to perception of asthma symptoms, instead of bronchoconstriction. Identification of cues that spark perceived asthma symptoms can aid in changing response to triggers as well as repeated exposure to the cue[2]. Psychological input could aid in decoupling the response between exercise and perceived asthma symptoms, with repeat ECT planned to assess if EIB is fully resolved from physiological standpoint.

References:

1. Aggarwal, B., Mulgirigama, A. and Berend, N., 2018. Exercise-induced bronchoconstriction: prevalence, pathophysiology, patient impact, diagnosis and management. npj Primary Care Respiratory Medicine, 28(1).
2. Janssens, T., Verleden, G., De Peuter, S., Van Diest, I. and Van den Bergh, O., 2009. Inaccurate perception of asthma symptoms: A cognitive–affective framework and implications for asthma treatment. Clinical Psychology Review, 29(4), pp.317-327.

DOES THE BORG RPE SCALE CORRELATE WITH PHYSIOLOGICAL MARKERS USED TO RATE EXERTION IN RESPIRATORY DISEASE?

Mr Jake Troy Brown[1]
[1]*NHS Lothian, Edinburgh, Scotland*

Introduction: Despite evidence of a lack of validity of the Borg RPE scale in patients with respiratory disease, it is still regularly used within this population[1].

Methods: Patients who performed an Incremental Walk Test (IWT) (n=763) between June 2019 and June 2020 were included. Ethics committee approval was obtained. Patients were organised into four groups – 1) all groups combined, 2) chronic obstructive pulmonary disease (COPD), 3) interstitial lung disease (ILD) and 4) Other Diseases. The IWT required patients to walk for a maximum of 10 minutes on a treadmill at a pre-determined pace, which increased incrementally every 60 seconds. Measurements obtained during the IWT included; distance covered, O_2 saturation and HR. Additionally, patients rated their level of dyspnoea at the end of the final incremental level. Statistical analysis included D'Agostino-Pearson normality test, Students paired t-test, Wilcoxon signed-rank test and one-way analysis of variance (ANOVA), with additional Tukey test analysis. $P<0.05$ was considered significant.

Results: A poor correlation was identified between the Borg score estimated peak HR (BSEPHR) and measured peak HR in all patient groups. Furthermore, BSEPHR was found to be significantly higher compared to measured peak HR in all patient groups. Finally, results showed that the mean difference between BSEPHR and measured peak HR is significantly greater in the COPD group compared to the ILD group. No significant difference found between any other groups.

Conclusion: Results suggest that validity of the Borg RPE scale is relatively poor when used as a tool to gauge physiological exertion in patients with respiratory disease during exercise. Other studies suggest that respiratory rate may have been a more appropriate physiological criterion to use when measuring the validity of the Borg RPE scale in patients with respiratory disease[2]. BSEPHR is significantly higher compared to measured peak HR in all patient groups, which suggests that patients with respiratory disease, regardless of phenotype, experience an increase in perceived exertion during physical activity compared to individuals without underlying health conditions.

References:

1. O'Donnell, D.E., Banzett, R.B., Carrieri-Kohlman, V., Casaburi, R., Davenport, P.W., Gandevia, S.C., Gelb, A.F., Mahler, D.A. and Webb, K.A., 2007. Pathophysiology of dyspnea in chronic obstructive pulmonary disease: a roundtable. Proceedings of the American Thoracic Society, 4(2), pp.145-168.
2. Robson, A., 2017. Dyspnoea, hyperventilation and functional cough: a guide to which tests help sort them out. Breathe, 13(1), pp.45-50.

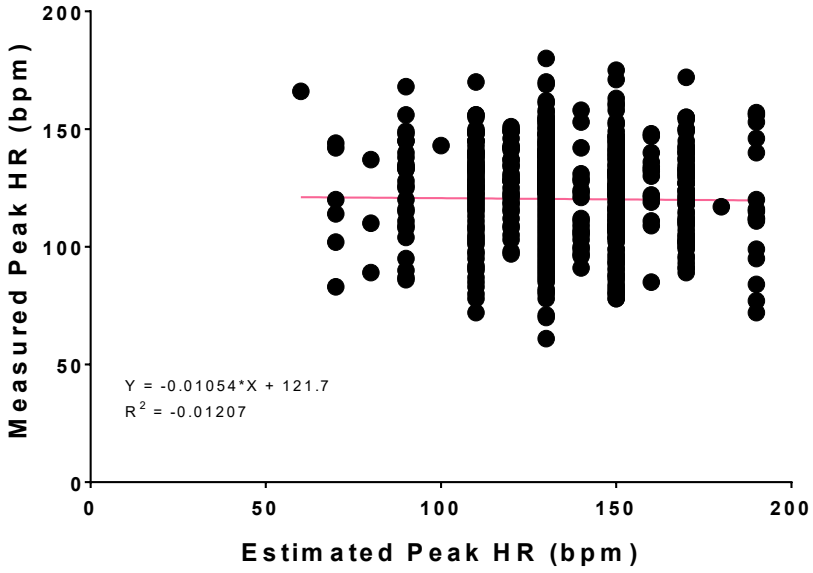

Figure 1. Correlation plot of estimated peak heart rate (n=690) versus measured peak heart rate (n=690). Dark circles indicate individual data points, and the fitted regression line illustrates the relationship between the two measurements. Coefficient of determination (R^2) value = -0.012, which confirms a poor correlation between the two measurements.

IS A SECOND BASELINE WALK REQUIRED FOR AMBULATORY OXYGEN ASSESSMENTS?

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[1]*University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom*

Introduction: Following a cross-site review of our standard operating procedures, it was decided that a second baseline 6 minute walk test (6MWT) is not required for patients who were naïve to the test. However, a second 6MWT was still recommended for ambulatory oxygen assessments, which are often time-consuming and can require multiple additional 6MWTs if oxygen titration is required.
We sought to determine if a second baseline walk is necessary in determining the clinical need for ambulatory oxygen.

Methods: All patients who performed two technically acceptable baseline walks during an ambulatory oxygen assessment between November 2021 and present were included in the study. 6MWT outcome measures (including peak SpO_2 and heart rate, walk distance, number of rests and BORG dyspnoea scores) were compared between walks 1 and 2 using a Wilcoxon Signed-Rank test. The walk used to determine the need for ambulatory oxygen was noted and the final outcome based on just walk 1 or walks 1 and 2 was compared.

Results: Data collection is ongoing but, at the time of submission, 18 patients were included. There were no significant differences in any outcome measures between walks 1 and 2 (***Table 1***). Walk 1 was selected for reporting in 50% of patients. The clinical requirement for ambulatory oxygen was indicated in only 4 patients (22%) but the performance of a second baseline walk did not influence this decision in any patient.

Conclusions: The patient cohort is currently limited both in overall patient numbers and the number of patients requiring ambulatory oxygen. However, the results to date strongly suggest that a second baseline walk is not required. This could appreciably reduce testing time required for ambulatory assessments.

Patients		
N =	18	
M : F	7 : 11	
Age (years)	70 (56 - 80)	
BMI (kg/m2)	25.6 (23.1 - 27.6)	
Capillary Gases		
pO2	9.51 (8.94 - 10.51)	
pCO2	5.05 (4.65 - 5.55)	
pH	7.45 (7.41 - 7.46)	
6MWT	**Walk 1**	**Walk 2**
Peak SpO2 (%)	92 (90 - 95)	92 (90 - 95)
Peak HR (%pred)	60.3 (57.8 - 62.7)	59.5 (56.0 - 61.8)
Peak BORG Dyspnoea	4 (3 - 7)	4 (3 - 7)
Distance Walked (m)	240 (185 - 313)	240 (203 - 310)
Number of Rests	0 (0 - 2)	0 (0 - 1)

Table 1: A summary of the patients included in the study and a comparison of the outcome measures from baseline walk 1 and walk 2. There were no significant differences between walks 1 and 2 and the performance of a second 6MWT did not influence the decision to proceed to ambulatory oxygen in any patient.

THE USE OF REMOTE MONITORING FOR IDENTIFYING CPAP NON-COMPLIERS AND RECLAIMING UNWANTED DEVICES

Miss Taran Rai, Mrs Maria Sharif, Dr James Stockley, Professor Brendan Cooper
[1]*University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom*

Introduction: CPAP is the dominant therapeutic option for obstructive sleep apnoea (OSA). Modern devices allow for remote monitoring and more efficient clinical management.

In a time of a global shortage of CPAP devices, we sought to utilise our remote database to identify CPAP non-compliers and contact them with the hope of reclaiming devices for reissue.

Methods: Patients in our database (ResMed, Oxford, UK) were screened sequentially. Those who had not been using CPAP for >1 month were included and characterised in terms of disease severity and clinical data (sex, age, BMI, snoring, daytime sleepiness, and witnessed apnoeas). Compliance before CPAP cessation was also noted. Data were compared using either a Kruskal-Wallis or Chi Square test.

Patients were contacted and asked if they planned to recommence CPAP. For those who did, issues affecting compliance were noted and follow-up appointments were scheduled. Patients who did not were advised to return their CPAP.

Results: 1025 patients from a total of 1650 on the database were screened. Of these, 107 (10.4%) had not been using CPAP for >1 month. Across disease severity, there was no difference in demographics, symptoms, or the % patients compliant with CPAP prior to stopping (***Table 1***). CPAP itself was different as patients are currently assigned a pressure depending on disease severity.

From departmental records, it was clear in only 5 patients that CPAP had been returned. The telephoning of patients is ongoing but, at the time of submission, 27% did not answer, 50% wished to keep CPAP and try again if issues could be resolved, and 23% did not wish to try CPAP again.

Conclusion: CPAP non-compliers are easily identifiable on the remote database. Contacting them may allow for devices to be reclaimed, which could be useful in times of global CPAP shortage. However, there is a departmental issue with patients not being removed from this database after CPAP has been returned, which will be addressed moving forward.

	All	Mild OSA	Moderate OSA	Severe OSA	p =
N =	105	27	38	40	
M : F	71 : 24	14 : 13	27 : 11	31 : 9	ns
Age (yrs)	52 (20 - 87)	54 (38 -77)	48 (25 - 75)	54 (20 - 87)	ns
BMI (kg/m^2)	35.2 (30.2 - 40.5)	33.8 (29.7 - 41.0)	35.2 (30.0 - 39.8)	36.0 (32.3 - 43.2)	ns
Epworth	12 (7 - 15)	12 (8 -15)	9 (6 - 13)	14 (9 - 18)	ns
Symptom data in	41	10	16	17	
Daytime Sleepiness	38 (92%)	10 (100%)	13 (81%)	15 (88%)	ns
Witnessed Apnoeas	33 (80%)	8 (80%)	13 (81%)	12 (71%)	ns
Snoring	37 (90%)	9 (90%)	14 (88%)	14 (82%)	ns
CPAP (cmH_2O)	12 (11 - 14)	11 (10 -12)	12 (11 - 12)	15 (14 - 15)	< 0.0001
Compliant before cessation?	23 (21%)	5 (19%)	8 (21%)	10 (25%)	ns

Table 1. Demographic, symptomatic and CPAP data for all patients and spilt by disease severity. Data are presented as Median (IQR) except Age which is Median (Min-Max). There were no differences in the patients or their symptoms and no difference in the proportion of patients compliant with CPAP before they stopped using the treatment.

CASE REVIEW: TRIAL OF AUTOCPAP IN PAEDIATRICS

Mr Ansel Godinho[1]
[1]*Great Ormond Street Hospital For Children NHS Foundation Trust, London, United Kingdom*

Introduction: Gold standard treatment for Obstructive Sleep Apnoea (OSA) in paediatrics is adenotonsillectomy (AT). Continuous Positive Airway Pressure (CPAP) is frequently used if AT is not possible or OSA remains unresolved[1]. Tolerance of CPAP is challenging in paediatrics. AutoCPAP is a recent ventilator technology enabling automatic adjustment of pressure within specified range in response to events.

Case: A 16-year-old boy with Crouzon syndrome attending for follow up sleep study, after using CPAP for >10 years with good adherence. Prescribed study plan to start on current 9cmH_2O CPAP and follow in-house titration protocol. During this study CPAP was reduced from 9cmH_2O to 7cmH_2O (***Figure 1***). Gas exchange was stable and normal across all pressures however signs of obstruction (boxing of respiratory effort and flow limitation) were observed while supine on 7cmH_2O. Obstructive respiratory events did not achieve AASM scoring criteria and therefore pressure was not up titrated.

AutoCPAP was trialled as treatment during a follow-up study four months later. CPAP boundaries were prescribed from 5cmH_2O to 12cmH_2O (***Figure 2***).

Similarly in this study gas exchange was maintained within normal limits. Average pressure overnight was 9cmH_2O (7cmH_2O in QS and 10cmH_2O in AS). Supine sleep was recorded and there were no underlying signs of obstruction observed.

Conclusion: These studies illustrate the utility of AutoCPAP in paediatrics for treating sub criteria obstructive events when compared with a predetermined manual titration protocol. Future plans are to trial AutoCPAP further in selected patient groups and ages.

References:

1. Khaytin, I., Tapia, I.E. Beck, S.E. (2020). J.Clin.Sleep Med., 16(10), pp.1825–1826.

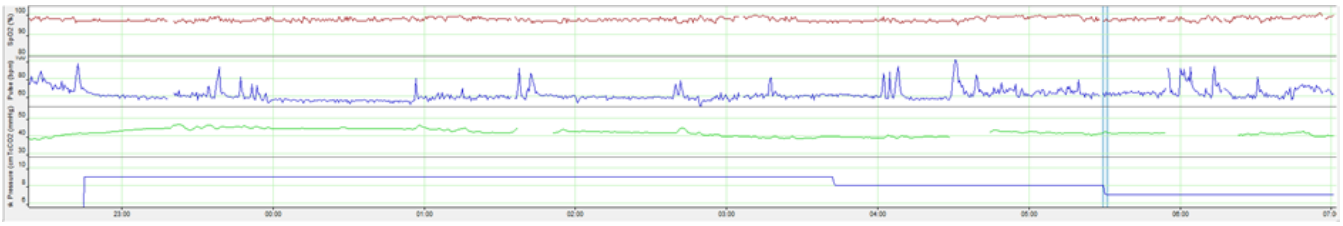

Figure 1: SpO_2, Pulse rate, $TcCO_2$ and CPAP (9-7cmH_2O)

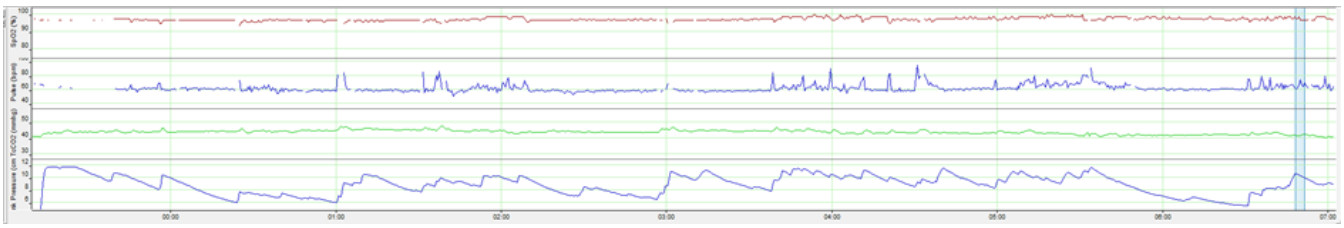

Figure 2: SpO_2, Pulse rate, $TcCO_2$ and CPAP Pressure (5-12cmH_2O)

WATCHPAT ONE VS NOX – AN AUDIT TO COMPARE THE DNA RATE, COST EFFICIENCY, STAFF TIME AND PATIENT TIME

Mr Michael Storey[1]
[1]*University College London Hospital NHS, London, United Kingdom*

Introduction: The Covid-19 pandemic encouraged many NHS departments to think of new, innovative and remote ways to provide the same, if not better level of patient care. We carried out a trial and subsequently, an audit to compare two different methods of home sleep study.

Methods: We took 300 NOX patients and 300 WatchPAT patients to compare 4 key variables that are often at the forefront when looking at the efficiency and convenience of patient care: DNA rate, cost efficiency, staff time and patient time. WatchPAT One appointments were done remotely via telephone, whilst NOX appointments remained face to face.

Results: We found that on average, a WatchPAT One home sleep study test when compared to a NOX home sleep study test resulted in a lower DNA rate (-11.7%), decreased amount of staff time (-18.48%), decreased amount of patient time (-94.62%), but at higher cost per appointment (+45.46%).

Conclusion: We conclude that overall, WatchPAT One studies offer a good alternative to NOX studies where quick and convenient OSA screening is needed.

ASSESSING THE COMMUNICATION REQUIREMENTS OF PATIENTS ATTENDING A NON-INVASIVE VENTILATION MULTIDISCIPLINARY OUTPATIENT CLINIC

Miss Amy Harrison, Mr Edward Parkes, Mrs Joanna Shakespeare
[1]*UHCW NHS Trust, Coventry, United Kingdom*

Introduction: As part of standard NHS care we performed a communication review to assess the communication difficulties that may occur when patients, including those with NMD (Neuromuscular Disease), COPD (Chronic Obstructive Pulmonary Disease), OHS (Obesity Hypoventilation Syndrome), RCH (Restrictive Chest Wall) and non-specified causes of chronic hypercapnic respiratory failure, attend the multidisciplinary (MDT) NIV clinic. The results of this review will allow us to understand the communication requirements of our patients allowing us to make any reasonable changes to our clinical practices.

Methods: When patients attended the NIV clinic between the dates of September 2021 and October 2021, we reviewed their communication. Data was collected over the above period of time which showed all of the patients that attended clinic, including if they had communication issues and, if they did, which aids they brought into clinic.

Results: In total, data of 56 patients were collected for the patient experience evaluation. Patient disease groups are shown in ***Table 1***. A total of 10 (18%) patients presented to clinic with communication difficulties. The majority (80%) of patients presented with communication difficulties associated with speech. Of the patients with communication difficulties 5 patients were assisted with a family relative or friend, 1 patient had a technology aid and 4 patients had no aids to support communication with the clinical team.

Conclusion: Our review highlights the communication needs of patients who attend the NIV MDT clinic. It is well evidenced that patients with NMD, specifically MND, are likely to develop communication difficulties associated with speech. The majority of patients who have communication difficulties regarding speech received support from a family member or friend. As health care professionals, our aim is to ensure that all patients have access to communication aids as part of equal and fair healthcare provision. The findings of our review will focus on implementing communication aids within our clinical practices to allow patients to partake in clinical care decision making.

Disease/Condition	Total number of patients (%)
COPD	12 (21)
RCWD	5 (9)
OHS	10 (18)
NMD	28 (50)
Other	1 (2)

Table 1

Minutes of the ARTP Annual General Meeting

Thursday 5th May 2022
Jurys Inn Hinckley Island Hotel
Chair: Julie Lloyd

1. Welcome

1.1 Julie Lloyd (JL), ARTP Honorary Chair, welcomed the audience that totalled 96 people and outlined the agenda for the AGM and the annual report that had been sent to all members prior to the AGM.

1.2 JL thanked the Board and the Council Members for their dedication and hard work this year.

2. Review of the ARTP Annual Report

2.1. JL gave an overview of the ARTP Annual Report, which had been made available to members before the AGM. JL reminded those present of the membership categories that have voting rights.

2.2. Eligible members present voted and the majority agreed to accept the Annual Report with no objections.

3. Membership report

3.1. JL informed of a slight decrease from 2020, which was likely due to the global pandemic and challenges faced in attending online events and attracting new members. JL confirmed that numbers of renewed ARTP members remains stable.

4. Financial report

4.1. Presentation of the Balance Sheet and Financial Statement for the year ended 31st March 2021

4.2. JL reported that the Statement of financial activity shows that the total funds are significantly lower than 2020, this is not surprising with the restrictions due to Covid, however with a review of our financial position we are confident we will be in a better position at end of next financial year.

4.3. JL reminded those present of the membership categories that have voting rights. Eligible members present voted and the majority agreed to accept the Accounts with no objections.

4.4. JL expressed acknowledgements for the support of the membership and manufacturers over the previous 12 months.

4.5. JL gave her thanks to Mike Lang (ARTP Treasurer) and to Executive Business Support (ARTP Support Services).

5. Officers for Election

5.1. JL advised that there are no officers for re-election this period. The Chair of Standards Peter Moxon, the Chair of Education Vicky Moore and the Chair of Events Kelly Pauley, have renewed for a further year.

5.2. Membership vote on:

5.2.1. The President of ARTP

5.2.2. The Secretary of ARTP

5.3. JL expressed thanks on behalf of ARTP to our Officers standing down, Dr James Hull ARTP President and Cara Roberts, Honorary Secretary

5.4. Following the ARTP Constitutional process, the role of ARTP President was nominated by ARTP Board and ratified by Council; the nominee for ARTP President was Dr William Man. Eligible members present voted and the majority agreed to this appointment with no objections and the nomination was accepted.

5.5. The role of ARTP Secretary following the ARTP Constitutional process, nominated Sara McArthur for the position. Eligible members present voted and the majority agreed to this appointment with no objections and the nomination was accepted.

5.6. After the voting was completed, a short video introduction was played introducing Dr William Man.

6. Notification of vacant and upcoming ARTP Committee positions

6.1. JL outlined further committee changes as follows:

6.1.1. New Workforce Chair (Max Thomas, current Vice Chair)

6.1.2. Spirometry Vice Chair (Vacant).

6.2. JL expressed her thanks to the outgoing post holders for their hard work and commitment during their tenure.

6.3. JL advised that the Spirometry and the Education committees have opportunities available for qualified students to take on roles as Mentors.

7. AOB

7.1. JL asked if there were any questions from the membership. No questions were raised.

8. Close

8.1. JL brought the AGM to a close and thanked the members present for their participation.

ARTP Association for Respiratory Technology & Physiology

Dear ARTP Membership,

It is a great honour to be nominated as the Honorary President of ARTP.

Respiratory physiology has always been and continues to be an important and integral part of my daily practice. My first proper respiratory job was over 20 years ago when I spent four years at King's as Professor John Moxham's PhD student studying respiratory mechanics, diaphragm and the peripheral muscles in COPD. With a supervisor like John Moxham, it was impossible not to fall in love with respiratory physiology! Now I am a chest physician and clinical academic with an interest in COPD, sleep and pulmonary rehabilitation so I am blessed to work clinically and academically with ARTP members every day.

With the NHS long term plans specifically acknowledging the importance of early and accurate diagnosis of respiratory disease, as well as the NHS reforms around the formation of community diagnostic centres, this is a really exciting time for ARTP. I will do my very best to help the executive committee keep the ARTP front and centre, and it is crystal clear to me that ARTP members are absolutely vital to the respiratory workforce. It is so important that policy makers are aware of this too and they do not plan respiratory services without taking into account the vital role that ARTP members play in delivering these services.

My respiratory career started in research and I am still very active in research. It would be remiss of me not to mention the many exciting research opportunities that exist in respiratory physiology. This is the era of wearable devices allowing continuous monitoring of ventilatory and respiratory variables, not just in sleep but also in daily life, and integrating this real time data with large data repositories will provide novel solutions for personalised respiratory medicine. This will include tele- monitoring of respiratory function. The respiratory lung function lab will no longer just be in hospital but also in the community and the patient's home. Artificial Intelligence is developing rapidly particularly in the field of interpretation, and this will help provide support for more mundane day to day activities and to support the workforce issues that will inevitably happen with the expansion of respiratory diagnostics within the NHS.

I am really looking forward to taking up the role and meeting many of you in the weeks and months to come.

Dr William Man
Consultant Chest Physician
Respiratory Medicine

ARTP Association for Respiratory Technology & Physiology

Would you like to get your region talking and support other local ARTP members?

ARTP are looking to recruit Regional Leads in the following areas;

South East

West Midlands

Northern Ireland

East of England

East Midlands

As a Regional Lead, you will be responsible for facilitating Regional Network Meetings (a minimum of 2 per year) and will feedback any topics discussed and matters of interest to the ARTP Network Co-ordinator. The purpose of these meetings is to promote discussion on regional and national matters and offer an opportunity to share departmental practices and information such as SOPS, policies, audits and research. Questions and problems raised during these meetings can also be cascaded to the ARTP Executive board for advice and resolution, if needed.

ARTP would also like to hear from members who would be interested in attending Regional Network Meetings.

For more information, please contact the ARTP Network Co-ordinator, Geraldine O'Connell-Ramsay, at **networkcoord@artp.org.uk**

ARTP National Strategy Day for Leaders in Respiratory and Sleep Science

ARTP are delighted to announce that this year's ARTP National Strategy Day will take place at Hilton Birmingham Metropole on 2nd December.

As always, the event is open to Heads of Departments and their deputies from all respiratory and sleep departments across the country.

Please hold the dates – and we will be in touch very soon with the full programme.

We look forward to seeing you in December.