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ARTP Association for Respiratory Technology & Physiology

Inspire

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INSIDE THIS ISSUE:

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ARTP Association for Respiratory Technology & Physiology

FIRST WORD

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Welcome to the latest 'Inspire'. This is the first issue since the excellent conference in Belfast so, as you may expect, it contains an 'On the Blower' packed with products from the exhibition and the beauty of the e-version is that you can click on each company logo to go the manufacturer website for further information. My thanks to Matt for producing it. Of course, this 'conference-special' issue also contains the abstracts from all presentations in an easy-to-browse format (I hope). The minutes from the AGM held at conference are also here and outline the amount of work the various ARTP committees contribute voluntarily.

Away from conference, we have the final part of Adrian Kendrick's series on the assessment of patients for elective surgery, this time concerning the role that sleep studies can play. I noted that an earlier article by the same author, on lung function via tracheostomy, was referred to in the ARTP-forum recently, so it is good to know these articles make an impact (and members can, of course, access via the ARTP website). Similarly, you may one day wish to refer to the ARTP Standards Committee-approved report on the test times for respiratory and sleep investigations. Our ARTP Chair provides details of some potentially exciting collaborations regarding the education of Clinical Physiologists in the future. It shows that ARTP is exploring new ways to deal with the increased demand for training.

What else? We have one article from an ARTP Education Bursary Award winner. Remember these are available for ARTP members to attend conferences—you can apply here. We also have shock news of a Respiratory Physiologist attending a cardiology course and (whisper it) enjoying it. There is an article on air pollution which I thought may be of interest so reformatted after agreement from the author (and was previously published in 'The Conversation'). Please let me know if you would like to see similar in the future, or indeed if there is anything else you would like included in future issues. Finally, I would like to welcome Suhilla Hashimi as the new 'Inspire' Deputy Editor and to thank the Editorial team.

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A WORD FROM THE CHAIR

Dr. Karl Sylvester

ARTP Honorary Chair

Another fabulous edition of Inspire ably compiled by our Editor and the editorial team. Lots of great content to read and 'inspire' you all, sorry!

I'm pleased to announce the start of some fantastic initiatives between ARTP and other organisations. Firstly we had our inaugural meeting of the ARTP/ BTS Joint Strategy Board. It was good to discuss our common areas of joint working. High on the list is the need to improve physiological education among the medical workforce. From the medical student right up to consultant level it was recognized that physiology is currently poorly understood and we need to put systems in place to correct this. A starting point is to organise a joint course with as much physiology as we can pack into one course. This has been approved by the BTS Education committee so once further approvals have been received look out for this and recommend it to the medical teams in your areas of work. It's also good to engage with your medical teams and offer them some support in understanding the physiology of what we do. From joint lung function reporting to providing monthly training sessions, I know that whatever support you can provide will be gratefully received.

The national initiative ensuring spirometry competency for everyone performing the test is now really taking off, being recognised by a number of organisations, including CQC, as an assurance of best practice. ARTP proudly take the lead in the initiative and our standards are the benchmark by which healthcare professional competency is assessed. We will also be holding the national spirometry register and hosting the national scrutiny board. This board will be overseeing the entire process and include other organisations with an interest in spirometry training. The first chair of the board will be Professor Mike Morgan, Respiratory National Clinical Director for NHS England. We can expect the uptake of spirometry training courses to steadily increase over the next 3 years. To ensure our ability to cope with this increase there will be some changes and improvements to the current process, so look out for these changes in the near future. If you currently don't offer spirometry training I would urge you to seriously consider it. See the website for more information on how to become an accredited centre.

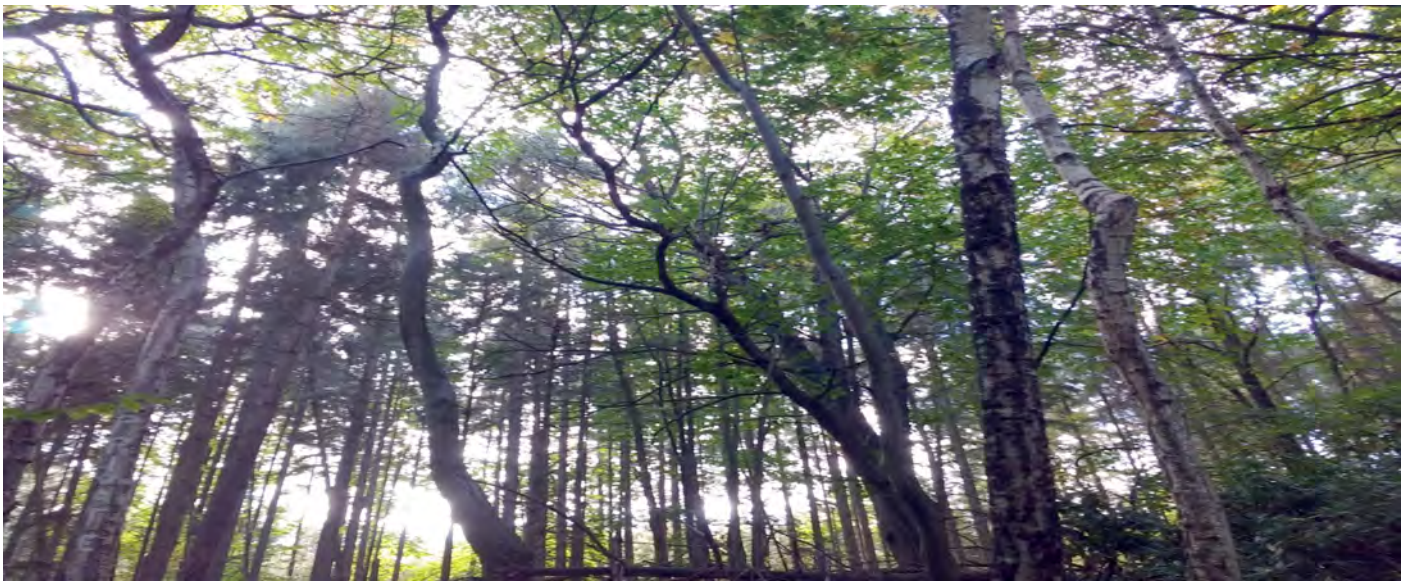
I'm pleased to announce the start of some fantastic initiatives between ARTP and other organisations.

With all of this talk of education I am delighted to announce that we are now working with the Institute for Clinical Science & Technology (IS&T), having

signed the contract just this week. IS&T are at the forefront of online education and will be helping ARTP to take their well respected taught courses into the digital age. IS&T produce some outstanding content in the form of animations and other captivating material to make learning much more interactive and engaging. Between us we have the vision to take ARTP to the next level in the delivery of respiratory and sleep education. Watch this space for courses such as blood gas analysis, lung function and cardio-pulmonary exercise being complimented with online content.

So, as ever, ARTP are engaged with outstanding collaborators to ensure that our message of quality assured standards in the performance and understanding of respiratory and sleep physiology goes from strength to strength. We can achieve far more together than we can alone.

Karl



Take a deep breath – here's what 2016 revealed about the deadly dangers of air pollution

From an article originally published on 'The Conversation', December 13 2016[1]. Republished under Creative Commons licence by permission of the author. Images, A. Laverty.

Gary Haq is a Human Ecologist and Senior Research Associate at the Stockholm Environment Institute at the University of York (UK). He is currently a visiting fellow at the EC Joint Research Centre's Sustainable Transport Unit (Italy). Gary has undertaken research on a wide range of environmental policy issues including air pollution, transport, behavioural change, older people and environment and policy impact assessment. He undertook the first assessment of air quality management in 20 Asia cities (Earthscan, 2007) and developed a foundation course on air quality management. He has co-ordinated regional and local campaigns to engage the public and raise awareness of climate change issues and foster behavioural change. He held the first UK workshop on Older People and Climate Change (2008). He is author of numerous reports and papers including Environmentalism Since 1945 (Routledge, 2012) and is co -author of A Short Guide to Environmental Policy to be published by Policy Press (2014).

Beijing[2], London[3], Mexico City[4], New Delhi[5] and Paris[6] are among the cities that have drawn attention for their dangerously high air pollution levels in 2016 – but they're not alone. The World Health Organisation (WHO) has confirmed that 92% of the world's urban population now live in cities where the air is toxic[7].

In India, a study[8] found that 41 Indian cities of more than a million people faced bad air quality on nearly 60% of the total days monitored. Three cities – Gwalior, Varanasi and Allahabad – didn't even manage one good air quality day.

Over on the African continent, dirty air was identified[9] as the cause of 712,000 premature deaths – that's more than unsafe water (542,000), childhood malnutrition (275,000) or unsafe sanitation (391,000).

In Europe[10], it was found that around 85% of the urban population are exposed to harmful fine particulate matter (PM2.5) which was responsible for an estimated 467,000 premature deaths in 41 European countries[11].

It's not all bad news though: 74 major Chinese cities[12] have seen the annual average concentrations of particulate matter, sulphur dioxide and nitrogen dioxide, decrease since 2014 although the Chinese government's "war on air pollution"[13] has received criticism.

The health impacts of air pollution are well documented; but now, new evidence suggests a link between air pollution and dementia[14] and Alzheimer's disease[15], with exposure to poor air quality equivalent to passively smoking six cigarettes a day[16]. Not only that, toxic air has been blamed for more road traffic crashes[17] from pollutants distracting drivers, causing watery eyes and itchy noses.

It is often poor, young, old and disadvantaged people who are worst affected by poor air quality. Air pollution is responsible for the deaths of 600,000 children under the age of five every year[18]. Ethnic minorities are more likely to be exposed to high pollution levels than other groups. In London, black, African and Caribbean people were exposed to higher illegal nitrogen dioxide levels (15.3%) because of where they lived, compared to the rest of the city's population (13.3%)[19].

Air pollution also affects regional climate, which impacts on future water availability[20] and ecosystem productivity. Black carbon is a particulate matter created through the burning of fossil fuels (such as diesel) and biomass. As well as effecting human health, it is responsible for glacial melting in the Himalayan and Tibetan Plateau[21]. Black carbon deposits on snow and ice darkens surfaces, resulting greater absorption of sunlight and faster melting.

Research from the World Bank[22] estimated that the global economic cost of air pollution-related deaths to be US$225 billion in lost labour income (in 2013) and more than US$5 trillion in welfare losses. The OECD[23] predicted that global air pollution-related healthcare costs will increase from US$21 billion in 2015 to US$176 billion in 2060. And by 2060, the global annual number of lost working days that affect labour productivity is projected to reach 3.7 billion – it is currently around 1.2 billion.

A number of creative ways of understanding and addressing the air pollution problem were seen throughout 2016. In London, racing pigeons[24] took to the skies equipped with pollution sensors and a Twitter account, to raise awareness of the capital's illegally dirty air. Amsterdam carried on the bird theme, with smart bird houses that light up to show the air quality status, while offering free Treewifi[25].

Other innovations included the development of an inexpensive over-the-counter inhaler[26] that protects the lungs against air pollution, and the installation of a seven-metre tall tower in Beijing, which sucks pollutants from filthy air[27].

Raising awareness of the causes and effects of air pollution is important, as we are not only victims, but also contributors to the problem. There have also been many air quality monitoring projects to engage citizens on air pollution issues such as "curious noses"[28], which saw Antwerp residents measure traffic pollution and "clean air zones"[29] in North Carolina, US, where individuals measured particulate matter in real time.

We've also seen awareness lead to action, when the demand for clean air led to ClientEarth[30] taking legal action against government failure to tackle illegal air pollution. Meanwhile, artists in London produced their own campaigns[31], aimed at warning young people about the effects of poor air quality.

This year the UN's New Urban Agenda[32], the Sustainable Development Goals[33] and the Breathe Life Campaign[34] called for action to improve urban air quality and deliver social, environmental and economic co-benefits.

Meanwhile, Paris, Mexico City, Madrid and Athens have pledged to remove all diesel vehicles from their streets by 2025[35], while promoting walking and cycling infrastructure. In Asia, a city certification programme[36] is being piloted to encourage cities to make advances in air quality management.

If anything, 2016 has showed us that poor air quality is a scourge of the developed and developing world alike – and that it requires immediate action. The evidence is clear: we need to clean up our act, to protect human health and reap the benefits of clean air for all.

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The Role of Respiratory and Sleep Physiology in the preoperative risk assessment of patients undergoing elective surgery

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Part III: Sleep Studies

So far...

This review outlines the case for the role of both the lung function and sleep services in the assessment of patients undergoing elective surgery.

Part I LUNG FUNCTION TESTING *('Inspire', August 2016)* showed the FEV_1 and the DLco are the two primary indices used in the assessment of patients for lung resection. The evidence for other indices, including arterial blood gases, non-invasive blood gases and measurements of static lung volumes is, in most cases, not supportive of their routine use however, may be used in some groups of patients. For instance, the measurement of static lung volumes may be appropriate in patients who have significant obesity, and blood gas measures may be useful in patients within known airflow obstruction.

Part II EXERCISE TESTING *('Inspire', December 2016)* assessed exercise testing, the tests of stair climbing, shuttle walk test, 6-minute walk test and CPET and surmised that the available evidence allow clear guidelines to be provided to those undertaking the assessment of patients.

Finally, SLEEP STUDIES are covered in this issue. Sleep constitutes about one-third of our day, and the prevalence of obesity leading in many to obstructive sleep apnoea is an important component of the pre-operative assessment. This should not be overlooked as there is evidence that sleep apnoea may present some difficulties in the post-operative phase.

The role of respiratory and sleep departments in the pre-operative assessment of patients is here to stay, and will increase the demands placed upon these services. Challenges, will include the assessment of an increasingly older population who wish to have surgery and this should be the case. None of the tests we undertake should be seen as preventing patients from having surgery, more they should be seen as advising the patient about the likely risks of having the surgery and possibly to explore appropriate alternatives.

Sleep Disordered Breathing Prevalence and Surgical Issues

A significant proportion of referrals to our Sleep Service in Bristol are from anaesthesiologists who are concerned about a patient who appears to have breathing problems during sleep, and they have decided to postpone surgery until they have a clearer understanding of whether sleep apnoea is a problem or not. This applies across all forms of surgery, including bariatric surgery (Neff & le Roux, 2013; Reed, Pengo & Steier, 2016).

Background: The United Kingdom has one of the fastest growing rates of obesity in the developed world (McPherson et al, 2007), with about a quarter of adults being obese and 2% morbidly obese, as of 2013 (HSCIS, 2013). The UK government estimates that potentially more than half of the UK population could be obese by 2050. The potential problems with obesity are related to an increase loading on the respiratory system (Steier et al, 2009; Steier et al, 2010a), which results in increasing breathlessness, and is associated with other conditions, which include obstructive sleep apnoea (OSA), asthma, pulmonary embolism and pneumonia (Zammit et al, 2010). There is therefore a potential for these patients to have adverse events occurring during or postoperatively, where if prior knowledge of the existence of the condition were in place, then additional precautions etc. can be instigated.

Why is all this so important? Patients with undiagnosed OSA may present a variety of perioperative concerns (Porhomayon et al, 2013). These include a higher incidence of difficult intubation, delirium, postoperative complications, myocardial infarction, acute hypercapnia, increased admissions to intensive care unit (ICU), and longer duration of hospital stay (Auckley et al, 2003; Hwang et al, 2008; Mador et al, 2013; Hiremath et al, 1998; Gupta et al, 2001; Liao et al, 2009; Kaw et al, 2012a; Kaw et al 2012b: Sabers et al, 2003; Gali et al, 2009; Vasu et al, 2012; Stieer et al, 2010b, Mokhlesi et al, 2013). These studies variously showed higher rates of postoperative complications.

In 2008, Chung, Yuan & Chung reviewed the literature in a systemic review and concluded that the literature supported an increased perioperative risk in patients with SDB/OSA. The American Society of Anesthesiologists (2006) guidelines aimed at reducing the risk of adverse outcomes in patients with OSA and to improve perioperative care. These guidelines were built upon scientific evidence from the research literature and opinion-based evidence of the ASA task force and consultant practitioners. The overall outcome of this extensive review was to suggest ways in which to screen for OSA in the preoperative setting and proposed various perioperative management strategies. It also highlighted the need for some quality research in this complex and difficult area.

The prevalence of OSA in the surgical population is higher than in the general population, and varies with the different surgical populations (Frey & Pilcher, 2003; Candiotti, Sharma & Shankar, 2009; Brenner & Goldman, 2014; Amra et al, 2014). However, it should be noted that at least one study did not find adverse outcomes attributable to OSA (Lockhart et al, 2013). In a further study (Karmatovskaia et al, 2014), there appeared to be no association between OSA or BMI and the development of acute respiratory distress syndrome (ARDS).

Kaw et al (2012a) observed in patients with OSA undergoing non-cardiac surgery, that there was a higher incidence of postoperative hypoxaemia, overall complications, ITU transfer, and increased length of hospital stay. In a large population-based study, Memtsoudis et al (2011) showed that OSA was associated with a significantly higher adjusted odds ratio of pulmonary complications after orthopaedic and general surgical procedures. Initiation of positive airway pressure therapy for patients with OSA can significantly decrease healthcare costs in the general population (Cai, Tan & Singer, 2012). The association between OSA and the incidence of postoperative delirium has been established recently (Flink et al, 2012; Bateman & Eikermann, 2012). With assessment and timely preoperative use of CPAP therapy the incidence of postoperative complications can be reduced in a bariatric surgical population with OSA (Weingarten et al, 2011).

In 2013, Singh et al, undertook a historical cohort study of 1085 patients, all of whom had had PSG or limited study. Surgeons and anaesthesiologists were blinded to the sleep study results. In 819 patients subsequently analysed, 111 (13.6%) had pre-existing OSA. Of these 111 patients, 64 (58%) were not diagnosed by the surgeons and 17 (15%) were not diagnosed by the anaesthesiologists. Of the remaining 708 patients, 267 patients with moderate to severe OSA, based on the AHI, 245 (92%) were not diagnosed by the surgeons and 159 (60%) were not diagnosed by the anaesthesiologist.

Anaesthetists, therefore, could potentially provide long-term health benefit to the patients with undiagnosed OSA by the implementation of screening for OSA, initiation of CPAP therapy perioperatively, and ensuring follow-up by the sleep physician after operation (Chung & Liao, 2010; Mehta et al, 2012).

Sleep Disordered Breathing - Screening by Questionnaire

Patients who are suspected of having OSA can be screened in the POAC service or when referred for lung function tests using two simple questionnaires – the Epworth score (Johns, 1992) and the modified STOP questionnaire (Chung et al, 2008) – the STOP-Bang questionnaire (Ong et al, 2010). There are alternatives that have been used, which include the Berlin Questionnaire (Netzer et al, 1999), the adjusted neck circumference (ANC; Flemons et al, 1994; Flemons, 2000) and the Sleep Apnoea of Sleep Disorder questionnaire (SA-SDQ; Douglass et al, 1994), which are included in this review for completeness.

Epworth Sleepiness Score (ESS): This established questionnaire indicates the propensity to fall asleep. It does not, as has been suggested in some circles, indicate that you have OSA. A normal score (0 – 10) suggests no significant daytime sleepiness, whereas a score of >15 indicates severe daytime sleepiness (SIGN, 2003). Importantly, a normal ESS does not exclude OSA and a high ESS does not necessarily include OSA, as there may be other reasons why an individual is sleepy in the daytime. The important point is that when combined with key clinical features of OSA – obesity, high collar size, snoring, reported apnoeas etc, the ESS gives an indication of OSA likely to be causing disturbed sleep, and hence daytime sleepiness.

Berlin Questionnaire: This questionnaire includes questions about snoring, daytime sleepiness, BMI and hypertension and is a validated screening tool which reliably identifies older persons in the community who are at a higher risk of OSA. The scoring is divided into three categories and is perhaps a little complicated to use routinely in busy outpatient clinics. The outcome is either “high-risk” or “low-risk” for OSA as if a patient is positive in at least two of the three categories, then the patient is high-risk (Netzer et al, 1999).

Sleep Apnoea questionnaire (SA-SDQ): This was developed by Douglass et al (1994) and contains eight questions and four items related to weight, smoking status, age and BMI. Each question in answered using a 5 –point scale, resulting in a maximal score of 60, with generally cut-off scores for identifying OSA as 36 in men and 32 in women.

Adjusted Neck Circumference (ANC): The ANC is calculated by measuring the patient’s neck circumference (in centimetres) and adding additional centimetres if there is a history of hypertension (4 cm), habitual snoring (3 cm), and nocturnal choking (3 cm). A score of < 43 indicates a low probability of sleep apnoea, whilst a score of 43 - 48 intermediate probability (4 to 8 times as probable as low probability), and a score of > 48 indicates a high probability (20 times as probable).

STOP-Bang questionnaire: This was a development of the STOP questionnaire. The title stands for Snore, Tiredness, Observed, Pressure – BMI, Age, Neck circumference and Gender. There are 8 questions scoring a “1” for “Yes” and a zero for “No”. The higher the score, the higher the risk of having OSA (Figure 1). The questionnaire can be accessed at http://www.stopbang.ca/osa/screening.php

This questionnaire has been validated in a number of surgical populations and is now used in preoperative clinics and has been reviewed in relation to its application in a range of disorders (Chung et al, 2008; Abrishami, Khajehdehi & Chung, 2010; Vasu et al 2012; Silva et al, 2011; Farney et al, 2011; Chung et al, 2012a; Nicoll et al, 2013; Singh et al, 2013; Corso et al, 2014; Nunes et al, 2015; Kim et al, 2015; Nagappa et al, 2015; Reed, Pengo & Steier, 2016).

Chung et al (2008) developed the STOP questionnaire in patients attending a preoperative clinic and many also had a polysomnography study. Effectively the STOP questionnaire identified those patients with OSA. The modification – the STOP-Bang questionnaire had excellent sensitivity of 83.6%, 92.9% and 100% in pre-operative patients with an AHI of > 5, > 15 and > 30 events/hour. In their systematic review, Abrishami et al (2010) analysed 9 prospective studies and one retrospective study. Only three of the studies were specifically highlighting pre-operative assessments. The review assessed the Berlin, the STOP and the STOP-Bang questionnaires, and concluded that there was inconsistency between the outcomes, but the STOP-Bang as more appropriate for screening for OSA in surgical populations.

Vasu et al (2012) in their review of different studies noted that in their single study that used the STOP-Bang (Vasu et al, 2010), those patients identified as having a high risk of OSA, had more post-operative complications and had a longer stay in hospital.

In their review of questionnaires, Silva et al (2011) compared the use of a four-variable screening tool (Takegami et al, 2009), the STOP, the STOP-Bang questionnaires and the Epworth Sleepiness Score. They noted that of the 4770 subjects studied, 603 had moderate to severe SDB and 345 had severe SDB and in these, the STOP-Bang had the higher sensitivities at 87% and 70.4% respectively when compared to the Epworth (39% and 46%) the STOP (62% and 68.8%) or the 4-variable (24.7% and 41.5%).

Farney et al (2011) attempted to categorize the severity of OSA into 4 categories ranging from none to severe in 1426 patients using the STOP-Bang questionnaire. They noted that the sensitivity for an AHI > 15/hr and > 30/hr were similar to those of Chung et al (2008). Where

scores are from 6 – 8, then the probability of having severe OSA is high. If the score is 3 – 5, the probability of having mild, moderate or severe OSA are more evenly balanced. There is insufficient discriminatory power to separate out no, mild and moderate OSA. The authors concluded that this questionnaire may be useful to categorize OSA severity, triage patients for diagnostic evaluation or exclude from harm.

Chung et al (2012a) assessed the use of the STOP-Bang questionnaire in a surgical population of 746 patients.

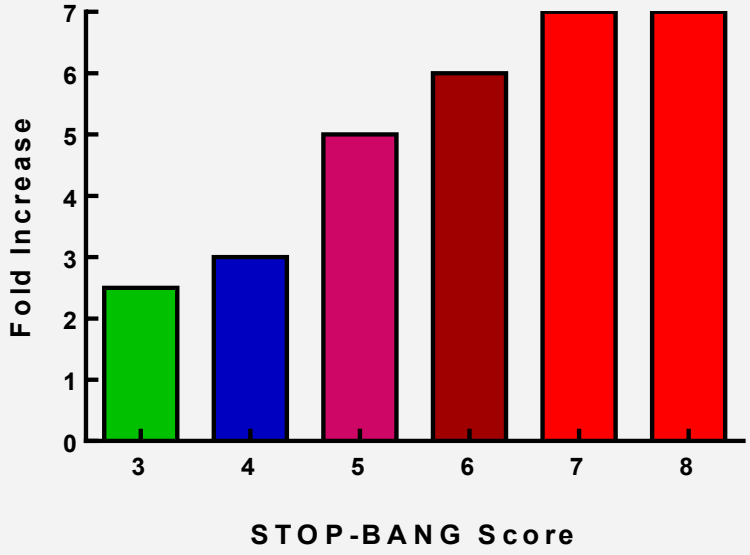

Figure 1. The increased risk of suffering from Moderate or Severe Obstructive Sleep Apnoea in relation to the STOP-BANG score when comparing each score from 3 to 8 with the score 0 – 2. Data from Chung F, et al (2008) and Chung et al (2012)

They noted that a score of 5 – 8 identified patients with a high probability of moderate/severe OSA. The authors concluded that this questionnaire can assist in stratifying patients for unrecognized OSA or triage patients for diagnosis and treatment.

Nicholl et al (2013) assessed the use of the Berlin, the STOP-BANG and the Adjusted Neck Size questionnaires (Flemons et al, 1994; Flemons, 2002) in patients with end-stage renal disease (ESRD) and chronic kidney disease (CKD). OSA is common in both clinical situations ranging from 27% to 54% in CKD and 45% to 70% in ESRD patients, although OSA may be unrecognized in these patients with potentially significant clinical implications. Of the 109 CKD and the 63 ESRD patient, 38% and 51% of patients had OSA. The authors concluded that in this group of patients, none of the three screening tools accurately identified OSA, and that these patients should have objective cardiopulmonary monitoring to reliably identify OSA in these patients.

Singh et al (2013) undertook pre-operative screening with the STOP-Bang questionnaire and a polysomnographic study (PSG). Importantly, at the time of this study, screening for OSA was not part of standard preoperative assessment. The range of surgery included Ear Nose & Throat, gynaecology, ophthalmology, spinal and orthopaedic. Of the 819 patients who had a PSG, 111 (13.5%) had pre-existing OSA. Of the remaining 708 patients, 223 (31.5%) had an AHI of £ 5/hr and 119 an AHI > 30/hr.

When reviewing the observations of the anaesthetists and surgeons regarding patients with moderate to severe OSA and comparing their observations to the prediction of “at risk” using the STOP-Bang questionnaire, 159/267 (60%) and 245/267 (92%) were missed respectively, whilst the STOP-Bang questionnaire identified 92.5% and 93.1% of patients respectively. This study therefore suggests that closer attention should be paid to screening for possible OSA either as “at risk” or “high risk” using scores of 3 or more and 5 or more respectively.

Corso et al (2014) studied 3452 pre-operative patients scheduled for elective surgery using a cut-off of ≤5 (Chung et al, 2012). Of the 3452 patients, 28997 (87%) were identified as low OSA risk, and 455 (13%) as high OSA risk patients. Operations included abdominal, head & neck, thoracic, genitourinary, vascular and orthopaedic across both the high risk and the low risk groups. Patients in the High-OSA risk group had more post-operative complications, but it is noted that High-OSA risk patients were older, had higher BMI’s and were

predominately male. Figure 2 shows the range of Odds ratios when comparing different variables and their outcomes. This study demonstrated that the prevalence of High-risk OSA patients is high and that the use of a questionnaire such as STOP-Bang with a cut-off of ≤5 should be part of the triaging process.

In connection with coronary artery bypass grafting (n = 40) and abdominal surgery (n = 41), Nunes et al (2015) evaluated the use of the Berlin questionnaire, the Epworth score and the STOP-Bang questionnaires and used polysomnography to assess for the severity of OSA. The outcomes are summarized in Figure 3. The STOP-Bang questionnaire had a high sensitivity in both groups. CABG and Abdominal surgery patients had different sleep patterns and levels of daytime sleepiness. The authors concluded that the presenting symptoms and surgical population may affect the performance of the screening questionnaires.

Kim et al (2015) assessed the diagnostic value of the three questionnaires – Berlin, SA-SDQ and STOP-Bang in a sleep outpatient clinic. In their cohort of 592 patients, 83.6% had an AHI ≥5/hr and 58.4% an AHI ≥15/hr. The STOP-Bang questionnaire had a sensitivity of > 97% regardless of AHI, but had, as noted in other studies a low specificity. SA-SDQ had poor sensitivity (< 75%) but better specificity (> 61%). The Berlin questionnaire fell between the STOP-Bang and SA-SDQ. The authors concluded that the STOP-Bang questionnaire may be useful for screening OSA in a sleep clinic but has a low specificity, which may limit its use.

Nagappa et al (2015) undertook a systematic review and meta-analysis of the STOP-Bang questionnaire as a screening tool for OSA in different populations. In their review, they included 17 studies which totalled 9,206 patients. In the sleep clinic population, the sensitivity to detect any OSA (AHI > 5), moderate to severe OSA (AHI ≥15) and severe OSA (AHI ≥30) was 90%, 94% and 96% respectively. Similar sensitivity was observed in the surgical population. The probability of OSA in a sleep clinic population with a score of ≤3 was 25%, which rose to 75% with a score of 7/8. The probability of OSA in a surgical population with a score of ≤ 3 was 15%, which rose to 65% with a score of 7/8. This review confirmed the usefulness of the STOP-Bang questionnaire in both sleep clinic and surgical groups. The higher the score, the greater the probability of moderate to severe OSA.

The final study in this review is that of Reed, Pengo and Steier (2016) who used the STOP-Bang questionnaire in a bariatric population. Using a cut-off of ≥4 patients were referred for screening pulse oximetry. They observed SDB in 73% (103/141) patients, with 13/141 (9%) having severe OSA and 38/141 (27%) having no OSA. The authors concluded that using the STOP-Bang questionnaire with a cut-off of ≥4 is useful in screening this population for OSA, with around 50% of the population requiring a plan for their respiratory management perioperatively.

Review: In a recent review, Chung et al (2016) have provided a suggested practical two-stage approach to the use of the STOP-Bang questionnaire, whereby patients with a score of 0 – 2 have a low risk for moderate to severe SDB/OSA, whilst patients with a score of 5 – 8 have a high risk.

The group where there is a score of 3 – 4 represent the "grey area" and this has been further delineated from intermediate risk to high risk, where the following combinations occur –

STOP ≥2 + Male

STOP ≥2 + BMI > 35 $kg.m^{-2}$

STOP ≥2 + Neck circumference > 40 cm (15.75 inches)

STOP ≥3 + serum HCO_3^- ≥ 28 $mmol.L^{-1}$

The last point is interesting in that this adds a new dimension to screening, whereby a standard venous blood sample for U&E's can be collected and the bicarbonate component assessed. This would normally be undertaken within POAC anyway, but could be undertaken both in Respiratory and Sleep services.

The reasoning behind this is that we know chronic daytime hypercapnia (PaCO2 > 6 kPa) is observed in up to 38% of patients with OSA (Mokhlesi, 2010) and as the severity of OSA increases, the risk of chronic daytime hypercapnia may also increase (Kaw et al, 2009). Serum bicarbonate (HCO3-) may increase in moderate to severe OSA without meeting the criteria of overt chronic daytime hypercapnia, as observed in the obesity hypoventilation syndrome (Kaw et al, 2009). Obesity hypoventilation syndrome is defined by daytime hypercapnia and hypoxemia (PaCO2 > 6 kPa and PaO2 < 9.33 kPa) in a patient with a BMI > 30 kg.m-2 who has SDB/OSA without any other known cause of hypoventilation (Mokhlesi, 2010). As nocturnal intermittent hypercapnia resulting from to SDB/OSA may result to renal $HCO3^-$ retention to compensate for acute respiratory acidosis it may result in raised serum $HCO3^-$ (Norman et al, 2006). Chung et al (2013) observed that serum $HCO3^-$ is significantly correlated to AHI and the addition of serum $HCO3^-$ ≥28 $mmol.L^{-1}$ to a STOP-Bang score ≥ 3 improves the specificity to predict moderate to severe OSA but decreases its sensitivity. Under that condition a STOP-Bang score of ≥ 3 plus $HCO3^-$ ≥ 28 $mmol.L^{-1}$, the specificity for detecting moderate to severe OSA increases from 30% to 82%, and from 28% to 80% for detecting severe OSA.

Conclusions: Identifying patients who may be at risk of OSA in patients attending a preoperative assessment centre may be assessed by the use of questionnaires, the simplest of which appears to be the STOP-Bang questionnaire. Any patient with a score ≥3, when seen in POAC or for assessment in a respiratory department should be highlighted to the referring team for further assessment, which should include at least overnight oximetry and a clinical history taken by an experienced SDB practitioner. Higher scores indicate increased probability of OSA.

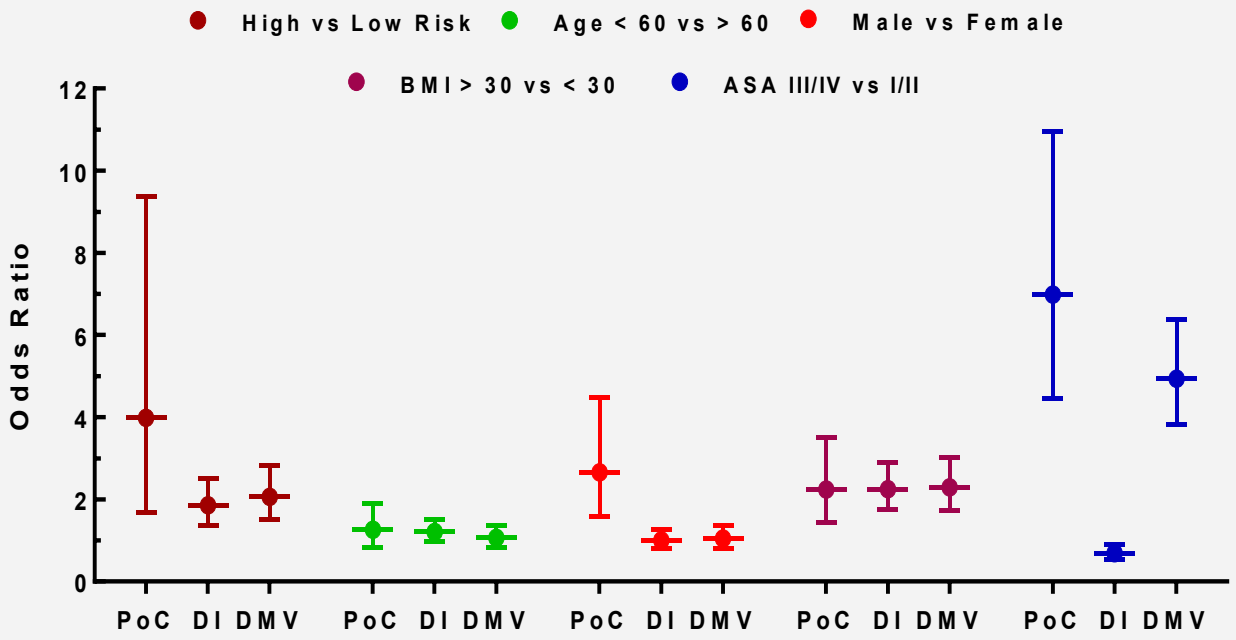

Figure 2. Odds ratios (OR) when comparing different variables in terms of Postoperative complications (PoC), difficult intubation (DI) and difficult mask ventilation (DMV). Data are shown as OR ± 95% confidence intervals. An odds ratio of > 1 indicates an effect when comparing the differences between the stated variables. Data from Corso et al (2014).

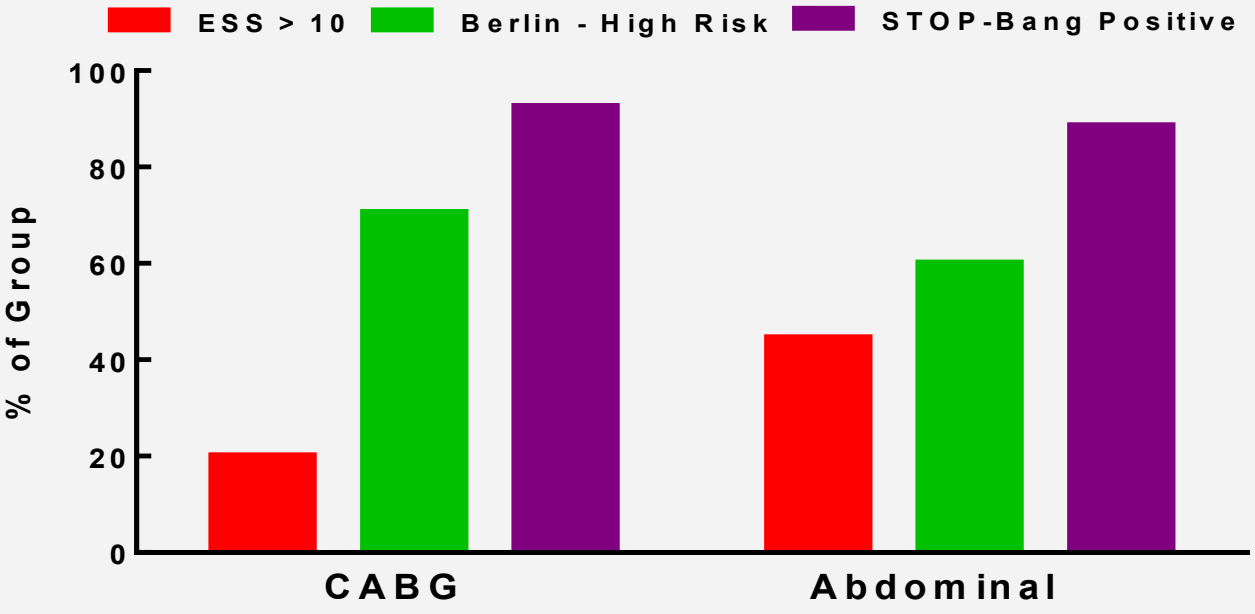

Figure 3. Percentage of each group with ESS > 10, Berlin High Risk category and a positive STOP-Bang using a cut-off of ≥ 3. There were 40 CABG patients and 41 abdominal surgical patients. Data from Nunes et al, (2015).

Paediatric Population

Children who have symptoms of sleep disordered breathing (SDB) or OSA should be identified before a general anaesthetic, as they are particularly vulnerable to perioperative respiratory adverse events (PRAEs). These events include airway obstruction, laryngospasm, bronchospasm, and breath holding, potentially leading to significant falls in oxygen saturation (Tait et al, 2013).

Coté et al (2014) investigated factors related to adverse events in children occurring during or after tonsillectomy, with an emphasis on OSA. Of the 111 cases analysed, death or permanent neurologic injury occurred in 77% (86/111), with death being the most common outcome (66%). Of the 86 cases, 63 (57%) fulfilled the ASA criteria of being at risk of OSA.

Sleep-disordered breathing is estimated to occur in 4% to 11% of school-aged children (Lumeng & Chervin, 2008), whilst the incidence of OSA is estimated to be between 1% to 3% (Brown, 2011). These events are characterised by recurring episodes of complete and/or partial obstruction of the upper airway during sleep, resulting in intermittent hypoxemia, hypercapnia, frequent arousals, and sleep fragmentation (Certal, et al 2012). What should be of concern is that a significant number of patients with SDB and OSA remain undiagnosed when going for surgery due to a lack of awareness and a parental underestimation of the issues (Certal et al, 2012).

Most children receive pain medication after surgery, yet exposure to chronic intermittent hypoxemia renders patients with OSA more susceptible to the respiratory depressant effects of opioids and more sensitive to the analgesic effects of opioids compared with patients without OSA (Schwengal et al, 2009).

Brown et al (2006) demonstrated the total analgesic opiate dose in children with OSA and recurrent hypoxemia was one-half of the dose required in children without such a history. From this observation, it is noted that the standard weight-based dose of an opioid medication may result in significant respiratory depression leading to hypoxia and hypercarbia in a child with OSA.

The current gold standard for diagnosis of OSA is polysomnography and may be used to determine the severity of SDB through assessment of obstructive breathing during sleep and scoring of the apnoea-hypopnoea index (AHI). Dayyat et al, (2007) suggest an AHI exceeding 1 event per hour of sleep in children is abnormal, but with OSA, the AHI may range from 1 to more than 100 events per hour. An AHI of >10, is classified as severe OSA in the paediatric population. Polysomnography is expensive and has limited availability thereby reducing its usefulness as a screening tool for routine preoperative use. An alternative is to use screening questionnaires devised specifically for use in a paediatric population.

The Sleep-Related Breathing Disorder scale of the Paediatric Sleep Questionnaire developed by Chervin et al (2000) is a 22-item SDB screening questionnaire validated in children aged 2 to 18 years. This was further validated by the same group in 2007 (Chervin et al, 2007). The scale predicted polysomnographic results as a useful guide for research, but unable to predict for an individual patient, except when predicted OSA-related neurobehavioural morbidity and its response to adenotonsillectomy.

Tait et al (2013) validated a paediatric screening questionnaire called the Snoring, Trouble Breathing, Un-Refreshed (STBUR) questionnaire. The STBUR questionnaire is composed of the 5 symptoms from the Sleep-Related Breathing Disorder questionnaire that were strongly predictive of PRAE. These were, in response to the question “While sleeping, does your child…..”

1. …..snore more than half the time
2. …..snore loudly
3. …….have trouble breathing, or struggle to breathe
4. Have you ever seen your child stop breathing during the night?
5. Does your child wake up feeling unrefreshed in the morning?

The authors found that the likelihood of developing PRAE was increased 3-fold with any three STBUR symptoms and 10-fold with all 5 symptoms present. The STBUR questionnaire compared favourably with both the 22-item Sleep-Related Breathing Disorder scale and polysomnography in identifying children at risk of PRAE, when related to undiagnosed SBD.

Spruyt and Gozal (2012) published a set of 6 hierarchically arranged questions that used clinical severity scales and were based on commonly used subjective respiratory symptoms assessed by the parent, which can also be used to screen for symptoms consistent with paediatric SDB. These questions were –

1. Do you ever shake your child to make him/her breathe again when asleep?
2. Does your child stop breathing during sleep?
3. Does your child struggle to breathe while asleep?
4. Are you ever concerned about your child’s breathing during sleep?
5. How loud is the snore?
6. How often does your child snore?

Using a 5-point Likert scale (0 to 4), a score for each question can be estimated. Relating the questionnaire scores to the severity of the AHI from polysomnography demonstrated the ability of these six hierarchical questions to indicate the potential for SDB and OSA in their study population aged 5 to 9 years (Figure 4). A cut-off of > 2.72 for the score was predictive of SDB and OSA.

More recently, Terry et al (2015), have undertaken a quality improvement program, whereby the STBUR questions were embedded into the electronic patient record used as part of the pre-operative screening process. This study showed that PRAE risk identification increased by 50% and that embedding these questions into the electronic record significantly improved identification of patients potentially at risk. This then allowed better perioperative management of these patients.

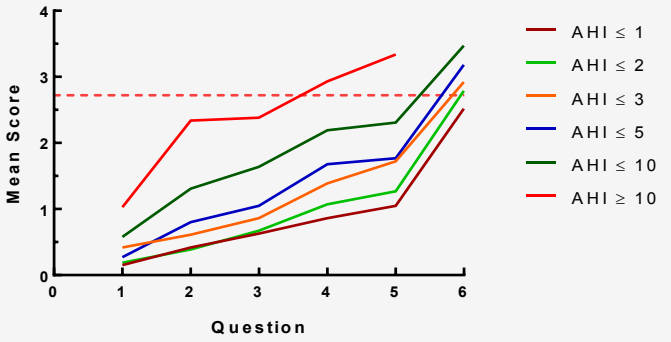

Figure 4. Severity hierarchy relating mean score against six hierarchical questions. Based on the analysis of the data, a mean score cut-off of > 2.72 (hashed line) is applicable for confirmatory purposes. Data from Spruyt & Gozal (2012).

Sleep Disordered Breathing - Screening by Overnight Studies

Assessment of suspected SDB/OSA is important to ensure that any treatment can be instigated prior to surgery, and that appropriate management before, during and after surgery are in place. Confirmation of the presence of SDB/OSA should be by using a minimum of pulse oximetry, but where there is doubt, then a minimum of a limited/semi-polysomnographic study should be employed.

The principal issues are:

1. The potential impact on resources available within a given service to assess patients for SDB/OSA,
2. The economic costs and impacts that not screening for SDB/OSA may have in the postoperative period and
3. How this fits into a clinical pathway, such as the cancer pathway, where time schedules may dictate how quickly a test/service needs to be provided.

In the UK, the majority of hospital services should be able to provide simple screening for SDB/OSA in a timely manner. Beyond simple screening however, may prove to be more difficult because of resources and availability of equipment etc. Whilst we are aware of the potential economic impact and costs in the postoperative period in terms of additional bed days, complications etc, this is rarely fully evaluated (Brenner & Goldman, 2014; Memtsoudis et al, 2014; National Clinical Guideline Centre, 2015), to the extent that there is a significant paucity of quality data in this area. In terms of clinical pathways, these will often have time limits placed upon them, where “breaching” may occur and needs to be avoided. Whilst this may not be a significant problem, this may, on occasions put pressure on a service to deliver very quickly, even where clinically it is safe to delay final decisions for a reasonable period of time.

Pulse oximetry

This is the simplest form of assessment and has been used in a few studies (Isono et al, 1998; Gupta et al, 2001; Hwang et al, 2008; Chung et al, 2012b; Reed, Pengo & Steier, 2016).

Isono et al (1998) noted that postoperative SDB is potentially significant in terms of postoperative complications such as mental dysfunction, myocardial infarction and sudden unexplained postoperative death (Rosenberg et al, 1990; Rosenberg et al, 1992; Rosenberg et al, 1994; Aakerland & Rosenberg, 1994; Rosenberg-Adamson et al, 1996). At the time of this study, it was believed that OSA affected 2 – 16% of the adult population. The authors assessed pulse oximetry

before and after surgery and observed that preoperative hypoxaemia and apnoea witnessed by others were highly correlated with postoperative hypoxaemia.

Gupta et al (2001) studied 101 patients undergoing hip or knee replacements. They predominately used PSG, but about 16% were assessed using pulse oximetry. Regardless of the methodology, they observed significant post-operative complications in 39/101 patients who has OSA compared to only 18/101 matched controls without OSA. There was also a higher rate of transfer to ITU (25% vs. 9%) and an increased length of stay.

Hwang et al (2008) studied 172 patients using only pulse oximetry. Patients with an 4% ODI ≥5/hr had a significantly higher rate of postoperative complications than those with 4% ODI < 5/hr (15.3% vs 2.7%) with an adjusted odds ratio of 7.2. The complication rates increased with increasing ODI severity.

The authors concluded that an 4% ODI ≥5, determined by home nocturnal oximetry, in patients with clinical features of OSA, is associated with an increased rate of postoperative complications.

Malbois et al (2010) compared the sensitivity of nocturnal oximetry to ambulatory monitoring in order to identify patients with sleep apnoea prior to undergoing bariatric surgery. Pulse oximetry with a 3% ODI, used as a screening tool for OSA, was able to rule out significant OSA, defined as an AHI > 10, and hence detect patients with severe OSA. The authors concluded that using oximetry with 3% ODI was useful as a screening tool for OSA, was cheap and widely available and could therefore accelerate the preoperative work-up of these patients.

Chung et al (2012b) used a high resolution pulse oximeter (Pulsox 300i, Konica Minolta Sensing Inc, Osaka, Japan), which has a sampling memory of 1 Hz and an averaging time of 3 seconds. Data from this device was compared to unattended polysomnography in the patient's home in 475 patients as part of their presurgical assessment for a range of surgical procedures, including orthopaedic, spinal and general surgery. The 4% ODI > 10/hr had a sensitivity of 93% and a specificity of 75% to detect moderate and severe OSA and therefore provided a simple, cost effective method of screening patients with suspected OSA.

Reed, Pengo and Steier (2016) using the same pulse oximeter as Chung et al (2012b) in a bariatric population identified patients with a STOP-Bang score of ≥4. Of the 103 patients identified at greater risk using the STOP-Bang score, 47% were identified as having mild to severe OSA using a 4% ODI.

It is noted in their discussion that in the UK in 2006, only 500 bariatric procedures were undertaken, this rising to > 6,000 in 2013 (Welbourn et al, 2014). Translating these figures into the potential number of patients who may have mild to severe OSA suggests that we may need to be screening, using pulse oximetry, around 3,000 patients per year, assuming a prevalence of 47% as identified in this study. However, two previous studies have observed a prevalence of 78.3% (Lopez et al, 2008) and 77% (O'Keeffe & Patterson, 2004), using polysomnography, which would suggest a potentially larger problem that may need assessing. Identifying these patients, and treating them with NIV could potentially optimise peri-operative management of these patients.

Conclusions: Clearly, pulse oximetry is a viable screening tool which will provide a quick turnaround for assessments of patients undergoing surgical procedures. The majority of studies have used a 4% ODI, and this seems to provide a reasonably accurate methodology in determining who does or does not have SDB/OSA. A 3% ODI may be more sensitive and probably relates better to hypopnoeas than a 4% ODI. One important point is that where the clinical history and possibly the STOP-Bang score is ≥4, a negative 3% or 4% ODI may require a more complex study to assess whether SDB/OSA is present.

Polysomnography

This is clearly the definitive methodology to assess whether SDB/OSA is present, but is a limited resource in the UK, and those centres who have dedicated facilities to study patients' in-lab are probably already overburdened with work.

In-lab polysomnography studies have been undertaken by a number of authors in a range of pre-operative surgical (Gupta et al, 2001; Sabers et al, 2003; Kaw et al, 2006; Hallowell et al, 2007; Ahmad et al, 2008; Luizaga et al, 2010; Singh et al, 2012; Kaw et al, 2012).

Many of these studies were retrospective analysis of databases to determine whether postoperative complications occurred, which was not always the case (Sabers et al, 2003; Ahmad et al, 2008). In one study, where mandatory OSA screening occurred, adverse respiratory events were effectively eliminated (Hallowell et al, 2007).

One alternative is to undertake unattended studies in the patients' own home (Malbois et al, 2010; Chung et al, 2012; Singh et al, 2012; Nicholl et al, 2013). In these studies, there was no reported failure of studies, although some patients did refuse to undertake such studies (Nicholl et al, 2013). In the study by Singh et al (2012), two groups were studied, the initial group using in-lab PSG and a second group were studied using a

validated in-home system.

In terms of what is actually required to define the presence of SDB/OSA, the "sleep" component of the polysomnographic study could be ignored, and hence a limited or semi-polysomnographic study, just including the measurement of airflow, thoracic and abdominal movements and pulse oximetry would suffice. The debate however regarding the appropriateness of home versus laboratory studies and in which patients this should be applied to continues (Corral-Peñafiel, Pepin & Barbe, 2013; Walia et al, 2014). An algorithm presented in the article by Corral-Peñafiel, Pepin & Barbe (2013) provides useful guidance as to when a home study should be considered and when a laboratory study should be used.

One possible solution would be to use additional home-based systems run simultaneously with laboratory based systems using telematic data transmission (Bruyneel et al, 2013). The laboratory operator can be in touch with the home-based patients via telephone or Skype to ensure that signal quality etc. is maintained.

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ARTP EDUCATION BURSARY

An Investigation of the correlation between Alveolar Volume (VA) and Total Lung Capacity (TLC) in a cohort of patients referred for lung function testing

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Faculty of Science and Engineering, University of Wolverhampton[2]

Introduction: Previous studies suggest significant underestimation of V_A compared to TLC in obstructive lung disease. Lung function tests; Spirometry, Lung volumes (via multi-breath He dilution) and Gas transfer (single breath CO-Jones Meade method) monitor presence of lung disease, severity and treatment response. Gas transfer calculates V_A, an estimation of TLC (using CH_4) to determine restrictive disease (fibrosis) and obstructive disease (hyperinflation in COPD). A suitable surrogate for TLC in normal subjects is V_A, agreeing within 300-350ml[1].

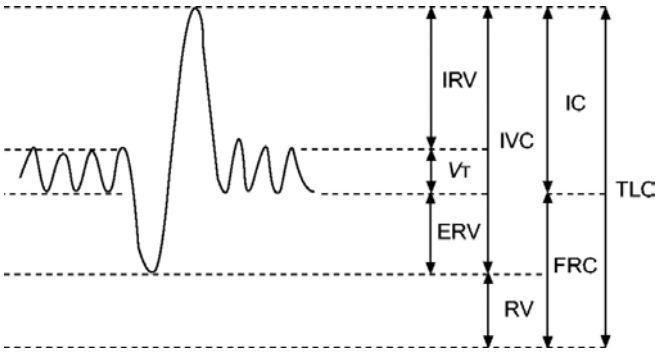


Fig. 1 Measured static lung volumes and capacities (Wanger *et al.,* 2015)[4]

Aims & Objectives: The aim of this study was to identify if V_A could be used as a surrogate for TLC in patients with normal, obstructive and restrictive ventilatory defects.

This would have the potential to reduce test time and therefore have a direct impact on the patient waiting list.

All data obtained was anonymised, complying with patient confidentiality and data protection. The study was registered with the Trust Research Department as a Service Review.

Method: This was a retrospective data analysis. 587 subjects underwent spirometry, lung volumes via multi-breath helium dilution and single-breath transfer factor for carbon monoxide. After receiving Trust approval, data from the local database (nSight, nSpire Health, USA) was reviewed (September 2013) and categorised using a Graph Pad Prism spread sheet, including; Gender, age at diagnosis, height, weight and testing parameters (FEV_1, FVC, PEF, FEV_1/FVC, FRC, TLC, RV, VC, TLco, V_A and Kco).

The inclusion criteria consisted of subjects with reproducible results with accordance to the ERS

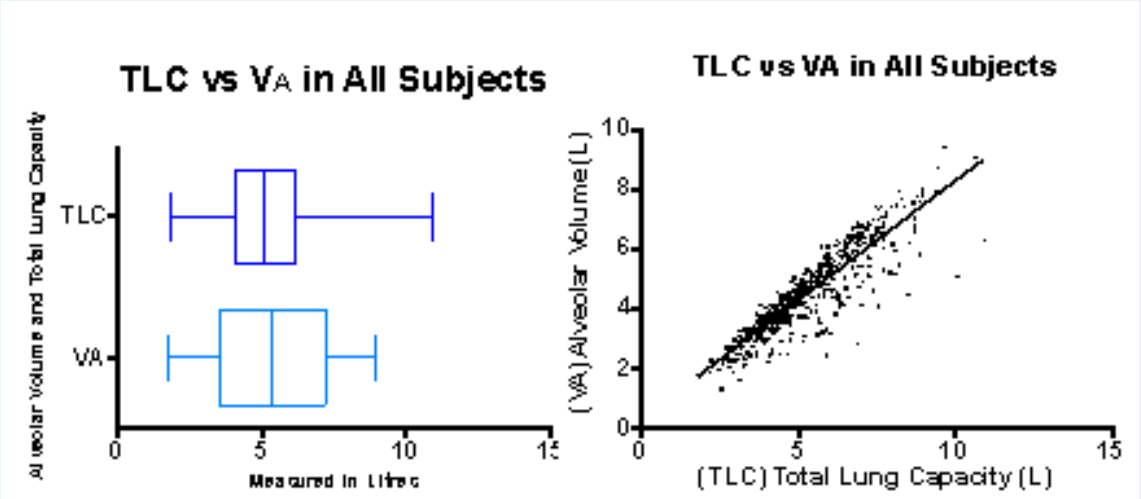
2005 acceptability criteria[2] using the nSpire CPL equipment. Whereas, subjects with technically unacceptable results, results performed via the nitrogen washout/whole body plethysmography methods were excluded. As well as subjects that presented with mixed ventilatory defects.

Subjects were classified as normal, obstructive or restrictive pattern using standard residuals (SR's) and determined by FEV_1/FVC ratio and TLC. Obstructive patients were further subdivided in to mild, moderate and severe.

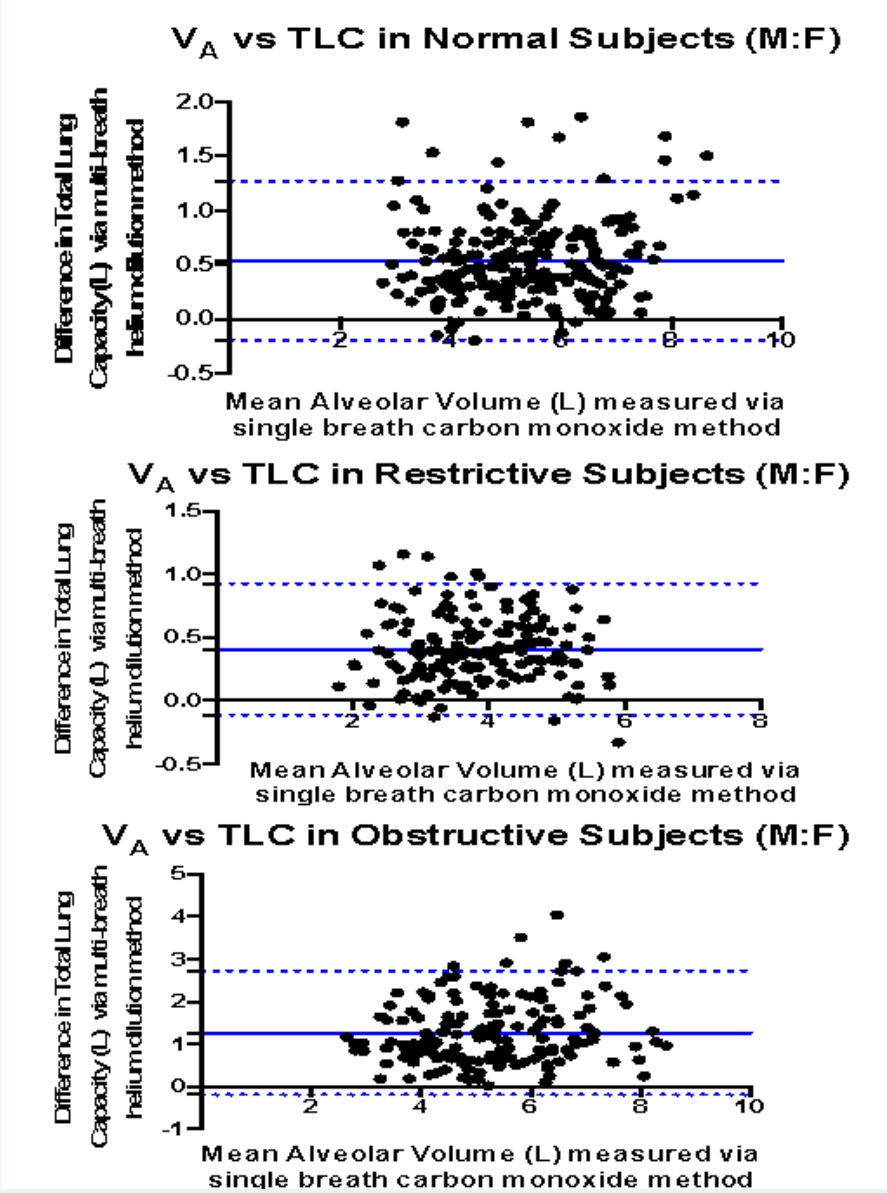
Standard Residual	Disease Severity
1.64-2.49	Mild
2.5-3.49	Moderate
>3.5	Severe

Analysis: Data was analysed using students paired t-test to quantify difference. A Bland-Altman plot[3] was performed to look at differences between each sub group when categorised on disease severity.

Results: Parameters from constructed paired t-tests, as well as data graphically displayed using Bland-Altman plots:



	Obstructive (N:168) (M:F)	Restrictive (N:171) (M:F)	Normal (N:217) (M:F)	Total (N: 556) (307M: 249F)
Mean TLC (L)	5.983 (SD: 1.535)	4.040 (SD: 0.9168)	5.624 (SD: 1.318)	5.246 (SD: 1.520)
Mean V_A (L)	4.660 (SD: 1.361)	3.623 (SD: 0.9540)	5.066 (SD: 1.284)	4.499 (SD: 1.359)
Significant difference?	P Value <0.0001 (Yes)	P Value <0.0001 (Yes)	P Value <0.0001 (Yes)	P Value <0.0001 (Yes)



	Normal	Obstructive	Restrictive
Bias	0.5361L	1.266L	0.4071L
SD	0.3732L	0.7432L	0.2655L
95% Limits of agreement			
From	-0.1953L	-0.1906L	-0.113L
To	1.267L	2.723L	0.9275L

There is good correlation between TLC and V_A. However, p-values suggest that V_A and TLC are significantly different and therefore V_A cannot be used to estimate TLC.

The limits of agreement were shown to be wide for both restrictive (0.92L) and normal (1.26L) subjects. Although the limits of agreement were even greater for obstructive subjects (2.72L).

A p-Value of <0.001 suggests that V_A significantly underestimates TLC in all subjects.

Conclusion

V_A measured using single breath Helium dilution cannot be used as a surrogate for TLC. V_A significantly underestimates TLC in all patient groups as shown in previous studies.

Closest agreement between V_A and TLC is seen in restrictive disease. Limits of agreement are wider in obstructive disease due to poor gas mixing and inhomogeneous ventilation.

Further Study: The department will therefore continue with current practice, performing full lung function tests.

A larger cohort of data will be collected taking into account patients with restrictive ventilatory defects, as this particular group had the closest agreement in this study. If this study concludes that V_A can be used as a surrogate for TLC, the department may be able to perform spirometry and gas transfer for monitoring rather than diagnosis.

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A Review of the SCST Foundation Course in Essential ECG Interpretation

Joanne Tailford

Specialist Respiratory Physiologist, Cardiology and Respiratory Investigations Unit,

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I am a Specialist Clinical Respiratory Physiologist having worked 8 years in several Foundation Trusts in North East England. My current post within Durham and Darlington is the first combined cardio-respiratory department in which I have worked and so it is paramount I am informed with Electrocardiograph (ECG) theory and pattern recognition in order to be competent at cardio-pulmonary exercise testing (CPET).

I attended the pilot for the SCST Foundation Course in Essential ECG Interpretation. It was delivered clearly and very enthusiastically by a lecturer who is passionate about ECG. Many of my course colleagues found him very approachable and informative. The pre-course reading material was substantial and very valuable.

The SCST ECG course was a 2 day lecture-based course which covered basic ECG theory, the normal ECG including normal variants and axis, and recognising normal ECG subcomponents, e.g. PR interval, QRS complex and ST segments. Although in my role I am primarily looking for ischaemic changes during live ECG recordings, it is important to learn to identify all ECG features that have implications for immediate management.

The course also covered other ECG characteristics which enable me to identify clinical features that may occur during exercising ECG recordings. These include tachyarrhythmias, bradyarrhythmias, chest pain syndromes, and drug and electrolyte effects. These topics become particularly useful for identifying end-test criteria in CPET testing. In addition, the lecturer clearly explained differences between myocardial ischemia and infarction, and between pericarditis, myocarditis and pulmonary embolism.

At the end of the course there was a dedicated group-based session which allowed students to discuss a range of clinical scenarios illustrating many of the abnormal ECG patterns covered in the course. Although there were some ECG features which I shall probably never see during CPET, this session proved useful in that I was able to test my newly acquired ECG knowledge and delve further into other ECG pathophysiologies.

Overall, the course is very interesting and exceptionally useful. My course colleagues and I found it very rewarding in gaining a deeper confidence of the ECG that can be used in our practises. My only critique would be to include a practical session of the application of the ECG electrodes.

A report on the time allocated for Respiratory and Sleep diagnostic investigations and therapeutics

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Martyn Bucknall, St Georges University of London.

Introduction

The workload pressures on respiratory and sleep services are increasing. As services strive to improve efficiencies whilst maintaining the highest levels of patient care, a commonly asked question to the Association for Respiratory Technology and Physiology (ARTP) is "What are the recommended time intervals that should be allocated for the performance of respiratory and sleep diagnostic tests?" In order to explore current practice, the following ARTP Standards Committee report aims to identify the allocated length of appointment times for respiratory and sleep investigations and therapeutics based on current practice, in the United Kingdom. This report may assist services in their local service design and business planning.

In November 2016, heads of respiratory and sleep departments were asked to complete a short online questionnaire detailing the length of time currently allocated for each patient appointment slot within their services. The participating departments were instructed not to include time allocated for interpretation or reporting of investigations. Responders were asked to provide actual time allocated rather than a time range. Data presented is taken from fifty seven responding NHS respiratory and sleep departments.

The majority of participating departments were 'Respiratory and Sleep' departments (66.7%), whilst 14.0% of departments were classified as 'Cardiorespiratory' departments and 14.0% classified as 'Respiratory' departments. 5.3% of participants were 'Sleep' departments. The majority of services (94.7%) were 'Adult' services whilst 5.3% of participating departments were classified as 'Paediatric' services (Figure 1). The data presented in this report is taken from adult services only. Data submitted from the small number of dedicated paediatric services was not used in this data analysis, but can be found in the Appendix (Table 8).

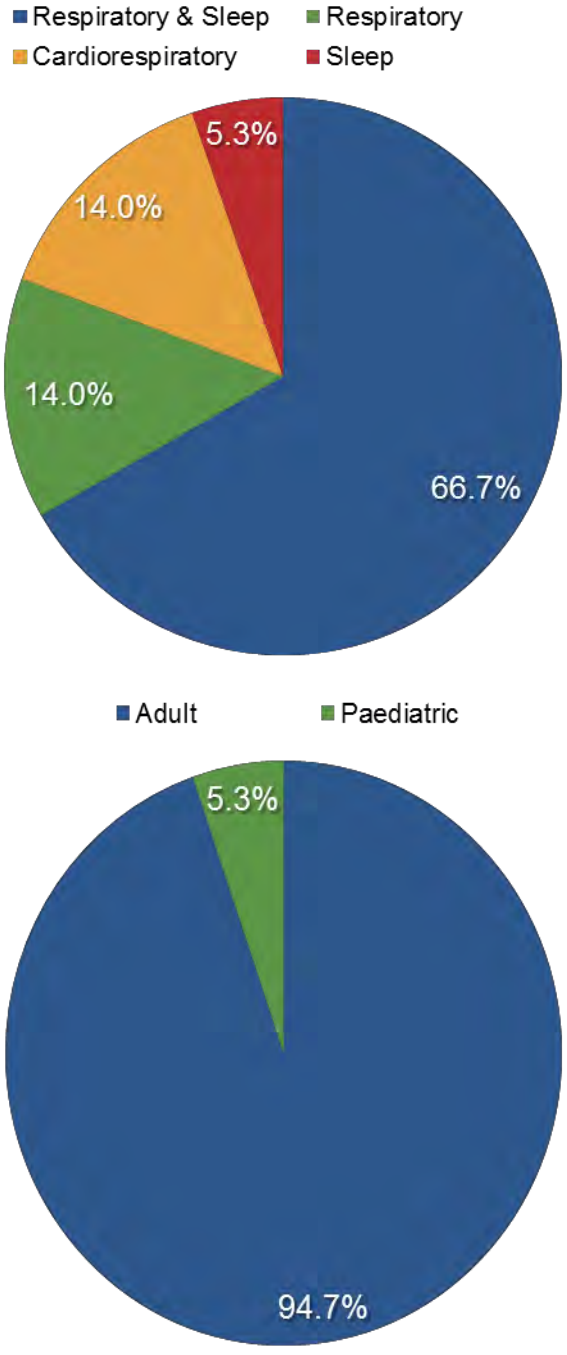

Figure 1: Participating department demographics.

Pulmonary Function Tests

Diagnostic tests of pulmonary function form the foundation of clinical activities performed in respiratory physiology departments. Ensuring patient safety is always a priority and adequate time should always be allocated to explaining the procedures, gaining consent, taking clinical history and screening patients for potential test contraindications. Adequate time should be made available for accurate measurement of height and weight as this is a vital requirement for many pulmonary function tests.

Pulmonary function tests require the communication of detailed and specific instructions to ensure tests are performed correctly and results generated are accurate and reproducible. It is therefore essential that allocated testing times reflect this requirement and suitable time is made available, for example, for those patients with communication difficulties or requiring language translation. Performance of many pulmonary function tests requires volitional effort by the patient and for some patients may result in increased dyspnoea during testing. Additional time may be required for those patients requiring greater periods of rest between measurements and this aspect should be considered when allocating time for testing.

Diagnostic Test	n	Median Time (mins)	Range (mins)
Peak Expiratory Flow (PEF)	20	5	5-20
Spirometry	51	15	5-30
Full Pulmonary Function Test *(Spirometry/Gas Transfer/Static Lung Volumes)*	52	45	30-60
Partial Pulmonary Function Test *(Spirometry/Gas Transfer)*	44	30	15-60
Bronchodilator Response (Metered Dose Inhaler)	38	30	10-45
Bronchodilator Response (Nebuliser)	34	30	15-50
Fractional Exhaled Nitric Oxide (F_eNO)	28	15	5-30
Carbon Monoxide Breath Test	1	10	n/a
Non-Invasive Respiratory Muscle Assessment *(SNIP/MIP/MEP/Positional VC)*	49	30	10-60
Shunt Assessment	4	60	n/a

Table 1: Median times allocated for pulmonary function tests in adults.

Table 1 shows the median allocated times for common pulmonary function tests in adults. The data shows that departments allocated a median time of 45 minutes for the performance of full pulmonary function tests (including spirometry, gas transfer and static lung volumes). The most common method for measurement of static lung volumes was whole body plethysmography (51.9%) whilst 31.5% of departments use helium dilution and just over 11% use nitrogen washout (Figure 2). It is often noted that nitrogen washout and helium dilution methods for lung volume measurement can take longer to perform, particularly in patients with airways obstruction due to poor gas mixing and gas trapping and for this reason one measurement is routinely made. Whole body plethysmography allows for multiple

attempts at the test, enabling observation of reproducibility between attempts. The data suggests that the method employed for measurement of static lung volumes does not alter the allocated testing time.

81% of responding departments offered appointments for both full pulmonary function tests and partial' pulmonary function tests. Over 14% of responding departments perform full pulmonary function tests

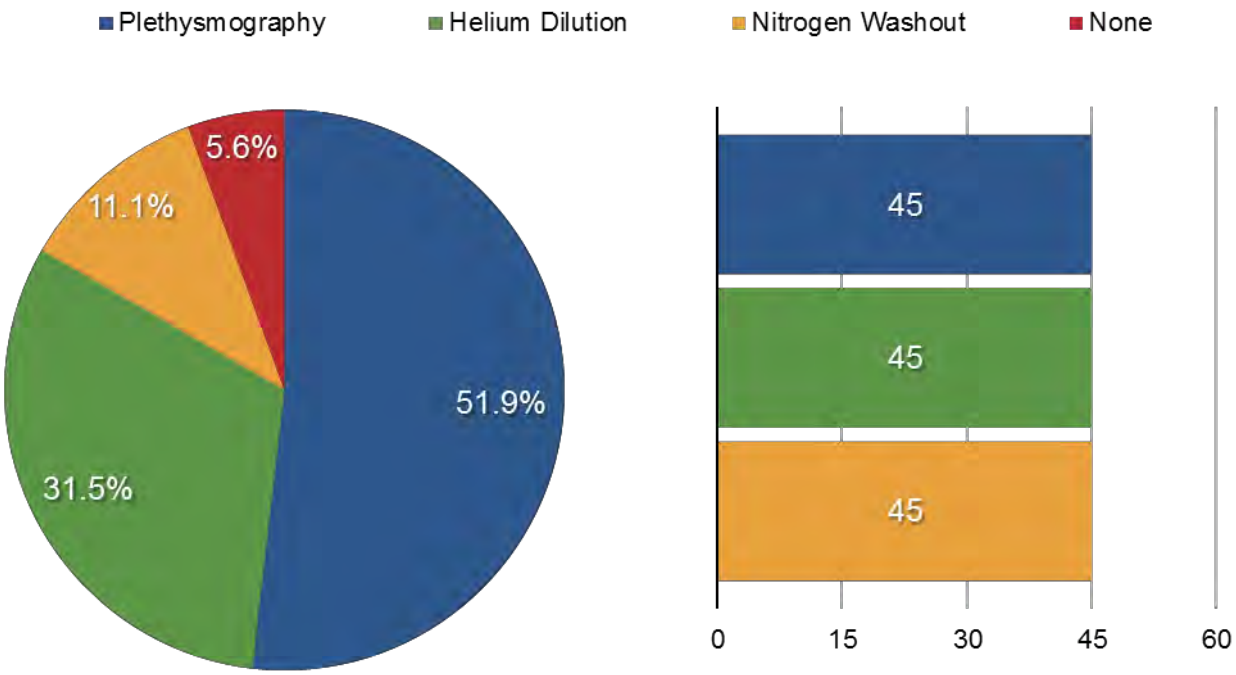

Figure 2: Primary method for measurement of static lung volumes (left) and time allocated (in minutes) for full pulmonary function tests depending on static lung volumes measurement method (right).

only and do not offer 'partial' tests. Partial pulmonary function tests are quicker to perform due to the omission of the measurement of static lung volumes and may be suitable when testing review or monitored patients at subsequent clinic visits.

Challenge Tests

As with pulmonary function tests, adequate time should always be allocated to ensure patient safety is maintained and appropriate measures are carried out to ensure that the patient understands the test fully and is consented to proceed. The nature of any challenge test involves potentially invoking a physiological response which may be distressing or uncomfortable for the patient. A key component to challenge tests is ensuring reversal of any detrimental physiological changes before the patient leaves the department. This often involves administration of bronchodilator agents and subsequent monitoring. Adequate time should therefore be allocated to appointments to enable post-test monitoring and recovery.

Allergy skin prick tests include a fixed period of waiting for any potential allergic reactions to occur. This is usually 15-20 minutes, but due to the associated itching and local skin reaction, adequate time should be available to reassure the individual or discuss any patient concerns after the test. With direct airway challenge tests using agents such as histamine or methacholine, time should be allocated to allow correct preparation of testing dosages and any equipment calibration ahead of testing. Differences in test methodologies, for example the tidal breathing method, Yan method or dosimetry, also require consideration due to differences in required test time.

Table 2 shows the median time allocated for performing challenge tests. This shows that a median time of 60 minutes is allocated for performing mannitol, histamine, exercise and hypoxic challenge tests. 30 minutes was allocated for performing allergy skin tests.

Challenge Test	n	Median Time (mins)	Range (mins)
Mannitol Challenge Test	33	60	45-180
Histamine Challenge Test	11	60	60-90
Methacholine Challenge Test	13	75	60-120
Exercise Induced Challenge Test	26	60	40-90
Allergy Skin Test	27	30	20-90
Nebuliser Challenge Test	9	45	30-180
Flight Assessment (Hypoxic Challenge Test)	40	60	30-120

Table 2: Median times allocated for challenge tests.

The data shows that the median time allocated to hypoxic challenge testing to assess suitability to fly in a commercial aircraft is 60 minutes. Common test methodologies consist of several stages, including baseline measurements of blood gases, hypoxic challenge and supplemental oxygen titration. This is reflected by the range of test times allocated by responding departments from 30 to 120 minutes.

Exercise Tests

Cardiopulmonary exercise testing is a highly complex test which requires a period of patient preparation ahead of performing the measurement. This consists of a detailed explanation of the test procedure, detailed clinical history taking and possible review of medical notes. Patients require preparation for 12 lead ECG monitoring, performance of baseline spirometry, attachment of pulse oximetry sensors and measurement of resting blood pressure. Time is also required to settle the patient on the treadmill or cycle ergometer, including adjusting the saddle height or handlebar position. Due to the maximal intensity nature of cardiopulmonary exercise testing, longer periods of recovery may be required on a per patient basis depending on clinical history or ECG changes. This is not easy to predict ahead of performing the test and may significantly increase contact time with the patient.

Table 3 shows the median time allocated by departments for undertaking exercise tests. This shows median times of 30 minutes for six minute walk tests and shuttle walk tests, and 60 minutes for cardiopulmonary exercise testing.

Field exercise tests, such as six minute walk and shuttle walk tests require less time due to the less complex nature of the test, reduced levels of physiological monitoring during the test and tightly controlled exercise durations. In line with existing clinical guidance [1, 2], services may undertake multiple walks tests and adequate time must be allocated for sufficient patient recovery between attempts. Ambulatory oxygen assessments require more time to perform due to the need to perform repeat walk tests with varying levels of supplemental oxygen.

Exercise Test	n	Median Time (mins)	Range (mins)
Six Minute Walk Test	39	30	10-90
Incremental Shuttle Walk Test	14	30	20-45
Ambulatory Oxygen Assessment	16	45	30-120
Cardiopulmonary Exercise Test	30	60	40-120

Table 3: Median times allocated for exercise tests.

Blood Gas Analysis

Figure 3 shows that 20% of departments perform both capillary and arterial sampling techniques, 35% of departments only perform capillary sampling and 7% only perform arterial sampling. It is interesting that 37% of departments do not perform capillary or arterial blood gas sampling.

Earlobe capillary blood gas (CBG) sampling often requires more time to perform, when compared to the arterial blood gas method (ABG). This is due to the time required for vasodilation cream to achieve optimal arterialisation of the earlobe (usually 10-15 minutes). The data shows no difference between

median times allocated for both methods.

Table 4 shows the time allocated by departments for undertaking blood gas analysis. The data shows a median time of 20 minutes allocated for both CBG and ABG performance. The data shows that departments allocate a median time of 90 minutes for performing long term oxygen therapy assessments. These tests involve the titration of oxygen flow rate for a period of time to assess for improvements in blood gas tensions. Multiple flow rates may need to be assessed before therapy can be prescribed to the patient. The range reported by responding departments is between 30 and 150 minutes.

Blood Gas Test	n	Median Time (mins)	Range (mins)
Long Term Oxygen Therapy (LTOT) Assessment	18	90	30-150
Capillary Blood Gas Sampling (CBG)	31	20	5-45
Arterial Blood Gas Sampling (ABG)	15	20	10-30

Table 4: Median times allocated for blood gas tests.

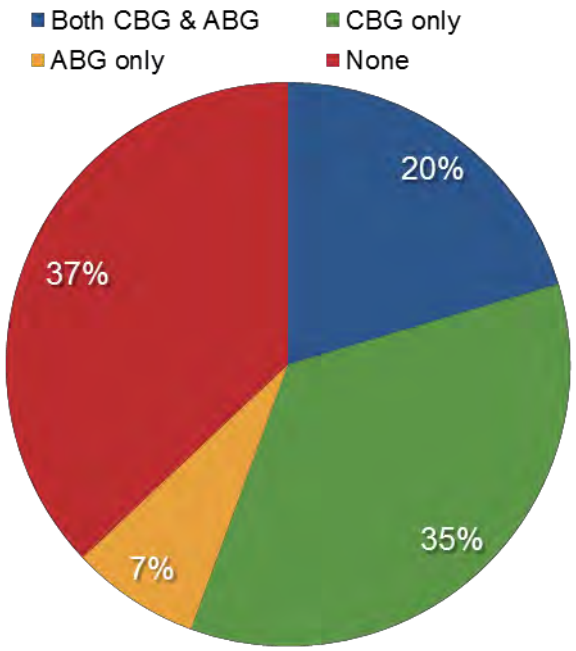

Figure 3: Percentage of departments performing blood gas sampling.

Sleep Diagnostics

Table 5 shows the median time allocated for undertaking sleep investigations. This shows that 15 and 30 minutes are allocated for issuing of oximeters and limited polysomnography equipment respectively.

For domiciliary sleep diagnostic tests such as limited polysomnography, actigraphy or overnight oximetry, time allocated for appointments is relatively short. This largely reflects the ease of use of modern

Sleep Diagnostic	n	Median Time (mins)	Range (mins)
Limited Polysomnography	40	30	10-60
Actigraphy	2	18	15-20
Overnight Oximetry	42	15	5-45
Sleep study scoring	27	30	15-240
Polysomnography	7	180	45-720
Multiple Sleep Latency Test	4	140	20-600

Table 5: Median times allocated for sleep diagnostics.

equipment which requires minimal input from the patient when using at home. This reduces the time needed to explain how to operate the equipment to the patient at collection. The time range reported in the data likely reflects additional data collection which often accompanies appointments, for example measurement of height, weight or collar size, completion of Epworth Sleepiness Score (ESS) or other questionnaires and any relevant clinical history taking which may be required. Before allocating time to these appointment types, it is important to consider what other clinical data will be required at the appointment.

More complex sleep diagnostics are often performed as inpatient admissions and require more time for setting up and also long periods of supervision or monitoring. Practice in sleep units will vary (hence the wide variation in allocated times) , with some services having dedicated staff monitoring studies overnight and some services having partial or no dedicated monitoring. Responding departments allocated a median time of 180 minutes for polysomnography and 140 minutes for multiple sleep latency tests. Of note, responders from dedicated sleep departments reported between 180 and 600 minutes allocated for polysomnography, with a median allocated time of 390 minutes.

Sleep Therapy

Table 6 shows that the median time allocated to set patients up on Continuous Positive Airway Pressure devices (CPAP) and Non-Invasive Ventilation (NIV) to be 45 and 60 minutes respectively. Median times of 30 and 35 minutes are allocated for review of therapy in both CPAP and NIV patient groups respectively. Interestingly, a small number of services reported undertaking telephone reviews for CPAP, and allocated 10-15 minutes for this. The increasing use of telemonitoring will reduce the amount of time required to review patients on CPAP and NIV and also save on hospital journeys.

The data shows that median time allocated for CPAP setup is less than time allocated for the setup of NIV. Differences in type of ventilation mode, equipment, experience of staff and patient cohort should all be considered when allocating time for new setup of these devices.

Patients established on CPAP and NIV devices require regular follow up and clinical review. The data shows that 30 minutes is allocated for both appointments. Adequate time should be allocated to review compliance data, replenishment of consumables and troubleshooting problems.

Sleep Therapy	n	Median Time (mins)	Range (mins)
Continuous Positive Airway Pressure Setup	34	45	30-90
Continuous Positive Airway Pressure Review	34	30	15-45
Continuous Positive Airway Pressure telephone Review	2	13	10-15
Non Invasive Ventilation Setup	21	60	30-240
Non Invasive Ventilation Review	22	35	20-90

Table 6: Median times allocated for sleep therapy.

General Laboratory Procedures

It is vital that clinical testing is performed in a clean and safe environment due to risk of spreading communicable disease, contamination or cross infection. Patients who regularly attend respiratory departments can often present in an immunocompromised state. It is therefore vital that time is set aside to minimise cross infection risks between patients by decontaminating test equipment in line with manufacturer recommendations and hospital infection control policies.

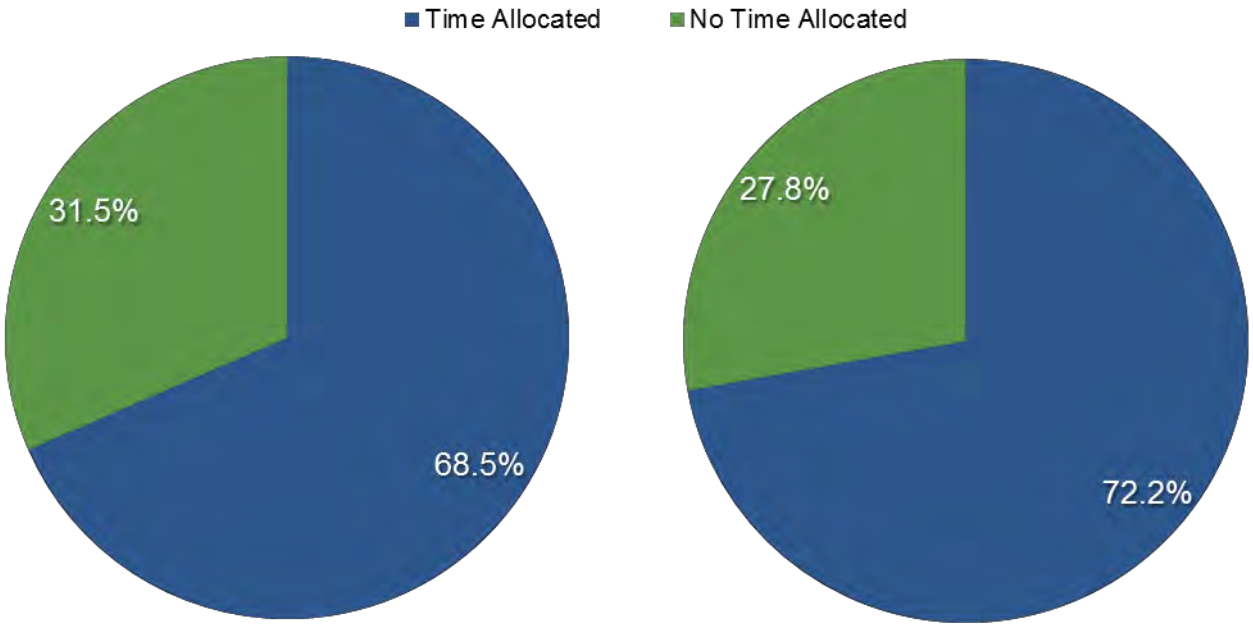

Figure 4: Percentage of departments who allocate time for daily cleaning duties (left) and quality control procedures (right).

Adequate time should therefore be allocated on a daily basis to facilitate and document environmental and equipment cleaning. The data presented shows that 31.5% of departments did not report allocating dedicated time for cleaning on a daily basis. It is hypothesised that those departments which do not allocate time for cleaning, complete required tasks on an ad hoc basis, fitted around patient testing sessions. This is likely due to workload and waiting time pressures on services. The median time allocated to cleaning was 30 minutes per day, whilst some departments allocate up to 1 hour.

Laboratory Duty	n	Median Time (mins)	Range (mins)
Daily Cleaning	37	30	10-60
Daily Quality Control	39	30	10-60

Table 7: Median times allocated for general laboratory duties.

Quality control practices are essential to ensure the continued quality of measurement data and to allow monitoring for deviations in data quality in order to identify potential equipment or measurement failure and sources of error. Physical and biological quality control routines should form

an integral part of day to day activities and enables a proactive approach to identifying, correcting and reducing sources of equipment error.

The data presented in Table 7 shows that departments allocate a median time of 30 minutes per day for quality control duties, whilst some departments allocate up to 60 minutes per day. It is likely that larger departments require more time to perform quality control duties due to increased numbers of clinical equipment. Figure 4 shows 27.8% of departments reported no allocated time for completion of daily quality control duties.

The aim is for all scientific and diagnostic services to become part of accreditation programmes, such as Improving Quality in Physiological Services (IQIPS), and demonstrate robust quality assurance measures. The accreditation process requires services to adhere to and document infection control and quality control procedures, whilst providing evidence that these processes meet the required standards and are embedded in the delivery of the service. All services should have up to date policies and procedures for cleaning, infection control and quality control embedded within their services. More information on IQIPS can be found at www.iqips.org.uk.

Summary

The data presented in this document is a review of times allocated for performing diagnostic and therapeutic procedures in adult respiratory and sleep services in the UK. It shows that there is large variation between allocated testing times amongst services and this has the potential to affect quality of diagnostics and impact on waiting times. Variation is likely due to increasing pressures on diagnostic services to improve efficiencies and the risk of reducing allocated time for patient diagnostic measurement is that quality, precision and safety are potentially sacrificed. We hope this paper will act as a guide for services when planning or reviewing clinical workload to ensure quality and also enhance patient experience. It is essential that clinical staff are given adequate time to undertake procedures to ensure accuracy and quality and to reduce possible work-related stress.

Of particular concern, some responders reported reduced allocated times for performing investigations including spirometry, cardiopulmonary exercise tests and respiratory muscle assessment. This is a concern and would promote concerns around how quality, safety and reproducibility is maintained. Additionally, some departments reported allocating just 10 and 15 minutes for measurement of bronchodilator response via metered dose inhaler and nebuliser, respectively. This is contrary to established clinical guidance[3] and does not account for time required to deliver the medication and provide adequate time for optimal bronchodilation effect.

Services should be allocating dedicated time within schedules to undertake essential laboratory duties including quality assurance programmes and ensuring dedicated time is provided for equipment cleaning and decontamination. It is not acceptable that dedicated time is not factored into busy laboratory schedules.

Whilst this document provides useful median data which may help to guide, justify and shape service provision in those services which are pushed to perform efficiently, it also highlights the need for further work in the areas of publishing, promoting and ensuring a standardised approach to allocating test times within respiratory and sleep diagnostic services in the UK in order to maintain quality assured standards.

Acknowledgements

We are grateful to the 57 respiratory and sleep departments who supplied data for this survey.

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APPENDIX 1. PAEDIATRIC DATA

Diagnostic Test	n	Median Time (mins)	Range (mins)
Peak Expiratory Flow	1	10	n/a
Spirometry	3	20	15-20
Full Pulmonary Function Test (Spirometry/Gas Transfer/ Static Lung Volumes)*	2	563	45-60
Partial Pulmonary Function Test (Spirometry/Gas Transfer)	3	30	30-60
Bronchodilator Response (Metered Dose Inhaler)	3	45	15-60
Bronchodilator Response (Nebuliser)	1	60	n/a
Fractional Exhaled Nitric Oxide	3	10	10-15
Non-Invasive Respiratory Muscle Assessment	3	15	15-20
Mannitol Challenge Test	1	30	n/a
Histamine Challenge Test	1	60	n/a
Exercise Induced Challenge Test	2	45	30-60
Nebuliser Challenge Test	1	45	n/a
Flight Assessment (Hypoxic Challenge Test)	3	60	45-120
Six Minute Walk Test	3	20	15-20
Incremental Shuttle Walk Test	1	20	n/a
Cardiopulmonary Exercise Test	1	75	n/a
Capillary Blood Gas Sampling	1	10	n/a
Limited Polysomnography	2	53	45-60
Overnight Oximetry	2	15	n/a
Sleep study scoring	2	90	60-120
Polysomnography	1	75	n/a
Continuous Positive Airway Pressure Setup	1	60	n/a
Continuous Positive Airway Pressure Review	1	20	n/a
Non Invasive Ventilation Setup	1	60	n/a
Non Invasive Ventilation Review	1	20	n/a
Daily Cleaning	2	75	30-120
Daily Quality Control	2	23	15-30
Sweat test	1	60	n/a
pH Impedance study	1	60	n/a
pH Impedance analysis	1	60	n/a
Laryngoscopy during exercise	1	60	n/a

Table 8: Median times reported by paediatric responders.

*All units reported using plethysmography for measurement of static lung volumes

APPENDIX 2. ADULT DATA

Diagnostic Test	n	Median Time (mins)	Range (mins)
Peak Expiratory Flow	20	5	5-20
Spirometry	51	15	5-30
Full Pulmonary Function Test (Spirometry/Gas Transfer/ Static Lung Volumes)*	52	45	30-60
Partial Pulmonary Function Test (Spirometry/Gas Transfer)	44	30	15-60
Bronchodilator Response (Metered Dose Inhaler)	38	30	10-45
Bronchodilator Response (Nebuliser)	34	30	15-50
Fractional Exhaled Nitric Oxide	28	15	5-30
Carbon Monoxide Breath Test	1	10	n/a
Non-Invasive Respiratory Muscle Assessment (SNIP/ MIP/MEP/Positional VC)	49	30	10-60
Shunt Assessment	4	60	n/a
Mannitol Challenge Test	33	60	45-180
Histamine Challenge Test	11	60	60-90
Methacholine Challenge Test	13	75	30-120
Exercise Induced Challenge Test	26	60	40-90
Nebuliser Challenge Test	9	45	30-180
Flight Assessment (Hypoxic Challenge Test)	40	60	30-120
Six Minute Walk Test	39	30	10-90
Incremental Shuttle Walk Test	14	30	20-45
Ambulatory Oxygen Assessment	16	45	30-120
Cardiopulmonary Exercise Test	30	60	40-120
Long Term Oxygen Therapy (LTOT) Assessment	18	90	30-150
Capillary Blood Gas Sampling	31	20	5-45
Arterial Blood Gas Sampling (ABG)	15	20	10-30
Limited Polysomnography	40	30	10-60
Actigraphy	2	18	15-20
Overnight Oximetry	42	15	5-45
Sleep study scoring	27	30	15-240
Polysomnography	7	180	45-720
Multiple Sleep Latency Test	4	140	20-600
Continuous Positive Airway Pressure Setup	34	45	30-90
Continuous Positive Airway Pressure Review	34	30	15-45
Continuous Positive Airway Pressure telephone Review	2	13	10-15

ADULT DATA CONTINUED

Diagnostic Test	n	Median Time (mins)	Range (mins)
Non Invasive Ventilation Setup	21	60	30-240
Non Invasive Ventilation Review	22	35	20-90
Daily Cleaning	37	30	10-60
Daily Quality Control	39	30	10-60

Table 6: Median times allocated for sleep therapy.

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Matt Rutter
Alan Moore
Brendan Cooper

ON THE BLOWER

This edition of 'On the blower' is focused on the Manufacturers stands at conference. Click on the company logo to access their website for more information.

Manufacturers Survey

Thank you to all those that did respond. Ideally we would have preferred a lot more responses as the manufacturers do really value your feedback.

We are looking at ways of improving the survey for this year.

Well done to all the Manufacturers. MR

Category	Winner
Small diagnostics	nSpire
Lung function	Med Graphics
Sleep Diagnostics	Philips Respironics
Sleep Therapy	Philips Respironics
Manufacturers special mention	Travers Barr
Best conference stand	Carefusion
Survey Draw winner	Jill Macleod

http:///www.baywater.co.uk

Baywater Healthcare provide home based healthcare services in the UK, we currently partner with the NHS to support over 3000 patients to use a ventilator or CPAP device safely at home.

We've used our experience to develop a range of services that improve sufferers' lives. So whether it's just for home based diagnostics or fully-managed services with all equipment supplied we can help.

- We provide overnight home sleep diagnostics, ensuring quick diagnosis to reduce waiting times.
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Call: 0800 1214524 or www.baywater.co.uk

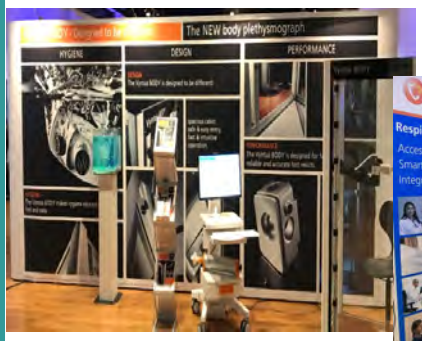
http://www.carefusion.co.uk/

Firstly we would like to say thank you to all of those who attended our workshops at the recent ARTP in Belfast. They were well attended and the feedback has been very positive, so thank you.

We also officially launched our new Vyntus BODY at the recent ARTP. And while the t-shirts may have caused some interesting discussions, the new Vyntus BODY was well received and we are extremely excited to launch it into the UK market place. Additionally, we recently announced that CareFusion/BD and Apax Partners would launch a joint venture as a stand-alone, global respiratory company, Vyaire Medical. We said at the time that we were excited by the future of Vyaire Medical and the possibilities the new company will create. And with that, I am pleased to announce that we are actively recruiting for 2 new field service engineers to further enhance our service provision in the UK to you and ultimately the patients that you support.

One other exciting piece of news is that we will be relocating our head office (we will remain in Basingstoke) where we will be set up as a pure-play "breathing company". We will be informing our customers very soon regarding the new address, but moving forward it is business as usual and please continue to use 01256 388512 and 01256 388717 as direct dials to the office. In our new premises, we are aiming to have our respiratory diagnostics showroom set up during the summer months and please feel free to come and have a look, you will be most welcome – contact your local account manager for more details.

As always we remain committed to delivering the high quality products and services that you have come to expect from CareFusion and we look forward to continuing to serve you as Vyaire Medical.



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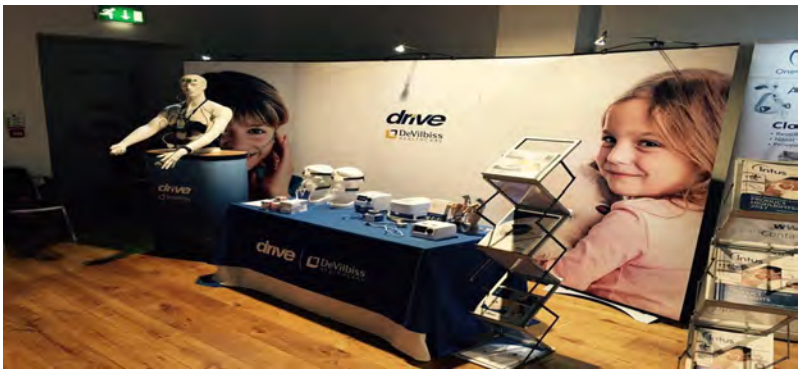


Drive DeVilbiss Healthcare showcased a range of products at this year's conference.

Their latest development in sleep therapy the DeVilbiss Blue was shown to delegates. The StandardPlus and AutoPlus versions were available for demonstrations, as well as the additional Pulse Dose Humidification comfort feature. The range offers a high level of performance with advanced algorithms and improved sound levels. The SleepCube series was also available for demonstrations during the two day conference.

A new, cost effective fingertip pulse oximeter was also shown on the stand. The Hb0-2000 is compact, durable and lightweight in design. The stylish little device incorporates a state of the art OLED screen display and has been designed for daily non-invasive screening for patient S_p0_2 and pulse rate detection.

Watch this space for some more exciting developments in the coming months!

Fisher & Paykel HEALTHCARE

http://www.fphcare.co.uk

Fisher and Paykel had a range of products on show, which included OSA masks, Humidifiers and Nasal high flow therapy.

The OSA masks were the Brevida, which is a new nasal pillows mask, the ESON2 which is the latest nasal mask and the Simplus is the latest full face mask.

The humidifiers were the MR810 humidifier which includes the Evatherm circuit . This is a NIV humidifier with a heated circuit which reduces condensate designed for home use. The HC550 humidifier was designed specifically for home use for both invasive and non-invasive ventilation, featuring a simple user interface.

F&P MR810
Heated Humidifier

F&P 900MR810 Evatherm
Heated Breathing Tube

The myAIRVO2 is a nasal high flow therapy device designed to deliver Optiflow in the home and chronic care environment.

http://www.gvs.com/

GVS Group manufactures filters and components for applications in the Healthcare, Life Sciences, Automotive, Appliance, Safety, and Commercial & Industrial Filtration.

For more than 35 years, GVS has focused on innovation in its products range and production processes, constantly improving its development capacity

GVS Respiratory line include a proprietary range of HME (Heat and Moisture Exchanger) and HMEFs (Heat and Moisture Exchanger and bacterial / viral Filter) and Filters (Bacterial and Viral) for use in anaesthesia, intensive therapy, respiratory medicine, and ventilation, with efficiencies up to 99.99999%. A series of insufflation products for use during laparoscopic surgery have more recently been added to the range.

This GVS Filters section provides an overview of the products relevant to each category, e.g. Filters, HME, HMEFs, Suction Filters, Insufflation Filters, Spirometry, Vent Filters, and Homecare.

GVS Spirometry Filters

GVS provides Filters for Lung Function Testing (Spiroguard) with proven filtration efficiency of 99,99999% up to 0,027 micron. GVS Spiroguard enables testing without the risk of cross contamination for patients and health care professionals, as well as equipment. GVS's compact design Spiroguard are all manufactured to a high quality and hygienically packed in a clean room to ensure maximum protection against contamination.

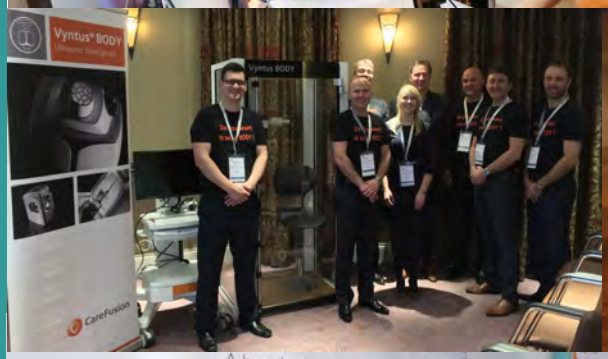
GVS Filter Media

GVS Spiroguard utilise an electrostatically charged synthetic media. The positive and negative charge on filter fibres is generated during the manufacturing process and enhances the filter's ability to attract particulate matter. Unlike other spirometry filters, GVS's electrostatic filter media is covered in a protective scrim layer. This prevents fibres becoming loose, blocking the spirometer and therefore enhancing protective performance against harmful contamination.

The filter media has hydrophobic properties to minimise droplet contamination, as well as providing a low resistance and low dead space to improve the validity and consistency of respiratory testing results and minimise rebreathing.

ON THE BLOWER

From around the Exhibition...



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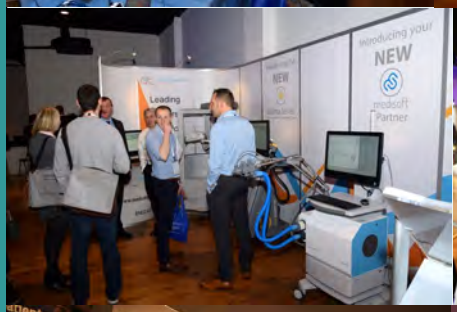


http://www.intustrade.co.uk/

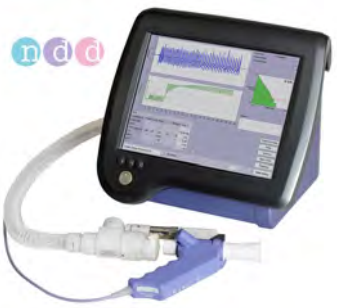
Intus Healthcare presented the BresoDx Sleep Apnoea diagnostic at the 2017 ARTP Conference.

The clinically-validated device uses breath sounds to provide an AHI with a 95% correlation to PSG. Since the conference, the BresoDx has become part of Intus' sleep study service. This service provides a BresoDx device for each patient, which can be worn in-home or in-clinic with ease, and a report summary is returned within 48 hours that aids a formal diagnosis. Prices for the service are under £200 excluding VAT per study. For more information, and the clinical research behind BresoDx, visit www.intus.pro/bresodx.

ON THE BLOWER

intermedical http://www.intermedical.co.uk/

At this year's ARTP, Intermedical were showcasing products from their Cardio Respiratory and Sleep diagnostics range.



The Easy One Prolab from ndd was demonstrated on the stand. It is a fully portable PFT system for spirometry, transfer factor and lung volume measurements including lung clearance index. It uses ultrasonic technology to measure flow, volumes and the molar mass of gases. It has been used in the following applications in the UK: outreach clinics, ward testing, for testing paediatric and adult CF (both clinically and for research) and for routine lung function testing in paediatrics and adults. The software is license-free and can be networked with hospital systems.

Also on display was the Resmon Pro, which is an oscillometry device that can detect peripheral airway disease missed by spirometry from tidal breathing. It is currently being used in the UK in CF and paediatric applications and in a multi-centre trial by Chiesi.

From the sleep diagnostics range, the Medibyte was displayed on the manikin. This is a sleep recorder for domestic use available in 6 and 12 channel versions. The device is robust and can be used with single-use pre-sized RIP belts. There is also a cloud service available for remote testing and diagnosis.

Intermedical also featured on the stand their range of desktop and handheld spirometers including the ndd Easy on-PC and the brand NEW EasyOne Air. These devices use ultrasonic technology to measure the flow and volumes. The NEW EasyOne Air is a welcome addition to the range replacing the existing EasyOne and features a touch screen, Bluetooth, direct print options and is fully compatible to the licence-free EasyOne connect software. The MIR Intermedical Spirolab is a beautifully designed desktop spirometer specifically designed for use in the UK. It features a large 7 inch touchscreen and built in thermal printer. Spirometry PC software is also available with the Spirolab.

NSPIRE HEALTH

http://www.nspirehealth.com/

At the ARTP Conference in Belfast nSpire Health Ltd had their latest systems on display including the KoKo Px and KoKo Sx systems along with the first component of the modular Iris software.

The KoKo Px range includes systems for body plethysmography testing, where a full range of tests including a second method of Lung volumes measurement can be performed from within the box or outside the box. The new cart allows easy adjustment of working height from seating to standing.

The KoKo Sx Spirometer integrates with the main PFT system and Iris using spirometry only software and sharing the same database to keep all results in one place.

The Iris software comprising of Iris Decision and Iris Connect, brings everything together. The first module of Iris Decision - the interpretation module; presents all relevant clinical and diagnostic respiratory data together in one place to allow interpretation based on the complete results. Iris Connect gives seamless communication with EMR/HIS systems using HL7 with a standards-based approach for orders and results ensuring full integration of devices allowing a paperless environment.

MGC DIAGNOSTICS

medisoft® CARDIO-RESPIRATORY INSTRUMENTATION

http://www.medicalgraphicsuk.com/

Medisoft were proud to be displayed alongside our UK Partner Medical Graphics UK. As both Medisoft and MGCD USA the parent company both entered into the 40th year as manufacturers it was fitting we showed the Medisoft flagship, the Spiro Air.

Using Volume displacement technology remains unsurpassed as a true volume measurement unaffected by content or viscosity. This Technology still finds a warm welcome in the UK and USA for its durability and accuracy alongside the other technologies offered by the group.

The partnership Medical Graphic UK and Medisoft brings the widest choice of products and measurement types of any of the current suppliers in the UK. Supported by the excellent after sales service of MGUK we will build in partnership the UK market with real and long term solutions to the Pulmonary Function department.

In London September 2016 at the ERS, MGCD USA launched a Technical faculty designed to allow the group to provide the solutions not only for today, but also for tomorrow and the future, improving and developing instruments to meet the changing needs of the patient population including the need for smaller dead spaces and higher resolution.

Medisoft have a commitment to the UK market to get all users to the latest software version, this is a free upgrade that will assist greatly the support for the market. This software update will enable many customers to be able to follow the NHS lead to move from Windows XP, to Windows 7 or 10 to enable all the benefits of the new computer hardware on the market.

Whilst we look forward to the exciting new partnership, Medisoft recognise the investment and help given by Vitalograph during the run of that contract, also remember with fondness Paul Griffiths (Griff) for his contribution to that success. Whilst missed never forgotten!

Please do not hesitate to contact Medical Graphics UK for all your service, consumable and future business opportunities. The activity will be supported by Kevin Hogben known to many of you.

PHILIPS
RESPIRONICS

http://www.philips.co.uk/healthcare/solutions/sleep-and-respiratory-care

At Philips Respironics, we are a global developer of respiratory technology. We are passionate about providing innovation and integrated solutions for healthier patients, healthier practices, and healthier businesses. This philosophy applies directly to our Sleep Therapy business and our newest platform – the Dream Family…

Philips Respironics sleep apnea solutions, and specifically the Dream Family, are designed to help by:

1. Focusing on patient-driven design to help patients use their therapy
2. Offering solutions to help patients use their therapy for the long-term
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We are excited to announce the latest addition to our Dream Family range – the Dream Station BiPAP AutoSV. Available mid 2017.

DreamMapper — Patient engagement software

Our new DreamMapper app and website are designed to empower patients to take ownership of the ir therapy while helping you to support them effectively and efficiently.

Visit www.philips.co.uk/dreammapper to lean more or speak to your Phillips Respironics representative.

REMOTE A

http://www.remotea.co.uk/

RemoteA's ehealth service provides you with devices to carry out more home sleep studies which you can interpret yourself at your hospital or forward to our clinicians. We only charge a fee for once a successful sleep study has been carried out.

Our APV2 is an AASM Type III device with the following channels: Airflow, Heart Rate, Pulse Oximetry, Position, Respiratory Effort (Abdomen) and Respiratory Effort (Chest).

Price: Pay per sleep study interpreted only. You can interpret the data yourself or use one of our clinicians. Feel free to test it so you know it works well.

RemoteA ehealth services are easy to access and use. After a 30 min demo, if you decide to take on our services, we arrange a training session, bring the devices with us and setup the browser-based analysis software. There are no costs for setup and no costs for devices. We also provide you with a trial period if needed and as our customers, you get top quality customer service by phone and email.

The Remote Diagnostic Service Platform includes:

- Easy to use and durable monitoring devices
- Sophisticated browser-based analysis software for the specialists
- Pay-per-use, no monthly or yearly service charges etc.

The system has been designed from the start with user-friendliness, fail-safe operation and scalability in mind – this means it is as easy to introduce it for a network of a handful of physicians and specialists as it is for a hospital or dozens of clinics nationwide.

For more information: Feel free to contact trinesh.champaneri@remotea.co.uk, Client Services Manager. Tel. +44 (0) 1753 722 125 Mobile: 07908 656215

www.remotea.co.uk

http://www.resmed.com/uk/en/healthcare-professional.html

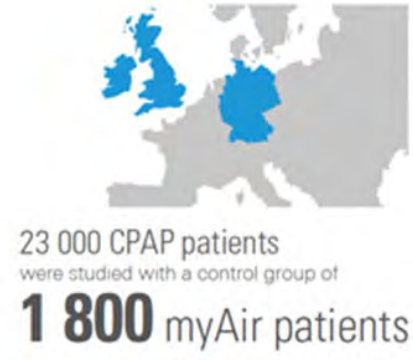
Experience the new AirFit20 series

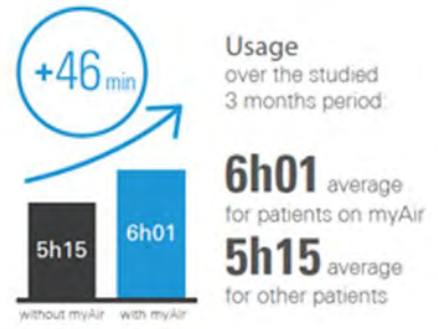
ResMed's AirFit20 series is has been designed with innovations to improve mask fit, comfort and ease of use, the new-generation ResMed masks are the result of more than three years of research and development.

The AirFit F20 and AirFit N20 feature ResMed's innovative new InfinitySeal silicone cushion that adapts to the unique facial contours of each patient to increase comfort, improve fit and reduce leakage for maximum treatment efficacy.

ResMed's myAir improving daily usage and adherence to PAP therapy.

New European research reveals that patients with sleep apnoea who use myAir, ResMed's online support programme, show significantly better daily usage of their device, and greater adherence to their continuous positive airway pressure (CPAP) treatment than other patients. The data, published in a white paper, demonstrates that





myAir patients use their device for an average of **46 minutes longer per night** compared to other patients. Furthermore, the **average adherence to CPAP** treatment for new patients in their first week of **treatment is 76% for myAir** patients compared to 71% for other patients.[1]

Connected respiratory care at home To help better manage your patients' home-based care, the ResMed Connectivity Module (RCM) delivers cellular connectivity for ResMed's Stellar ventilators. This enables you to transmit therapy data straight from your patients' ventilators into our secured network with ease.

1. Empowering the sleep apnoea patient. A study of how myAir users behave better. PwC 2016

S-MED

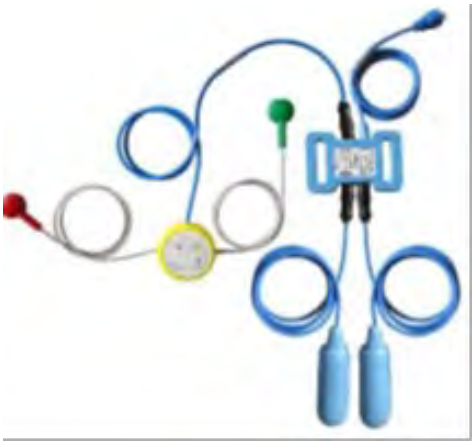
http://www.s-med.co.uk/Home.aspx

S-Med exhibited the SOMNOtouch RESP Sleep Screener which can record up to 21 channels of Cardio Respiratory and Sleep signals.

The SOMNOtouch features a built-in S_pO_2 Module, Rechargeable Battery and Memory with a unique Touch Screen for controlling the device and viewing signals.

The SOMNOtouch also has Bluetooth for transmitting data to an Android Tablet or Phone – all this at only 64 grams and one of the smallest Screeners on the market today.

Also shown was the NEW combi electrode for the SOMNOtouch which combines the Abdominal Effort Sensor, 2 x PLM electrodes and a 1-channel ECG Electrode while only utilising one connector.



The NEW Home Sleep Video Camera also attracted a lot of attention, this camera features built-in Infrared and Memory and can record continuous video and Audio which provides huge benefits in being able to synchronise to our complete range of diagnostic sleep recorders.

Stowood

http://stowood.com/

The new Embla Embletta ambulatory sleep monitor

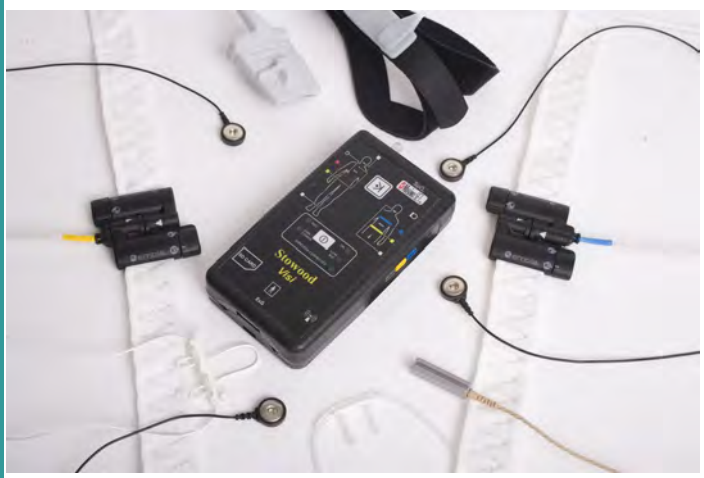
The newest Embletta sleep diagnostic monitor (manufactured by Embla and distributed exclusively in the UK and Ireland by Stowood) is now available.

Named the Embletta MPR PG (Multi-Parameter Recorder, Polygraphy), this brand new model now has a full colour screen for reviewing signals, records true sound all night from a microphone at the patient's face, new firmware, 2x RIP, airflow, oximetry, ECG, and uses the standard software, RemLogic.

The device is also upgradeable to full PSG with wireless digital video and audio, still recording into RemLogic.

With 24-bit resolution, the Embletta can record some of the best quality signals on the market, allowing easy sleep diagnosis. Allowing clinicians and physiologists to continue to use RemLogic software with the added advantage of using the latest hardware, backwards compatible with consumables in stock.

New easy setup for Stowood Black series ambulatory sleep monitors



The Stowood Black series ambulatory sleep monitors (designed and manufactured in Oxfordshire by Stowood) have a new feature: truly wireless setup.

The setup works how you work- from as simple as powering on the device, to sophisticated: a recording scheduled for a certain time, with all patient details attached to the recording.

Clinicians can now schedule recordings with patient details, using a simple and easy setup wizard. This gives greater confidence that the patient details have been entered correctly, and allows quick modification of recording montages and start times if required. Compatible with the industry-standard software, Visi-Download, for seamless setup, download, analysis and report generation.

The following companies were also present at the conference. For more information on their products, please follow the hyperlink to their websites.

http://www.dolbyvivisol.com/home.aspx

https://www.radiometer.co.uk/

https://www.remservemedical.com/

https://somnomed.com/uk/

https://vitalograph.co.uk/

ARTP conference 2017

Accepted abstracts

Click on the Abstract Number (#) to view the abstract

#	Author(s)	Title
O1	Archer L, Shakespeare J	THE PREVALENCE OF UNDIAGNOSED COPD IN PATIENTS WITH AN ABDOMINAL AORTIC ANEURYSM AND ITS IMPACT ON CARDIOPULMONARY EXERCISE TESTS
O2	Moore V, Burge S, Robertson A, Parkes, E, Walters G	WHAT CAUSES OCCUPATIONAL ASTHMA IN CLEANERS?
O3	Peat R	REAL FLIGHT SPO_2 COMPARES WITH HYPOXIC CHALLENGE TESTING IN ADULTS WITH CYSTIC FIBROSIS
O4	Smith L, Aldag I, Hughes P, Horn F, Marshall H, Norquay G, Collier G, Highes D, Taylor C, Horsley, Wild J	LONGITUDINAL MONITORING OF DISEASE PROGRESSION IN CHILDREN WITH MILD CYSTIC FIBROSIS USING HYPERPOLARISED GAS MRI AND LUNG CLEARANCE INDEX
P1	Beacham M	WOULD CHANGING FROM EUROPEAN COMMUNITY FOR COAL AND STEEL (ECCS) REFERENCE EQUATIONS TO THE GLOBAL LUNG INITIATIVE (GLI) REFERENCE EQUATIONS AFFECT THE GRADING OF SEVERITY OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) WHEN USING NICE GUIDELINES?
P2	Glover R, Lloyd J, Ismail I	DEVELOPMENT OF A NON-COMPLEX NON-INVASIVE VENTILATION SERVICE IN A GENERAL HOSPITAL: PROCESS, EARLY DATA AND RATIONALE
P3	Kaur B, Lloyd J, Laverty J	AN INVESTIGATION OF THE CORRELATION BETWEEN ALVEOLAR VOLUME (V_A) AND TOTAL LUNG CAPACITY (TLC) IN A COHORT OF PATIENTS REFERRED FOR LUNG FUNCTION TESTING.
P4	McArthur S	A PATIENT PRESENTED TO HOSPITAL WITH BREATHLESSNESS, HEADACHE, DISTURBED VISION AND HYPOXIA – A CASE STUDY.
P5	Mitchell J, Al-Sheklly B, Stout M, Kelsall A, Issa B, Collier t, Corfield D, Smith J	SENSATIONS ASSOCIATED WITH EXPERIMENTALLY EVOKED COUGH: A COMPARISON OF CHRONIC COUGH PATIENTS WITH HEALTHY CONTROLS
P6	Munro E	A COMPARISON OF THE CORRELATION OF HEALTH STATUS OF THE ONE MINUTE SIT-TO-STAND TEST (STST) AND THE SIX MINUTE WALK TEST (6MWT) IN STABLE COPD.

P7	Noakes R	EVALUATION OF 7 SEPARATE SHUNT FRACTION FORMULAS USED IN CLINICAL PRACTICE
P8	Parkes E, Moore V	THE INTER-RATER VARIABILITY IN DETERMINING THE ANAEROBIC THRESHOLD (AT) AFTER PREOPERATIVE CARDIOPULMONARY EXERCISE TESTING (CPET)
P9	Peat R	TELEMEDICINE SPIROMETRY VALIDATION
P10	Rees S, Raywood E, Laverty A, Abel F, Samuels M	A MODIFIED HYPOXIC CHALLENGE TEST (HCT) ASSESSMENT ON A PATIENT WITH CONGENITAL CENTRAL HYPOVENTILATION SYNDROME (CCHS)
P11	Matharu T	A PILOT STUDY INVESTIGATING THE BENEFITS OF PERFORMING SLEEP DIAGNOSTICS IN PRIMARY CARE OF A LOCAL POPULATION
P12	Sharley T, Stockley JA, Cooper BG	A COMPARISON OF TWO SPIROMETERS IN HEALTHY SUBJECTS AND PATIENTS WITH RESPIRATORY DISEASE.
P13	Butler A, Lloyd J	DOES EPWORTH SLEEPINESS SCORE (ESS) PREDICT COMPLIANCE WITH CONTINUOUS POSITIVE AIRWAYS PRESSURE (CPAP) THERAPY, IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA (OSA)?
P14	Cachada N, Thomas M	COMPARISON OF MANUAL AND AUTOMATIC SCORING OF LIMITED CHANNEL SLEEP STUDIES: NOXTURNAL SOFTWARE CORRELATES WELL WITH MANUAL SCORING IN SEVERE OSA.
P15	Clavaud F	CAN RIP FLOW ANALYSIS BE USED AS A RELIABLE ALTERNATIVE TO NASAL CANNULA FLOW DURING SLEEP STUDIES?
P16	Cramp G, Clarke D, Goodlad M, Matharu T, Shakespeare J	COMPARISON OF CPAP PRESSURES USING A PREDICTED EQUATION VERSUS 95TH PERCENTILE CALCULATED BY AUTOTITRATING CPAP MACHINES
P17	Godinho AJ, Laverty A, Samuels M	SIGNAL INTEGRITY AUDIT ON PAEDIATRIC CARDIORESPIRATORY SLEEP STUDIES
P18	Al Humoud A, Benson J, Balanos G, Griffin H	INTERMITTENT NEGATIVE AIRWAY PRESSURE: COULD IT HAVE IMPLICATIONS FOR TREATING OSA?
P19	Newby K, Lloyd J, Newey D, Kaur B	REVIEW OF GOOD HOPE HOSPITALS' CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) ANNUAL FOLLOW UP APPOINTMENTS
P20	O'Sullivan C	COMPARISON OF AUTO-TITRATING CPAP DERIVED APNOEA-HYPOPNOEA INDEX WITH PULSE OXIMETER OXYGEN DESATURATION INDEX IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA
P21	Webber S	UTILISATION OF OVERNIGHT OXIMETRY IN A REGIONAL SLEEP SERVICE
P22	Cooper BG, Gunn S, Johal G, Harte N, Sharley T, Jones M, Batsford, Griffin H, O'Reilly L, Savage J,	QUALITY REVIEW OF EMBLETTA POLYGRAPHY SERVICE

Return to abstracts menu

THE PREVALENCE OF UNDIAGNOSED COPD IN PATIENTS WITH AN ABDOMINAL AORTIC ANEURYSM AND ITS IMPACT ON CARDIOPULMONARY EXERCISE TESTS

Archer, L, Shakespeare, J, University Hospital Coventry and Warwickshire, Coventry, England

Introduction:
Chronic obstructive pulmonary disease (COPD) affects 5% of the global population and is characterised by airflow obstruction, which is not fully reversible. Cigarette smoking is a known contributing factor to COPD, as it is to the formation of an aneurysm. In addition COPD has been found to be the most important risk factor associated with abdominal aortic aneurysms (AAA). Many studies[2] have observed the relationship of COPD and AAA, demonstrating that AAA prevalence in COPD patients was 3.7% and there was a 1.22 to 1.78 fold increased risk of AAA when compared to those without COPD[1].

Anecdotally, we had identified that many of our preoperative AAA patients demonstrated airflow obstruction on spirometry with no known respiratory diagnosis. As there is a link between COPD and AAA, we wanted to identify the prevalence of airflow obstruction in our patient group and the affect this had on a patient's cardiopulmonary exercise test (CPET) results. We hypothesised that those with airflow obstruction would have a decreased breathing reserve and peak VO_2 when compared to those without. This has the potential to impact on surgical decision making.

Methods: : Data from 122 patients (108 male), median age 75 years (range 65 – 90) with a known AAA of 5cm or more attending for pre-operative CPET between September 2014 and May 2016 were included. Spirometry, CPET, smoking history, BMI and current medication were all analysed. The patient's clinical records were reviewed to establish any previous respiratory diagnosis.

Results: 17/122 (14%) patients had a known diagnosis of COPD however 32/122 (26%) had airflow obstruction on spirometry, with only 12 of these having a diagnosis of COPD. 5 patients with a diagnosis of COPD did not demonstrate airflow obstruction.

The data was subsequently split into those with airflow obstruction (n=32) and those without (n=90). Despite differences in the group size, the two groups were matched for aneurysm size, age and V_E/VCO_2 at anaerobic threshold.

There were significant differences between those with airflow obstruction and those without for breathing reserve 20.8 versus 37.95 % (p=0.0002), anaerobic threshold 11.0 versus 12.30 ml/min/kg (p=0.0073), peak VO_2 15.1 versus 16.8 ml/min/kg (p=0.0018), smoking history 49 versus 30 pack years (p=0.0069) and BMI 26.0 versus 28.1 kg/m^2 (p=0.0024); respectively.

Conclusions: The results confirmed that a significant proportion (16%) of our patients had previously undiagnosed/unrecognised airflow obstruction with the prevalence of airflow obstruction 26%. As would be expected, patients with airflow obstruction had an increased pack year smoking history and a decreased BMI when compared to those without. Airflow obstruction also resulted in a decreased peak VO_2 and a worsening of ventilatory limitation which has the potential to influence surgical decision making.
A respiratory review and optimisation of therapy in these patients may result in improvements to baseline lung function and ultimately CPET results and should be considered prior to surgical decision making.

References

1. Flessenkaemper, I.H., Loddenkemper, R., Roll, S., Enke-Melzer, K., Wurps, H. and Bauer, T.T., 2015. Screening of COPD patients for abdominal aortic aneurysm.
2. Vishal Sharma, M.D., 2011. Abdominal aortic aneurysm: a comprehensive review.

WHAT CAUSES OCCUPATIONAL ASTHMA IN CLEANERS?

Moore V, Burge S, Robertson A, Parkes, E, Walters G
Birmingham Occupational Lung Disease Service, Heart of England NHS Foundation Trust.

Introduction:
Domestic cleaners show a consistently raised risk of developing asthma in population-based epidemiological studies. The main risks appear to be the use of bleach and sprayed cleaning agents. These risks are now found in other occupations, such as healthcare due to the requirement for disinfection of clinical areas. We have carried out 4 specific inhalation challenge tests to chlorine-releasing tablets mixed with cold water but none of these have elicited an asthmatic reaction. Due to the negative nature of the tests, we considered the possibility that the chlorine itself may not be the provoking factor, but that the chlorine-releasing formulations are reacting with amines from urine or bodily fluids when they are being used to disinfect clinical areas. We now present a new case of OA in a 48 year-old care assistant for the elderly. Her exposures included latex gloves, floor cleaning materials and alcohol gel. She carried out 2-hourly serial peak flow records at work and at home which showed work-related changes (Oasys score 3.12). A specific inhalation challenge (SIC) was carried out to ascertain the cause.

Methods: Neutral detergent solution, "Haztab" chlorine solution (10,000ppm), urine, and a chlorine/urine (5%) mixture were painted onto cardboard on separate days for a total of 70 minutes. FEV_1 was measured every 5-10 mins during the first hour then hourly for the following 10 hours.

Results: The chlorine/urine mixture provoked asthmatic symptoms and a sustained drop in FEV_1 of up to 34% from baseline. There was no response to chlorine or urine alone nor the detergent. Figure 1 shows the main results. She showed mild airway hyper-reactivity pre challenge which was not repeated post challenge due to a continued low FEV_1 of 39% predicted.

Conclusions: The SIC results suggested that chloramines were the cause of her asthma, similar to the agents causing occupational asthma in workers exposed to indoor swimming pool vapours/ mists.

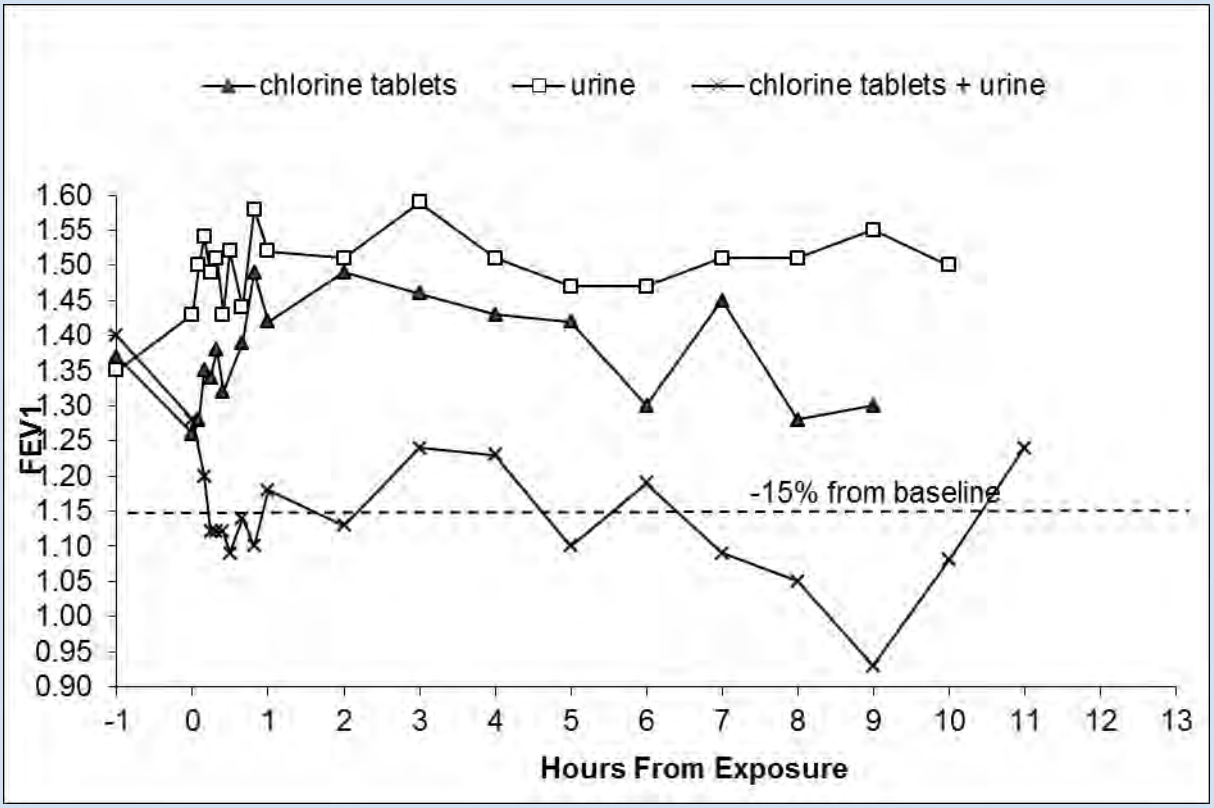


Figure 1. FEV_1 vs hours of exposure

Return to abstracts menu

REAL FLIGHT S_PO_2 COMPARES WITH HYPOXIC CHALLENGE TESTING IN ADULTS WITH CYSTIC FIBROSIS.

Peat R. Liverpool Heart and Chest Hospital

Introduction:
Limited data are available comparing air travel with the hypoxic challenge test (HCT) in adults with cystic fibrosis (CF). The aim of this study was to assess the predictive capability the HCT to in-flight hypoxaemia in adult passengers with CF.

Methods:
Fifteen subjects (three male) volunteered for this study. Lung function measurements (FEV_1) were performed pre and post flight. Oxygen saturation measured by pulse oximetry (S_pO_2) and symptoms were recorded in-flight on both outward and inward flights. The HCT was performed post flight and the in-flight oxygenation response was compared to the HCT and lung function results.

Results:
All subjects flew without the use of oxygen, and no adverse events were recorded in-flight. Air travel caused significant desaturation ($p<0.001$) (mean pre flight S_pO_2 95+-1%; mean in-flight S_pO_2 90+-3%). The HCT caused mean desaturation ($p=<0.001$) that was comparable to that of air travel (90+-3%). The pre flight FEV_1 and in-flight S_pO_2 showed weak correlation ($r=0.41$ $p=0.125$). The HCT SpO2 showed strong correlation with in-flight S_pO_2 ($r=0.74$ $p<0.001$). The HCT showed the strongest correlation with the lower S_pO_2 value measured from both outward and inward flights ($r=0.92$ $p<0.001$).

Conclusions: Significant in-flight desaturation can be expected in passengers with CF. The HCT results compare favourably with air travel data and may be considered the best widely available laboratory test to predict in-flight hypoxaemia in adults with CF.

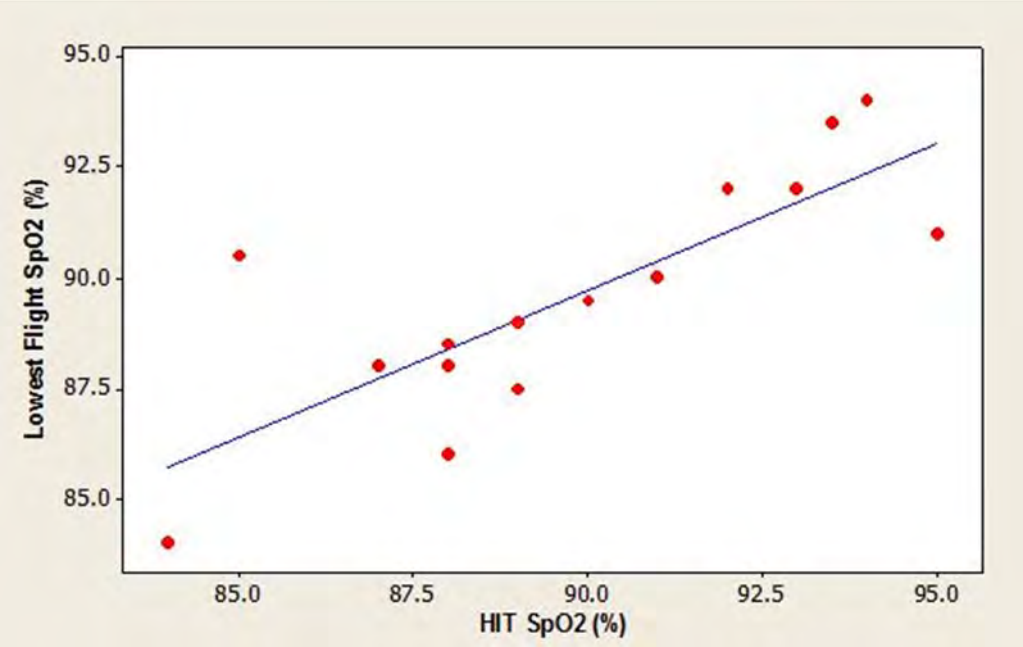


Figure 1 HCT S_pO_2 vs lower mean in-flight S_pO_2

LONGITUDINAL MONITORING OF DISEASE PROGRESSION IN CHILDREN WITH MILD CYSTIC FIBROSIS USING HYPERPOLARISED GAS MRI AND LUNG CLEARANCE INDEX

Smith L[1,2], Aldag I[1], Hughes P[2], Horn F[2], Marshall H[2], Norquay G[2], Collier G[2], Highes D,[1] Taylor C[1], Horsley A[3], Wild J[2]

1 Sheffield Children's Hospital

2 University of Sheffield

3 Manchester Adult CF Centre

Introduction: FEV_1 is insensitive to early changes in lung disease in cystic fibrosis (CF), yet it remains the clinical lung function standard. Ventilation magnetic resonance imaging (MRI) allows direct visualisation of lung ventilation after the inhalation of a hyperpolarised noble gas. In mild CF, small ventilation defects are often visible using ventilation MRI, which is more sensitive than FEV_1, CT and the lung clearance index (LCI) at detecting early lung disease. We hypothesised that ventilation MRI would be able to monitor disease progression with time and that ventilation MRI metrics would be more sensitive to longitudinal change than LCI or spirometry.

Aim: To assess changes in lung disease using ventilation MRI, LCI and spirometry in a group of children with mild CF at 2 year intervals.

Methods: 9 children with CF and FEV_1 >-1.64 z-score were assessed at baseline and 2 years later.

Results: FEV_1 did not change significantly over 2 years: baseline FEV_1 z-score = -0.01 (0.81) vs -0.02 (0.70) at 2 years. 2/9 subjects had an abnormal LCI at baseline. At 2 years, LCI had increased significantly and 6/9 subjects had an abnormal LCI: baseline LCI 6.98 (0.64) vs 8.17 (1.36), p=0.008. All subjects had ventilation defects evident on ventilation MRI at baseline, which significantly worsened at 2 years. Ventilation defect volume % was significantly increased (4.5 (2.1) vs 13.03 (4.97)% p=0.004). The coefficient of variance (inter-voxel ventilation heterogeneity) was increased in 6/9 subjects at 2 years compared to baseline, though not statistically significant (10.12 (1.49) vs 11.8 (1.99)% p=0.1). Figure 2 demonstrates comparative ventilation MR images and lung function at baseline and 2 years from the same subject.

Conclusion: Hyperpolarised gas ventilation MRI is capable of detecting sub-clinical lung disease in well children with CF. Ventilation MRI is more sensitive at detecting longitudinal lung function deterioration than both LCI and FEV_1.

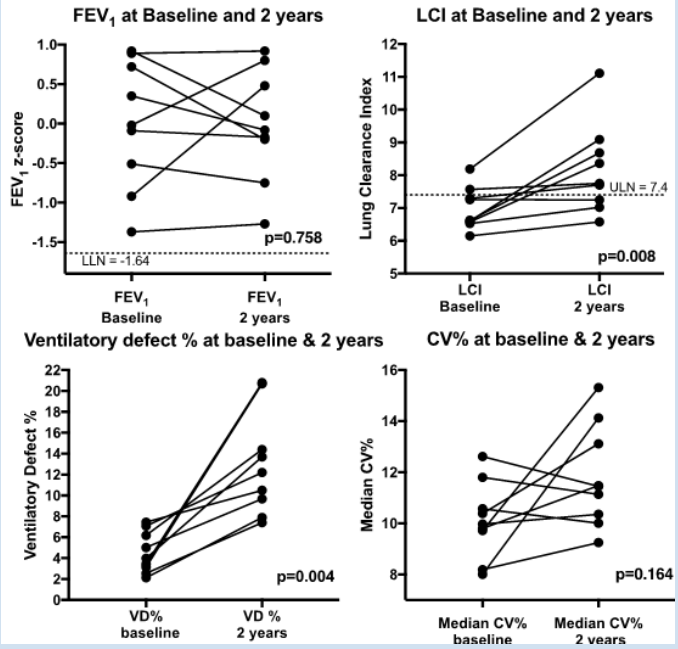


Figure 1. Comparison of lung function at baseline

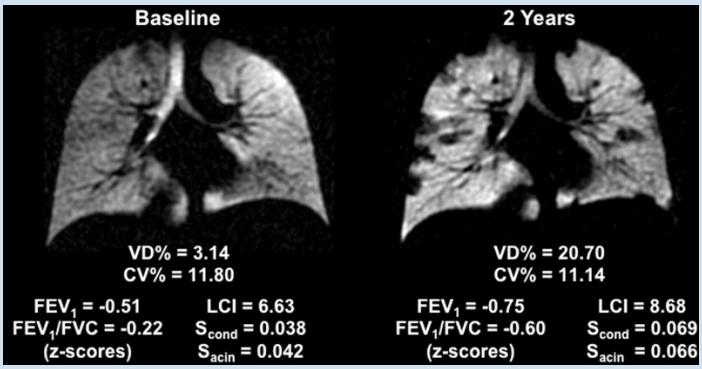


Figure 2. CF example subject. Baseline and 2 year follow-up ventilation MR images and corresponding lung function

Return to abstracts menu

WOULD CHANGING FROM EUROPEAN COMMUNITY FOR COAL AND STEEL (ECCS) REFERENCE EQUATIONS TO THE GLOBAL LUNG INITIATIVE (GLI) REFERENCE EQUATIONS AFFECT THE GRADING OF SEVERITY OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) WHEN USING NICE GUIDELINES?

Beacham M. Respiratory Centre, New Cross Hospital, Wolverhampton

Introduction: Reference equations are essential in lung function as they help determine normal lung function for an individual in respect of: gender; age; height; weight and ethnicity. The European Community for Coal and Steel (ECCS) reference equations have been predominantly used in lung function laboratories regardless of their limitations. It is widely known that ECCS has based their reference equations on European middle aged males who may have had a smoking history and who have occupation exposure to dust. Global lung Initiative (GLI) have recently developed new reference equations which include females and are based on people of all ages with normal lung function. GLI also provide reference equations for nearly all ethnicities. The aims of the new GLI equations are to make predicted lung function more accurate but also provide global standardisation of these tests. When changing from GLI to ECCS there is expected to be a change in the percent predicted value. This value is still commonly used to indicate abnormality and also grade severity of disease. Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death in the UK and can be graded for severity by using the FEV_1 % predicted – the percentage of the actual FEV_1 compared to the predicted value from the reference equations. A change in reference equations will therefore change COPD severity.

Methods: 356 males and females with a diagnosis of COPD by a respiratory consultant were included in this study. All patients had post-bronchodilator spirometry which met ARTP and departmental standards. All relevant data was input to a GLI calculator which allowed calculation of the % predicted FEV_1 using GLI reference equations. The two % predicted FEV_1's were then tested for statistically significant difference by performing a two tailed paired t-test.

Results: Table 1 shows 13% of patients were reclassified to a more severe COPD staging when changing from ECCS to GLI reference equations. It was found that ECCS underestimates the level of obstruction and on average patients in this study had a reduction in predicted FEV_1 by 4%.

Conclusion: This study has highlighted that change in reference equations is accompanied by change in disease severity and will therefore increase NHS expenditure on COPD. To overcome this, new guidelines must be produced on using GLI. Moving forward to GLI reference equations is an important development in lung function as these are better representative of the population. It is important that the impact this will have on spirometry interpretation is assessed, as eventually all laboratories in the UK will make this change.

References:

1. Miller, M. R. et al., 2011. Interpreting Lung Function Data Using 80% Predicted and Fixed Thresholds Misclassifies More Than 20% of Patients. Chest, Volume 139, pp. 52-59.
2. Quanjer, P. H., Brazzale, D. J., Boros, P. W. & Pretto, J. J., 2013. Implications of adopting the Global Lungs Initiative 2012 all-age reference equations for spirometry. European Respiratory Journal, Volume 42, pp. 1046-1054.
3. Sluga, R. et al., 2014. Impact of switching to new spirometric reference equations on severity staging of airflow obstruction in COPD: a cross-sectional observational study in primary care. Primary Care Respiratory Journal, 23(1), pp. 85-91.

Changes from ECCS to GLI	Males	Females
Mild to moderate	8	13
Moderate to severe	7	18
Severe to very severe	1	1
Total Changes	16	32
Amount of changes in study	48	

Statistics	ECCS	GLI
Observations	356	356
P(T<=t) two-tail	<0.01	
Mean FEV_1	61.32	57.28
Standard Error	1.043	0.958
Median FEV_1	60	56
Mode FEV_1	55	50
Standard Deviation	19.682	18.076
Sample Variance	387.42	326.75
Skewness	0.3916	0.3238
Average Change	-4%	

Tables 1 & 2. Summary of significant results

Return to abstracts menu

DEVELOPMENT OF A NON-COMPLEX NON-INVASIVE VENTILATION SERVICE IN A GENERAL HOSPITAL: PROCESS, EARLY DATA AND RATIONALE

Glover R, Lloyd J, Ismail I

Good Hope Hospital, Birmingham

Introduction: Non-invasive ventilation (NIV) is an established treatment for acute and chronic type II respiratory failure. Prior to this development, local services only accepted patients previously initiated on NIV following an acute admission.

Aim:

This is a clinical presentation of a local protocol developed to initiate non-complex NIV in an outpatient setting.

Method:

Therapeutic pressures are tentatively deduced in advance; end pressures are determined by tidal volumes, patient tolerance and blood gases. Effective ventilation, patient education and safety are primary goals.

Baseline and follow up measurements include, spirometry, blood gases, compliance with NIV and QoL measurement (SRI1). Follow up includes: 1) Remote monitoring of treatment data, with additional support/ appointments, 3) Review at one month for repeat measurements and consultation.

Results:

	Pre titration (SD)	Post titration (SD)	Change (SD)
pH	7.42 (0.03)	7.44 (0.04)	0.02
PCO_2 (kPa)	7.53 (0.9)	7.03 (0.8)	-0.50*
PO_2 (kPa)	7.34 (1.2)	7.66 (0.9)	0.32
HCO_3 (mmol/L)	35.4 (4.7)	33.2 (3.8)	-1.22

Table 1. Pre and post titration blood gases; *Significant difference

11 clinically stable patients underwent outpatient set up from February 2016 to October 2016; no adverse events were recorded. All subjects consented to long term NIV. There was a significant reduction in PCO_2 when comparing pre and post NIV titration blood gases ($p=0.0313$) and no significant change in PO_2. In patients with completed follow up to date, (currently 7/11), average compliance is reported as 4:59hrs in the first 30 days, and 6:35 in the preceding 7 days of the patients first review of therapy.

Conclusions:

Initiating NIV in outpatients can be successfully performed. NIV compliance is lower initially, and improves over time. This may be related to acclimitisation to therapy; correction of mask leak and delivering additional patient education which is made possible by utilising data obtained from remote monitoring. Further data to be reported is the efficacy of ventilation after a sustained period of usage.

References:

1. Windisch et al. The Severe Respiratory Insufficiency (SRI) Questionnaire: a specific measure of health-related quality of life in patients receiving home mechanical ventilation. J Clin Epidemiol 2003;56(8):752–9.

Return to abstracts menu

AN INVESTIGATION OF THE CORRELATION BETWEEN ALVEOLAR VOLUME (V_A) AND TOTAL LUNG CAPACITY (TLC) IN A COHORT OF PATIENTS REFERRED FOR LUNG FUNCTION TESTING.

Kaur B[1], Lloyd J[1], Laverty J[2]

1. *Respiratory and Sleep Investigation Department, Sutton Coldfield*
2. *Faculty of Science and Engineering, University of Wolverhampton*

Introduction: Previous studies suggest significant underestimation of V_A compared to TLC in obstructive lung disease. Lung function tests; Spirometry, Lung volumes (via multi-breath He dilution) and Gas transfer (single breath CO-Jones Meade method) monitor presence of lung disease, severity and treatment response. Gas transfer calculates V_A, an estimation of TLC (using CH_4) to determine restrictive disease (fibrosis) and obstructive disease (hyperinflation in COPD). A suitable surrogate for TLC in normal subjects is V_A, agreeing within 300-350ml[1].

Methods: 587 subjects (Sept 2013-Sept 2014), were retrospectively reviewed using a local database. Inclusion criterion was organised with accordance to ERS 2005 acceptability criteria[2]. The exclusion criteria were subjects with mixed ventilatory defects, technically unacceptable results and testing performed by nitrogen washout/whole body plethysmography. Students paired t-test quantified and compared differences between V_A and TLC. Bland Altman analysis observed variations between groups based on disease severity.

Results: 587 subjects data was collected, 35 were excluded. 552 subjects (M307:F249) were categorised using standard residuals (SRs). Median age at diagnosis was 76 years [range 25 to 84yrs]. The p-value for all subjects was <0.0001 even when categorised into obstructive, restrictive and normal subjects. p-Value suggested V_A and TLC were significantly different. Bland-Altman plots showed wide limits of agreement for restrictive (IQ range: 0.92L; SD: 0.26L) and normal subjects (IQ range: 1.26L; SD: 0.37L). Obstructive subjects had greater limits of agreement (IQ range: 2.72L; SD 0.74L), therefore V_A cannot be used as a predictor of TLC.

Conclusion: V_A (via single breath technique) and TLC (by He dilution) were significantly underestimated in all subjects. Closest agreement was seen in restrictive disease with greater difference in obstructive disease. V_A can't routinely be used as a surrogate measurement for TLC.

References:

1 Brusasco, V., Crapo, R., Vieg, G. (2005) Interpretative Strategies for Lung Function Tests. European Respiratory Journal, 26 (5), pp.948-968.

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A PATIENT PRESENTED TO HOSPITAL WITH BREATHLESSNESS, HEADACHE, DISTURBED VISION AND HYPOXIA – A CASE STUDY.

McArthur S

Royal Infirmary of Edinburgh

Introduction: A Caucasian female patient aged 26, height 1.675m, weight 44kg, presented to hospital with breathlessness, headache, disturbed vision and hypoxia. She has a previous diagnosis of polycythaemia, Gastro-oesophageal reflux disease (GORD) and epistaxis. The patient was given a diagnosis of idiopathic erythrocytosis and prescribed prophylactic aspirin. Her Von Hippel Landau (VHL) genetic test was negative. Full blood count, biochemistry and arterial blood gases showed raised haemoglobin (Hb) in keeping with previous polycythaemia. Her arterial blood P_aO_2 was 7.42KPa (normal range 11-13). She was in type 1 respiratory failure. Doctors queried whether she had a lower respiratory tract infection (LRTI) on admission so she was started on 3 day course of amoxicillin and clarithromycin. Virology throat swab and bacterial cultures were normal. The CT of her head and abdomen were normal but her CT pulmonary angiogram showed multiple arteriovenous malformations (AVMs) in all lobes of lungs. Her nuclear medicine ventilation/perfusion scan (Q) showed heterogeneous uptake of isotope within the lungs with no focal perfusion defects identified. Uptake of isotope was noted within the kidneys which is indicative of underlying right to left shunting. Her inpatient pulmonary function tests showed normal spirometry and lung volumes but transfer factor was severely reduced when corrected for Hb (moderately when uncorrected). When thinking of a differential diagnosis it could have been limited cutaneous systemic sclerosis (CREST syndrome) due to the facial telangectasias but it was more likely to be Hereditary Haemorrhagic Telangiectasia (HHT): Osler-Weber-Rendu syndrome. The patient was diagnosed with HHT. Her family are now all to be tested for HHT and receive genetic counselling. She was referred for potential embolisation of the large pulmonary AVMs to the Scottish Vascular Unit at the Golden Jubilee Hospital in Glasgow. A marked improvement in symptoms was noted since embolisation.

Abstract Extra Text

http://www.nhs.uk/conditions/hereditary-hemorrhagic-telangiectasia/Pages/Introduction.aspx http://labtestsonline.org.uk/understanding/analytes/jak2/tab/test/

Return to abstracts menu

SENSATIONS ASSOCIATED WITH EXPERIMENTALLY EVOKED COUGH: A COMPARISON OF CHRONIC COUGH PATIENT WITH HEALTHY CONTROLS

Mitchell J[1], Al-Sheklly B[1,2], Stout M[1,3], Kelsall A[1], Issa B[1,2], Collier T[1] Corfield D[2], Smith J [1,2]

1. *University Hospital of South Manchester, UK.*
2. *The University of Manchester, UK.*
3. *Manchester Metropolitan University, UK.*

Introduction: Cough is a common complaint for which patients seek medical care and considered a protective airway reflex. Emerging evidence suggests chronic coughing is provoked by airway sensations, such as irritation, tickle (throat) and urge to cough (UTC).

Objectives: We hypothesised that inhaling low dose irritants would evoke similar sensations, providing a model for investigating cough. We also investigated whether sensations are intrinsically linked to coughing, hoping to identify which sensations are most important.

Methods: 12 chronic cough patients (mean age 61.4yrs, 75% female, median cough duration 7.5yrs) and 10 healthy volunteers (mean age 48.8yrs, 40% female) inhaled increasing concentrations of citric acid from a dosimeter (0.012–4.0M). Following inhalation subjects rated irritation, tickle, taste and UTC on 100mm visual analogue scales (VAS; 0mm=none, 100mm=worst). The challenge continued until subjects coughed at least twice on any concentration (C2). For the analysis, VAS data were aligned by the C2 and sensation VAS scores compared using Mann-Whitney U tests. General estimating equation (GEE) modelling assessed relationships between sensations and amount of coughing.

Results: Chronic cough patients had a lower C2 than healthy controls (median 0.094 vs. 0.5M, p=0.009). UTC and coughs evoked were similar at C2 and for the preceding concentrations in both groups (Fig. 1). Tickle, irritation and taste were rated more highly by healthy volunteers at C2 and for preceding doses; e.g. at C2, irritation was significantly higher in healthy controls (p=0.035) and tickle borderline significant (p=0.052) compared with chronic cough patients, however taste was the same (p=0.29). GEE modelling suggested irritation and UTC most strongly predicted cough.

Conclusion:

As well as differences in cough threshold, chronic cough patients exhibit heightened UTC rather than other sensations in response to low level tussive agents.

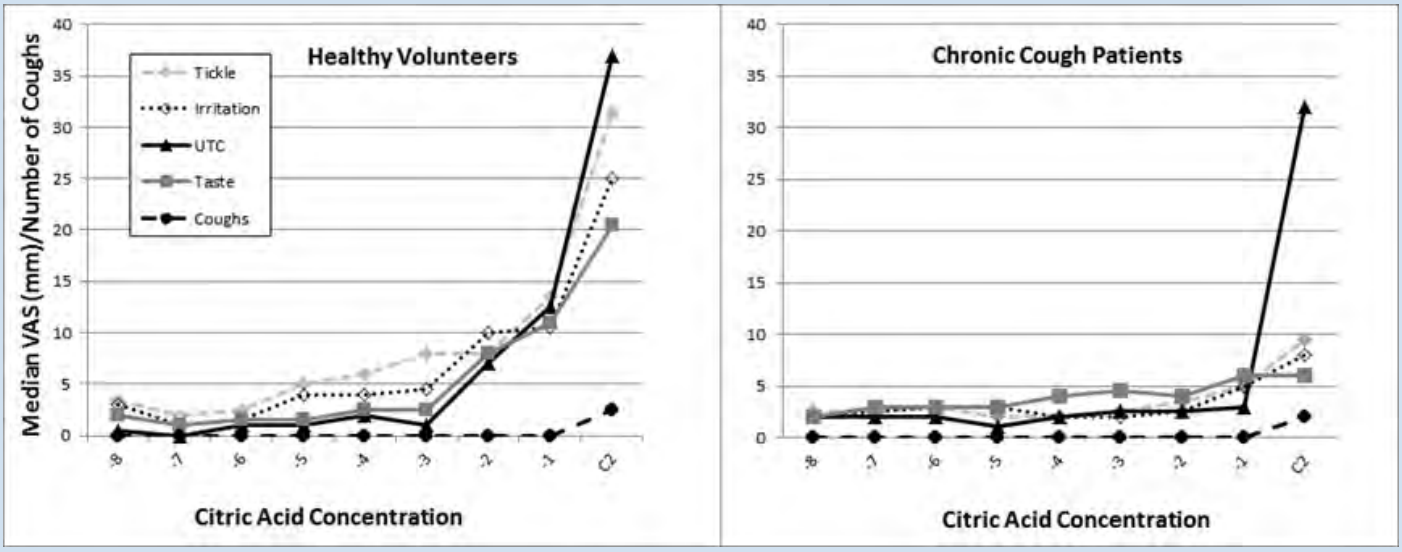

Figure 1

A COMPARISON OF THE CORRELATION OF HEALTH STATUS OF THE ONE MINUTE SIT-TO-STAND TEST (STST) AND THE SIX MINUTE WALK TEST (6MWT) IN STABLE COPD.

Munro E. University Hospital of North Midlands

Introduction: Dyspnoea and functional status have the largest impact on quality of life in patients with COPD. The STST is a quick, practical method of assessing functional status, but is used less often than the gold standard 6MWT. The primary aim of this investigation is to explore the results of the one minute STST in comparison to the 6MWT in relation to health status. An additional aim is to determine STST reproducibility in stable COPD patients.

Methods: Stable COPD patients attending a tertiary centre were recruited. STST and 6MWT were performed to assess functional status. Health status was assessed using St. George Respiratory Questionnaire (SGRQ), mMRC (modified Medical Research Council scale) and iBODE. Pearson's correlation was performed as a statistical analysis.

Results: 53 subjects were recruited (mean FEV_1=76.83% [15-127%]; FEV_1/FVC ratio= 55%[24-69%]; mean age=66.9 years [42-86]). The STST and 6MWT demonstrated strong association ($p<0.05$). Both correlated with health related quality of life (HRQoL) and respiratory disability ($p<0.05$).

Significant association was observed between the iBODE and 6MWT (p value 0.007). However, weaker correlations were noted between the iBODE and STST (p value 0.09).

Conclusions: The STST may be utilised as an alternative to the 6MWT for the evaluation of functional status in COPD patients. Furthermore, the STST correlates with both HRQoL and respiratory disability.

Return to abstracts menu

EVALUATION OF 7 SEPARATE SHUNT FRACTION FORMULAS USED IN CLINICAL PRACTICE

Noakes R. University Hospitals of North Midlands (UHNM)

Introduction: Hypoxaemia can be caused by numerous disorders including right-to-left shunt. The two types of right-to-left shunt are anatomic and physiological. The main effect of a right-to-left shunt is V/Q mismatching which results in hypoxaemia and is often not corrected with supplemental oxygen.

Shunt fraction (Qs/Qt) equations are used to calculate the degree of shunt. There are numerous formula available utilising arterial blood gas parameters whilst the patient breaths 100% oxygen. A number of assumptions and estimations are made within the formulas, and these differ depending on the formula used. The calculation's investigated included Löllgen (5,15); Chiang; Chiang Mod; Löllgen (5.00); Costabel; Haber; and Oczenski.

Aim: To validate current utilised shunt fraction formula (UHNM) against alternative calculations.

Methods: The Qs/Qt from 7 different shunt fraction formulas were compared in 28 subjects within UHNM's current practice (Up-to-date). The shunt study was performed on each subject as per the local standard operating procedure (SOP) and as part of normal clinical practice. The arterial blood sample was obtained (post 20 minutes FiO2 100%) with PaO2 and PaCO2 results inputted into all equations. Ethics approval was not required as all investigations followed normal clinical practice. .

Results: The data was non-normally distributed therefore, a Mann-Whitney test was conducted to compare Qs/Qt values derived from the 7 different formulas. There was no significant difference in the Qs/Qt value for all formulas (Table 1).

Conclusions: When using different formulas to calculate shunt fraction (Qs/Qt) there is no significant difference between the recognised formulas, however Costabel and Haber are more likely to indicate a shunt in borderline cases resulting in possible over diagnosis.

References:

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Formula	Mean (SD)	Median	Q1	Q3	p-value
Löllgen (5,15)	9.89 (6.74)	7.720	4.690	12.470	0.9347
Chiang	9.85 (6.72)	7.690	4.670	12.410	0.9543
Chiang Mod	10.15 (6.90)	7.940	4.840	12.790	0.7308
Löllgen (5,0)	10.15 (6.90)	7.940	4.840	12.790	0.7308
Costabel	11.40 (7.65)	8.550	5.410	14.420	0.3987
Haber	12.38 (10.14)	8.860	5.070	15.250	0.4363
Oczenski	9.67 (7.61)	6.950	4.100	11.830	0.5498

Table 1: Results

Return to abstracts menu

THE INTER-RATER VARIABILITY IN DETERMINING THE ANAEROBIC THRESHOLD (AT) AFTER PREOPERATIVE CARDIOPULMONARY EXERCISE TESTING (CPET)

Parkes E, Moore V. Respiratory Physiology and Sleep, Heartlands Hospital, Birmingham, UK.

Introduction: The oxygen uptake (VO_2) at the anaerobic threshold (AT) has been well documented to predict the relative risk of major abdominal surgery in the elderly patient[1]. It has been shown to correlate with length of hospital stay (LOS), postoperative complications (PC) and the requirement for either high dependency unit (HDU) or intensive therapy unit (ITU) bed allocation. The determination of the AT by the V-Slope method was first described by Beaver[3] in 1984 and has since become the 'gold standard' in clinical practice.

Aim: The purpose of this abstract is to assess the inter-rater variability of determining the AT after preoperative CPET.

Methods: Two raters determined the AT of a consecutive series of patients. The raters were blinded to each other's AT's during data collection. Pearson's correlation coefficient was performed to determine the inter-rater association. A Bland-Altman plot was used to assess inter-rater agreement.

Results: In total, two raters determined 29 consecutive AT's. Mean patient age was 69 years with 18 males and 6 females. A total of 5 patients were excluded from data analysis due to performing a submaximal CPET (no AT achieved) or CPET terminated due to safety reasons. Pearson's correlation coefficient was 0.956. Linear regression analysis produced an r2 value of 0.917 (Figure 1). The correlation between rater 1 and rater 2 reached statistical significance (p=<0.0001). Bland-Altman plot also showed a high level of inter-rater agreement. Independent samples t test showed no statistically significant difference between rater 1 AT and rater 2 AT. AT=Anaerobic Threshold CPET=Cardiopulmonary exercise testing

Discussion: To the best of our knowledge this is the first study that has investigated the inter-rater variability in determining the AT from CPET. This study shows that within this small single centre cohort there is a high agreement between two raters determining the AT by the 'gold standard' V-Slope method. Future, larger, multicentre studies would be required to further substantiate this study.

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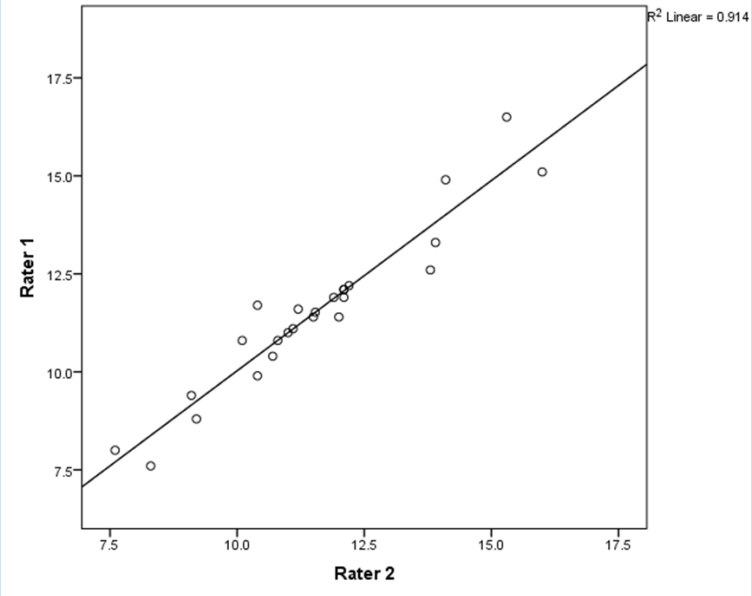


Figure 1. The inter-rater variability

Return to abstracts menu

TELEMEDICINE SPIROMETRY VALIDATION

Peat R. Liverpool Heart and Chest Hospital

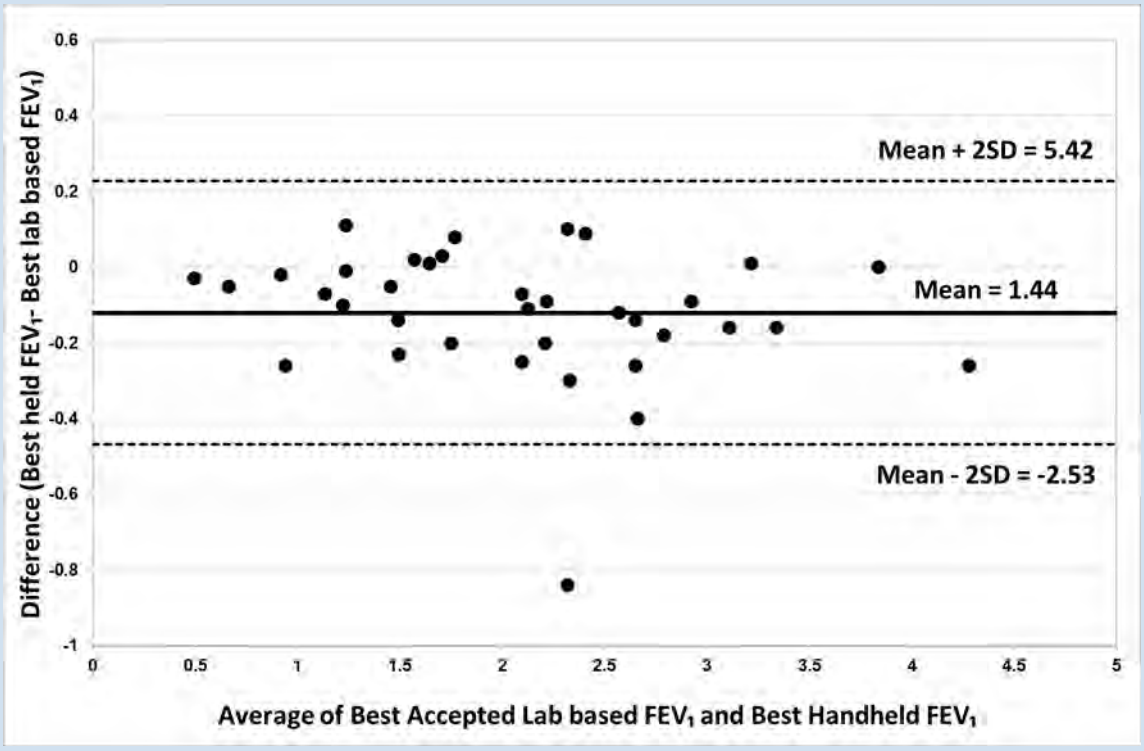
Introduction: Spirometry is considered one of the most important tests for the monitoring of CF and is commonly performed at each clinic visit. With the emerging appetite for telemedicine as a viable alternative to traditional hospital outpatient visits, the suitability of an inexpensive handheld spirometer was assessed for home use.

Methods: We compared the accuracy of a handheld spirometer (COPD6, Vitalograph, UK) with a standard laboratory based spirometer (Spirostik, Geratherm, Germany) in 41 consecutive adult CF patients (mean age 39 years [SD 11.4], mean predicted FEV_1 60% [23], 16 male) attending our regional CF centre. All were experienced at performing spirometry. They were randomly assigned to either device and carried out 3 manoeuvres before repeating the test session the alternative spirometer. Both testing sessions were supervised and performed in the same clinic room. Patient coaching and feedback was withheld from the handheld spirometry session. Intra-session analysis of flow volume tracings was carried out for lab based testing sessions.

Results: Acceptable paired results were obtained in 36 patients (88%). The mean Spirostik FEV_1 was 2.14L (variability 0.06 [2.3%]) and COPD6 2.02L (variability 0.09 [4.4%]); mean difference between devices 0.12L (5.6%). Eight of 36 (22%) results were lower on the handheld device.

Analysis of the flow volume tracing was required for 6 patients (16%) to either improve technique (3), or QC/ eliminate artefact (3): where artefact was not eliminated, FEV_1 was overestimated by 0.08 to 0.09L (~4.5%).

Conclusion: The handheld device was easy to operate and accuracy and repeatability was considered to be acceptable for a telemedicine/home use application. However, differences between traditional clinic/laboratory spirometry results and telemedicine spirometry results were observed. When comparing spirometry results clinicians should have an appreciation of expected differences. Additional variables may exist where patients are unsupervised in a home setting.



A MODIFIED HYPOXIC CHALLENGE TEST (HCT) ASSESSMENT ON A PATIENT WITH CONGENITAL CENTRAL HYPOVENTILATION SYNDROME (CCHS) .

Rees S, Raywood E, Laverty A, Abel F, Samuels M

Lung Function & Sleep Laboratories, Great Ormond Street Hospital for Children NHS Foundation Trust

Introduction: Congenital central hypoventilation syndrome (CCHS) is a rare disease with estimated prevalence of 1000-1200 cases worldwide[1]. CCHS is commonly caused by a spontaneous mutation of the PHOX2B gene, involved in the prenatal development of the autonomic nervous system, responsible for control of breathing by responding to carbon dioxide levels in the blood. CCHS patients require ventilator support while asleep and occasionally while awake. The management of respiratory patients planning air travel is well documented[2] however there is little literature on the impact of flying for CCHS patients. During hypoxic challenge testing (HCT), patients are assessed for supplemental oxygen requirements while at airborne cabin pressure.

Case Presentation: A 7 year old boy with CCHS and on current ventilatory support hoped to fly to Switzerland and was assessed using a HCT for response to hypoxia plus the effect of administering supplemental oxygen and/or mechanical ventilation.

Method: A HCT was performed following the recommended method[2]; using a body plethysmograph in which fractional oxygen concentration was decreased to 15% in an air tight chamber to simulate the cruising cabin environment. The patient's oxygen saturation (S_pO_2), heart rate and transcutaneous carbon dioxide (T_CO_2) were recorded.

Results: The patient's results can be seen in Figure 1. Within 3 minutes in 15% oxygen, S_pO_2 decreased to <90% and ranged between 87-91% over 10 minutes. The patient then applied his ventilator (Resmed Stellar 100 with oronasal mask) at his usual nocturnal settings and without a ramp. S_pO_2 was maintained between 92-95% on the ventilator. After 10 further minutes the ventilator was removed and the patient remained in 15% oxygen for 5 minutes, when a decrease in S_pO_2 to 83% was recorded. Supplemental O_2 (0.5L/min via nasal cannula) was administered and maintained S_pO_2 between 96-99%. T_CO_2 was 39-45mmHg throughout the test period.

Discussion: Currently there are no published or consistent recommendations for patients with CCHS undertaking air travel. The patient in this study was advised to use the ventilator rather than additional inspired oxygen, during the flight, to better maintain lung inflation, minimise VQ mismatch and avoid hypercapnia. However, a larger study would be required to determine if this would be applicable to all patients with CCHS. The role of ventilatory support and/or supplemental O_2 during air travel may also be relevant to other patients e.g. the ventilated neuromuscular cohort.

References:

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Figure 1: Yellow room air, Blue 15% O_2, Red 15% O_2 with patient wearing ventilator, Green supplemental O_2 1L/min. The graph starts and ends with the child in room air.

Return to abstracts menu

A PILOT STUDY INVESTIGATING THE BENEFITS OF PERFORMING SLEEP DIAGNOSTICS IN PRIMARY CARE OF A LOCAL POPULATION

Matharu T. Manchester Metropolitan University, UK; Respiratory Physiology Department, University Hospitals of Coventry and Warwickshire, UK

Introduction: Obstructive Sleep Apnoea (OSA) is a condition that affects an individual's quality of sleep. Its prevalence currently stands at approximately 5% of the UK population, of which only a small proportion of these have a confirmed diagnosis. The effects of untreated OSA are grave therefore diagnosis and treatment amongst this cohort of patients is paramount. The main limitation of detection is significantly reduced awareness of the condition amongst the general population. Currently, all sleep diagnostics are performed within a secondary or tertiary care setting. This has massive implications of waiting times currently due to increased levels of requests. As a result, a significant number of patients are breaching on the national stipulated 18-week care plan.

Aim: The aim of this study is to investigate whether having the ability to perform sleep diagnostics in primary care will reduce waiting times for patients.

Method: A desired sample size of 100 patients will be obtained through GP surgeries. Analysis of results will be carried out in accordance with American Association of Sleep Medicine (AASM). For positive studies, where treatment is warranted (AHI> 15/hour), treatment will be initiated.

Results: The data collected will look at the timescale of patient pathway care. Statistical analysis will be applied to see whether implementation of this change to the current pathway is statistically significant. Non-parametric data analysis will be applied to see whether current published symptoms associated with OSA remain true of a current local population.

Conclusion: Following full data collection the results will determine whether the new proposed pathway change will be worthwhile. Data collection at this stage is not complete. Provisional raw data shows a vast improvement in diagnosis time, with a current turn around of three weeks from initial GP consultation to diagnosis, in comparison with a current clock stop time period of greater than eighteen weeks. The provisional data, without statistical analysis, shows a vast improvement. Once all data has been collected a full statistical analysis will be applied and a firm conclusion will be determined.

Keywords:

OSA, primary care, sleep diagnostics, sleep diagnostics pathway of care

A COMPARISON OF TWO SPIROMETERS IN HEALTHY SUBJECTS AND PATIENTS WITH RESPIRATORY DISEASE.

Sharley T, Stockley JA, Cooper BG. Lung Function & Sleep, Queen Elizabeth Hospital Birmingham NHS Foundation Trust, Birmingham, United Kingdom B15 2GW

Aim: The aim of the study was to establish the accuracy of spirometry measurements produced by a newly developed turbine spirometer (SpiroConnect, MedChip Solutions, Kent, UK) in comparison to those obtained from a pitot-type spirometer (MGC Ultima). Recorded data was further analysed in order to establish whether the spirometers measured differently in subjects with a range of lung pathologies routinely having spirometry.

Methods: Each spirometer was calibrated or verified as per the manufacturer's instruction prior to each testing session. Subsequently FEV_1, FVC and VC measurements were made in a randomised order upon each spirometer in agreement with the ARTP/BTS Guidelines for the Measurement of Respiratory Function[2]. The prospective, cross over design study included 33 subjects, either healthy volunteers (n=10) or patients with lung disease (n=23). Bland and Altman analysis, analysis of variance, intra-class correlation coefficients and the mean percentage difference between devices were utilised to examine the results. Ethical approval for the study was granted by the Solihull NHS Research Ethics Committee.

Results: Summary data is shown in Table 1. FEV_1 (range 0.71-4.92 litres) FVC (range 1.49-6.43 litres) and VC (range 1.45-6.52 litres) measurements demonstrated close agreement between devices; this was further supported by mean measurements from both devices being within 2 standard deviations of the mean. However there were significant difference s in PEF and MMEF. Analysis of variance between devices demonstrated no statistically significant differences in the measurement of FEV_1, FVC or VC and intra-class correlation coefficients showed a high correlation between devices. There were significant differences flow measurements PEF, MMEF and FET (ANOVA, t-test, $p<0.05$))

Conclusions: No clinically significant differences in the FEV_1, FVC or VC measurements occurred in the two devices. However PEF, MMEF and FET differed significantly with increasing value.

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	Medgraphics						SpiroConnect					
	FEV_1 (L)	FVC (L)	FEV_1/ FVC (%)	PEF (L/s)	MMEF (L/s)	FET (s)	FEV_1 (L)	FVC (L)	FEV_1/ FVC (%)	PEF (L/s)	MMEF (L/s)	FET (s)
Mean	2.32	3.31	69.9	6.25	3.25	9.29	2.28	3.49	64.8	6.60	1.60	10.73
SD	1.05	1.16	15.7	2.06	7.88	3.58	1.04	1.14	15.7	2.15	1.22	4.31

Table 1.

Return to abstracts menu

DOES EPWORTH SLEEPINESS SCORE (ESS) PREDICT COMPLIANCE WITH CONTINUOUS POSITIVE AIRWAYS PRESSURE (CPAP) THERAPY, IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA (OSA)?

Butler A, Lloyd J. Respiratory & Sleep Investigations Department, Good Hope Hospital, Sutton Coldfield, England.

Introduction: Continuous positive airways pressure (CPAP) is the first-line treatment for moderate to severe obstructive sleep apnoea (OSA); however compliance with treatment is often low.

Aim: The aim of this study was to identify any correlation between baseline Epworth Sleepiness Score (ESS) and average nightly compliance with CPAP therapy.

Method: A retrospective service review was conducted for patients diagnosed with mild to severe OSA via multi-channel sleep studies, and initiated on CPAP between January and December 2015. ESS score was recorded at baseline. ESS and average compliance were recorded at follow up; 2-4 weeks post commencement of therapy.

Results: 121 patients were included. Average compliance with therapy was 5.50hrs (standard deviation= 2.16). Average baseline ESS was 12.30 (standard deviation = 5.08) with an average reduction of 5.64 (standard deviation = 4.69) points at follow up. Relationship between compliance and ESS was analysed using a Spearman's correlation. No significant relationship was found between baseline ESS and average nightly compliance (p= 0.49). Change in ESS and average nightly compliance also showed no significant relationship (p=0.196).

Conclusion: Neither baseline ESS, nor change in ESS, once therapy is initiated, can be used as a predictor of compliance with CPAP therapy. Further research is needed to assess the impact of gender and co-morbidities on ESS.

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Return to abstracts menu

COMPARISON OF MANUAL AND AUTOMATIC SCORING OF LIMITED CHANNEL SLEEP STUDIES: NOXTURNAL SOFTWARE CORRELATES WELL WITH MANUAL SCORING IN SEVERE OSA.

Cachada, N; Thomas, M. Respiratory Physiology and Sleep Disorders, Heart of England NHS Foundation Trust, Birmingham, UK

Introduction: Demand for diagnostic sleep services is increasing in line with the number of referrals for patients with suspected obstructive sleep apnoea (OSA). Current practice at Birmingham Heartlands Hospital is for a physiologist to manually score limited channel sleep studies with apnoea-hypopnea index (AHI) as the outcome. However, the software used for analysis employs algorithms to automatically score these events as well[1]. Using this auto scoring may reduce the delay between diagnosis and commencing treatment in patients, particularly useful in those with severe OSA.

Aim: To determine the reliability of auto scoring using Noxturnal software compared with manual scoring of sleep studies with AHI≥30/hour (severe OSA)[2].

Methods: The first ten severe OSA cases identified each month during 2015 (n=120) were included in the study. All the subjects received NOX T3 as a type III sleep study during one night. The time frame (lights off and lights on) was adjusted to the same range for both auto and manual scoring[2]. Agreement between the auto and manual measurement of AHI was determined by Bland-Altman plot and all outcomes were assessed for correlation using the Pearson's correlation coefficient.

Results: The average recording quality was 91.73%. There is a strong correlation in all the events analysed according to the Pearson coefficient. The data was skewed towards higher AHI with manual scoring. Nine studies changed OSA severity category to moderate by using the autoscoring system.

Conclusion: The automatic analysis is a reliable and time efficient tool. There is no clinical difference in the outcome for severe OSA patients and more research incorporating larger sample studies as well as other OSA severities is needed.

References:

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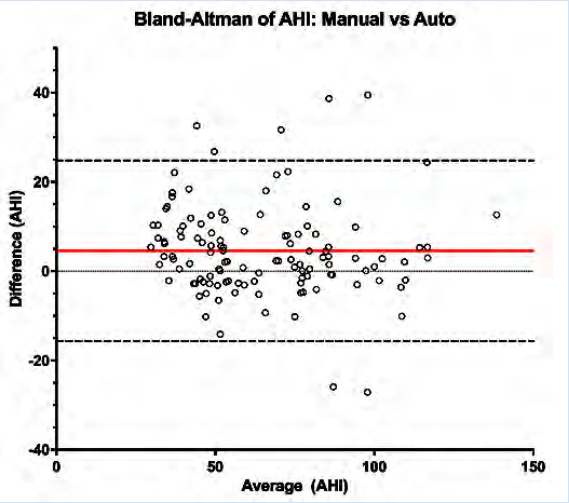
2. Richard, B. et al. The AASM Manual for the Scoring of Sleep and Associated Events, Version 2.3

n= 120	Average +/- SD. Manual (M)	Average +/- SD. Auto (A)	Pearson Correlation (r) M vs A*
AHI	67.25 +/- 24.29	62.70 +/- 25.11	0.9132
Oxygen Desaturation Index (ODI)	67.75 +/- 25.13	61.18 +/- 27.54	0.9421
Obstructive Apnoea (OA)	36.92 +/- 25.86	38.95 +/- 24.53	0.9543
Central Apnoea (CA)	1.71 +/- 3.25	1.74 +/- 2.99	0.9685
Mixed Apnoea (MA)	2.76 +/- 4.73	2.55 +/- 4.57	0.8533
Hypopnea	25.87 +/- 17.31	19.35 +/- 12.84	0.8399

* = p <0.0001 for all parameters Table 1. Statistical results



Return to abstracts menu

CAN RIP FLOW ANALYSIS BE USED AS A RELIABLE ALTERNATIVE TO NASAL CANNULA FLOW DURING SLEEP STUDIES?

Clavaud F. Salford Royal NHS Foundation Trust

INTRODUCTION: Nasal pressure transducer via nasal cannula (NC) is the American Academy of Sleep Medicine's (AASM) recommended way of measuring hypoponeas during a sleep study. The Nox T3 uses a Respiratory Inductance Plethysmography (RIP) from the abdomen and thorax respiratory effort belts to produce a substitute measurement of airflow.

OBJECTIVES: The aim of this study was to examine whether RIP flow analysis produces reliable results compared to NC flow analysis.

METHODS: This non blind study compared the difference in sleep study results between NC flow and RIP flow using the Nox T3 device. Studies from 15 patients with >95% reliability on both the NC flow signal and respiratory effort signals were included. The mean oxygen desaturation index was 31.5±9.0 % dips/hr, (range 4.6-118.8). Each study was analysed using two automated protocols (NC flow and RIP flow). Manual validation of events on either the NC or RIP trace, respectively was then performed using the AASM (version 2.1, hypopnoea rule1B) criteria by a trained physiologist. We report the results of Apnoea Hypopnea Index (AHI), Obstructive Apnoea Index (OAI), Hypopnea Index (HI), Central Apnoea Index (CI) and Mixed Apnoea Index (MI). Results are reported as mean±SEM. Differences were compared using a student paired t-test.

RESULTS: The results are shown in Table 1. Manual validation did not significantly alter any of the auto-analysed indices. Validated and non-validated OAI and AHI were significantly lower for RIP compared to NC flow. No significant difference was seen in the other indices.

Conclusion: RIP flow analysis under-estimates the AHI, particularly obstructive apnoeas, compared to NC analysis. This should be borne in mind when RIP flow is used to report sleep studies.

	Auto-analysis NC	Validated NC	Auto-analysis RIP	Validated RIP
OAI	12.6±3.7*	14.1±3.9 *	2.7±0.7	4.7±1.8
CI	2.6±1.3	3.3±1.3	6.7±4.2	3.2±1.6
MI	2.1±0.9	0.9±0.4	2.4±1.9	0.4±0.2
HI	20.9±7.5	17.6±5.1	24.1±7.7	21.1±7.3
AHI	38.1±8.5*	35.9±8.4 *	30.9±7.5	29.4±7.4

Table 1. Auto-analysis and manual validation indices for the nasal cannula (NC) and Resistance Impedance Plethysmography (RIP) flow analysis . * $p<0.05$ NC versus RIP.

COMPARISON OF CPAP PRESSURES USING A PREDICTED EQUATION VERSUS 95TH PERCENTILE CALCULATED BY AUTOTITRATING CPAP MACHINES

Cramp,G; Clarke,D; Goodlad, M; Matharu,T; Shakespeare,J. Respiratory Physiology and Sleep Department, University Hospitals Coventry and Warwickshire NHS Trust.

Introduction: .Obstructive sleep apnoea (OSA) can be successfully treated with continuous positive airway pressure (CPAP). The optimal pressure required to treat a patient's OSA can be determined by titrating the pressure over numerous nights, using a predictive equation or by utilising an autotitrating CPAP device to establish the 95th percentile pressure. Our department routinely uses autotitrating CPAP's however despite improvements in costs of these devices in recent times they still costs approximately £100 per person more than a fixed pressure device. Many patients with OSA can be effectively treated with fixed pressure devices which therefore has the potential to save costs.

A predicted CPAP equation was published by Loredo et al. in 2007[1]. This equation utilises parameters such as anthropometric measurements, sleep parameters and the Epworth Sleepiness Scale. The resultant equation is:

CPAP pred = (30.8 + RDI x 0.03 – Nadir Saturation x 0.05 – Mean Saturation x0.2) RDI = mean respiratory disturbance index (AHI/Total sleep time).

Aims: The aim of our study was to compare the predicted equation for CPAP pressure to the 95th percentile pressure from an auto titrating CPAP device. We also assessed the impact of device (using two different manufacturers) on the comparison between predicted equation and 95th percentile pressure.

Methods: The study included 40 patients (29 Male). Data was collected retrospectively from compliance data obtained from routine CPAP follow up clinics over a six month period. Equipment included ResMed S8, S9 and S10 devices and Phillips Respironics (Remstar range) devices and these were analysed using Rescan and Encore Pro 2 respectively. Data was limited to patients with greater than 70% compliance with therapy.

Results: There was no statistically significant difference between the predicted CPAP pressure and the 95th percentile pressure (p=0.2517) for the group as a whole.

Comparison of the predicted CPAP pressure equation and 95th percentile pressure by CPAP manufacturer did demonstrate significant differences. There was no difference between the pressure predicted by the Phillips Respironics devices (n=15) and the predicted equation (p=0.3847) with a mean difference of 0.76 cmH_2O. However the mean difference between the predicted pressure using the ResMed devices (n=24) was 1.375 cmH_2O and this was statistically significant (p<0.05).

Conclusion: This study demonstrates that for our patient group as a whole, the predicted equation is consistent with that from auto titrating CPAP devices. However, when the group was split according to equipment manufacturer there were significant differences. A limitation of the study was the sample size, this could have been larger and each device used in the second arm of the study could have had equal numbers used, as this may have contributed to the statically differences between the devices.

References:

Loredo JS, Berry C, Nelesen RA, Dimsdale JE (2007) Prediction of continuous positive airway pressure in obstructive sleep apnea. Sleep Breath 11:45-51

Return to abstracts menu

SIGNAL INTEGRITY AUDIT ON PAEDIATRIC CARDIORESPIRATORY SLEEP STUDIES

Godinho AJ, Laverty A, Samuels M. Respiratory Sleep Unit, Great Ormond Street Hospital for Children NHS Foundation Trust, Great Ormond Street Hospital, London, England

Introduction: Our attended paediatric cardiorespiratory sleep study measurements include respiratory bands (thorax/abdomen), S_pO_2 and pulse rate (oximeter), transcutaneous CO_2 (T_cCO_2), position and nasal flow (cannula).

Aims: To audit a score that assesses signal adequacy.

Methods: Studies were analysed (Embla REMlogic) to AASM paediatric guidelines[1]. Minimal channels required for diagnosis were specified as respiratory bands, S_pO_2 and T_cCO_2. A S_pO_2 signal audit formula was incorporated in the report to calculate % acceptable signal/artefact from Total Sleep Time (TST). A result > 50%TST was passed. T_cCO_2 was assessed from the overall trace. Respiratory bands were graded 1-5 for the time artefact-related signals were present. Studies scoring 3-5 were passed. Failed studies were reviewed for staff feedback. A secondary audit looked at % nasal flow from nasal cannula, using the audit formula for S_pO_2 but was not used for pass/fail criteria.

Results: 432 cardiorespiratory sleep studies were assessed and 99.8% passed with one failure due to T_cCO_2. This was confirmed by End-Tidal CO_2 spot checks. Nasal flow recording was less successful (62% TST) probably due to patients being ventilated non-invasively (mask) or invasively (tracheostomy) or where nasopharyngeal or nasogastric tubes were used.

Conclusions: A sleep sensor scoring system was developed to identify if signal quality was sufficient for analysis. Most studies passed overall, with nasal flow recording most likely to fail. The system is now incorporated into our daily practice.

References:

1. Berry RB, Brooks R, Gamaldo CE, Harding SM, Lloyd RM, Marcus CL and Vaughn BV for the American Academy of Sleep Medicine. The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications, Version 2.3. www.aasmnet.org. Darien, Illinois: American Academy of Sleep Medicine, 2016.

	S_pO_2 % pass	T_cCO_2 % pass	Effort Bands (1-5)	Nasal flow % pass	Study overall % pass
Mean	95.9	99	4.5	62.1	99.8
Standard Deviation	10.8	-	0.7	31.6	-

INTERMITTENT NEGATIVE AIRWAY PRESSURE: COULD IT HAVE IMPLICATIONS FOR TREATING OSA?

Al Humoud A[1], Benson J[1], Balanos G[1], Griffin H[2]

1. *The University of Birmingham*
2. *Hampshire Hospitals NHS Foundation trust*

Introduction: The upper airway is lined with mechanoreceptors that respond to negative pressure. When stimulated they cause a neural reflex that results in contraction of various muscles, which maintains airway patency. Although this reflex plays an important role in keeping the upper airway open during wakefulness in patients with OSA it is inadequate during sleep, which leads to upper airway collapse. CPAP is the current treatment for OSA but it is poorly tolerated, thus new therapies are required. A recent study on rats showed that exposure of these mechanoreceptors to intermittent negative airway pressure (INAP) causes a sustained enhancement of the reflex (Ryan and Nolan, 2009). If the same is true for humans and the responsible mechanisms can be identified then it is theoretically possible that a pharmacological agent could be developed to enhance this reflex. We have investigated whether INAP enhances the negative pressure reflex in humans.

Method: Following ethical approval by the University of Birmingham Ethics Committee, six healthy male volunteers undertook two experimental trials (INAP and Control). In the INAP trial participants were exposed to one hour of 30s episodes of breathing negative pressure (-15 cmH_2O) interspersed by 60s intervals of breathing ambient pressure. In the Control trial participants breathed at ambient pressure for one hour. The reflex activity of the genioglossus muscle (the major upper airway dilator) was measured during brief exposures (~3s) to negative pressure at baseline, immediately post INAP and one hour later. The magnitude of the reflex was assessed by comparing EMG activity during negative pressure to tonic activity during baseline (i.e. during ambient pressure) giving a % change, reported as the mean ± SEM.

Results: Results and Conclusions: In the INAP trial EMG activity at baseline was 495 ± 126 % which increased to 1,009 ± 464 % immediately post INAP and remained elevated at 936 ± 312 % an hour later. In contrast, in the Control trial EMG activity was 484.8 ±73.2 % during baseline, which was similar to both recovery time points (356.7 ± 68 % and 592.6 ± 165.8 % respectively).

Conclusions: Although this initial data is encouraging, development of the technique is required before further testing as the repeatability and magnitude of the recorded EMG was limited.

References:

1. PHILLIPS, C. L., et al., 2013. American Journal of Respiratory and Critical Care Medicine, 187, 879-87.
2. RYAN, S. & NOLAN, P. 2009. The Journal of physiology, 587, 3343-3353.

Return to abstracts menu

REVIEW OF GOOD HOPE HOSPITALS' CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) ANNUAL FOLLOW UP APPOINTMENTS

Newby K, Lloyd J, Newey D, Kaur B. Respiratory Investigation and Sleep Department, Good Hope Hospital, Sutton Coldfield, West Midlands.

Introduction: Due to the increasing numbers of patients' requiring long term CPAP within this area of the West Midlands, it has become increasingly challenging to review all patients annually. The use of remote monitoring technology has been suggested as a solution. It was assumed that patients would prefer remote monitoring and reduced hospital visits. A patient questionnaire was used to test this hypothesis before making changes to the current service delivery.

Methods: A patient questionnaire was produced in April 2016 to assess the various ways we could streamline the CPAP annual review service. The questionnaire was sent out with CPAP annual follow up appointment letters over a three month period (May – July 2016). Its purpose was to assess patient preference to proposed service change.

Results: 144 patients returned questionnaires at their appointment; 72% of respondents were male, mean age 60. 70% of respondents indicated they were happy to receive communication via email. 83% of respondents indicated that remote monitoring was appealing, and 53% would like the onus of their care left to themselves. 45-55 and 75-85 year old females would not like the onus of care left to them. 79% found an annual appointment beneficial; 63% of patients preferred a consultation, opposed to receiving consumables only. 65-75 year old females were the only group that preferred receipt of consumables without a consultation.

Conclusions: The majority of patients would like remote monitoring and would like to be contacted by email. Most found a benefit coming to clinic for a consultation, as opposed to just receiving consumables. However, they would prefer to contact the department for appointments rather than receiving routine appointments.

Based on this survey, a modified service with remote monitoring of usage and additional drop in clinics to allow patient led follow up will be trialled from October 2016. Email reminders will be sent to patients when they are due for review. The impact of the changes on workload and patient satisfaction will be monitored at 3 and 6 months and further changes to service delivery made as required.

Return to abstracts menu

COMPARISON OF AUTO-TITRATING CPAP DERIVED APNOEA-HYPOPNOEA INDEX WITH PULSE OXIMETER OXYGEN DESATURATION INDEX IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA

O' Sullivan C. Walsall Manor Hospital

Introduction: Intelligent auto-titrating CPAP devices measure multiple parameters, including AHI, that benefit the management of patients with OSA. Use of such parameters requires formal validation before they can be applied in clinical practice.

Methods: A retrospective single centre study compared the residual AHI, derived from the SleepCube autoCPAP (DeVilbiss Healthcare) with the 3% and 4% ODI measured via pulse oximetry. Analysis was completed for 103 patients with a diagnosis of OSA (ODI or AHI>5). AHI obtained from the autoCPAP was compared with simultaneous measurement of 3% and 4% ODI, completed in the home environment, as per normal practice.

Results: Bland-Altman analysis of data transformed by natural log was completed. The exponential of mean difference 4% and 3% ODI with AHI were 0.61 and 1.06 respectively. The exponential of limits of agreement for 4% and 3% ODI and AHI were ±3.42 and ±4.37 respectively. The intra-class correlation coefficients for 3% and 4% ODI with AHI were 0.498 (CI 0.196-0.697) and 0.623 (CI 0.443-0.745) respectively.

Conclusion: Although Bland-Altman analysis suggests that for this study sample AHI may be used as a surrogate for ODI, in particular 4% ODI, the confidence intervals of the intra-class correlation coefficients show there to be too much variation within the population. Poor agreement in AHI and ODI, within the clinical context, suggest that the data from the autoCPAP device may not be accurate enough to allow appropriate clinical assessments of patients outcome.

Return to abstracts menu

UTILISATION OF OVERNIGHT OXIMETRY IN A REGIONAL SLEEP SERVICE

Webber S. Birmingham Heartlands Hospital

Introduction: Continuous positive airway pressure (CPAP) is still considered as the gold standard treatment for Obstructive sleep apnoea (OSAS). It has been well documented that overnight oximetry is useful in aiding the diagnosis of OSAS and managing patients previously diagnosed with the condition.

Aim: The purpose of this abstract is to assess the utilisation of overnight oximetry in a regional sleep service.

Methods: All patients referred for overnight oximetry between 17th May 2016 and 31st August 2016 were retrospectively reviewed. The reason for referral (and source) was recorded.

Results: In total 84 patients were referred for overnight oximetry during this period. A total of 61 (75%) patients underwent overnight oximetry to assess the effectiveness of CPAP therapy, 11 (14%) of referrals utilised overnight oximetry to diagnosis OSAS, 6 (7%) were referred for the reassessment of OSA and finally 3 (4%) patients underwent overnight oximetry for the assessment of nocturnal hypoxia. 73 out of 84 (87%) referrals were requested by a sleep consultant, the remaining were a mixture of general respiratory and various other specialities.

Discussion: Overnight oximetry is utilised most in patients already diagnosed with OSA from multichannel sleep testing, in order to assess the effectiveness of CPAP therapy. The utilisation of overnight oximetry in this manner should be continued in order to allow appropriate optimisation of CPAP therapy.

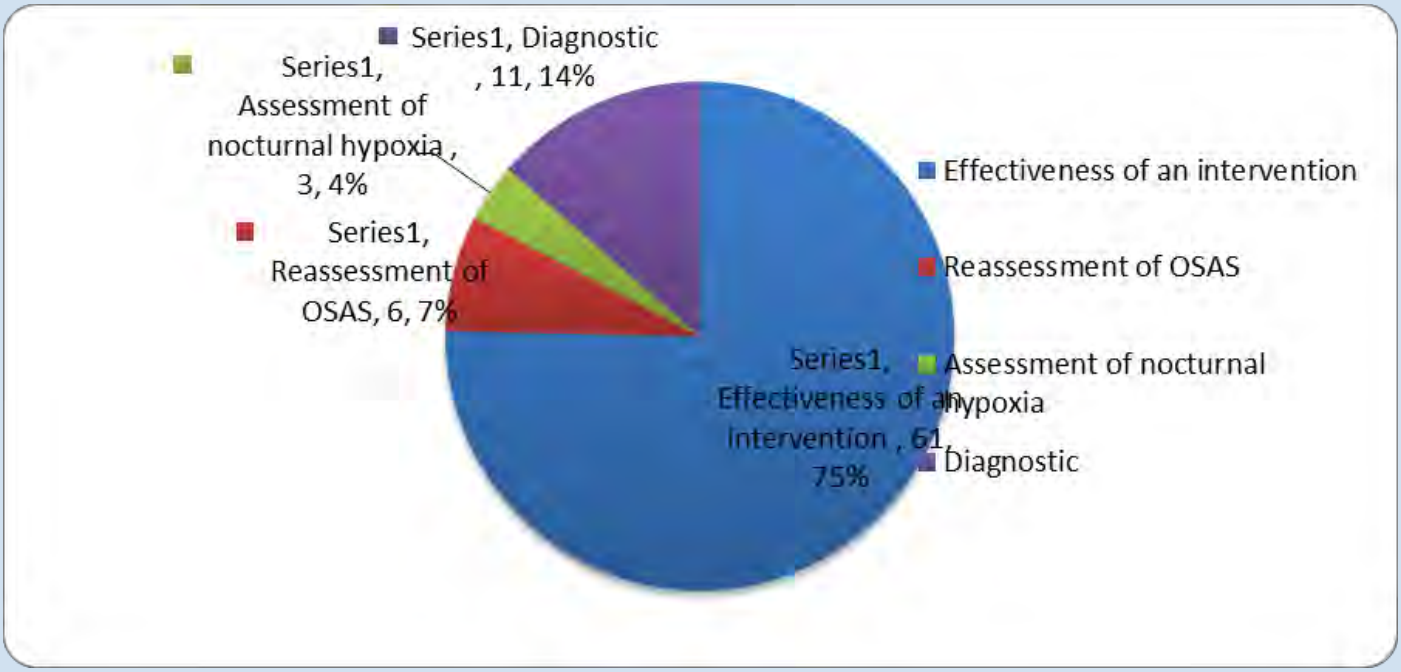


Figure 1– Reasons for overnight oximetry

QUALITY REVIEW OF EMBLETTA POLYGRAPHY SERVICE

Cooper BG, Gunn S, Johal G, Harte N, Sharley T, Jones M, Batsford, Griffin H, O'Reilly L, Savage J, Stockley JA, Hunt JA. *Lung Function & Sleep, Queen Elizabeth Hospital Birmingham, B15 2GW.*

Aim: We noticed recurrent failures with routine polygraphy studies and decided to monitor occurrences and feedback failures to the sleep apnoea team and see if feedback on service quality and changes to probes improved study outcomes.

Methods: We reviewed 193 consecutive, polygraphy studies using Embletta (SSI, Oxford, UK) in our routine service over 20 weeks. When each study was analysed by one operator (BC), all channels (oximetry, flow, snoring, thorax, abdomen and position) as well as short studies (<4 hours) and no data recorded were scored as either "OK", "Partial" or "Fail" in terms of quality. "Partial" was defined as the absence of a signal for more than 1 hour in the study. An overall study score using the three categories was used to categorise perfect and suboptimal outcomes. During the study, staff were informed of the polygraphy failure rates and new equipment with different probes (thorax, abdomen and oximeter) were introduced (June) to improve quality and a log of which staff set up each study was recorded.

Results: Table 1 shows the summary of the successful signals and studies for each month.

Discussion: The overall faultless study rate was 51% but significantly improved over the 20 weeks. The most unreliable signals were the oximeter and abdominal probes. The position monitor was the most reliable and only 8% of studies were too short. There were no significant patterns regarding who set the polygraphy up, but feedback and/or the new probes improved most signals in the last 2 months

Conclusions: (1) Monitoring quality in routine polygraphy can improve outcomes and enable improved success rates; (2) shows the impact of changing probes and (3) increases staff awareness of failures and improve service quality.

% signal success

Month (n=)	Oximetry	Flow	Snore	Thorax	Abdom	Position	Short	No Data	Overall
May (37)	81.1	89.2	81.1	89.2	86.5	100.0	97.3	91.9	45.9
Jun (34)	70.6	79.4	79.4	79.4	64.7	94.1	94.1	94.1	26.5
Jul (31)	87.1	74.2	90.3	74.2	67.7	93.5	87.1	93.5	45.2
Aug (38)	85.0	95.0	100	100.0	95.0	100.0	90.0	100.0	70.0
Sep (40)	87.5	95.0	97.5	95.0	87.5	95.0	92.5	97.5	75.0
TOTAL	81.3	84.4	86.9	85.0	79.4	95.6	91.9	93.1	50.6

Table 1– the summary of the successful signals and studies for each month.

Minutes of the 41st Annual General Meeting (AGM) of the Association for Respiratory Technology and Physiology (ARTP)

held at the Europa Hotel, Belfast on 19th January 2017 at 15.15.

Dr Karl Sylvester (KS), ARTP Honorary Chairman welcomed the audience that was in excess of 70 people and outlined the agenda for the AGM.

Review of 2016 Objectives

The key 2016 aims & objectives of the ARTP were reviewed and progress was reported as follows:

- ARTP Respiratory Function guidelines update in publishable format - complete
- Updating the ARTP brand - complete
- Website re-development - on-going
- Development of online courses and educational material- on-going
- Supporting ERS 2016 in London - Provided volunteers for public events. Organised a very successful evening event for group 9.1
- Continuing to work and develop new relationships with external organisations - complete and on-going

KS announced Professor Greg Whyte as ARTP Patron

ARTP Collaborations

KS gave an overview of current ARTP collaborations that included the European Respiratory Society/ European Lung Foundation & Healthy Lungs for Life Campaign.

ARTP Liaison

KS outlined the current ARTP Liaison activities:

- British Thoracic Society
  - ARTP/BTS Strategic Delivery Board
  - Summer BTS Meeting
  - Education Committee
- Dept of Health
  - MSC Team
  - (Respiratory Futures)
- Royal College of Physicians
  - IQIPS Programme
  - National COPD audit
- British Lung Foundation
  - Patient Information plus other workstreams
- National School for Healthcare Science
  - Themed Board
  - OSFA examiners
- Respiratory Education UK / Education for Health
  - Spirometry Training
  - National Inhaler Group
- European Respiratory Society
  - Assembly 9 / Group 9.1
  - Member Organisation
- Academy of Healthcare Science
  - Council member
- British Sleep Society

KS outlined the potential joint working of AHCS and RCCP to aim towards a joint register/ new organisation

KS discussed the process of formalising ARTP Scotland in to its own group under the banner of ARTP UK. There are early discussions with ARTP Wales and potential for ARTP Northern Ireland.

National Strategy Day

KS outlined the National Strategy Day that was held in Coventry on 17th October 2016. The meeting was well attended with 66 delegates and 15 manufacturers exhibiting.

Communications Report

Chris Jones (CJ) presented the Communications Committee report and detailed the current ARTP Publications:

- ARTP Journals
  - Inspire, Snews

He noted that Exhale had been discontinued

- Monthly Newsletters (email)
- ARTP Website
- ARTP Forum
- Social Media
  - Twitter
  - Facebook

CJ gave thanks to the whole Editorial Group, especially Aidan Laverty and Paul Burns, who has now left the post (Inspire), Vicky Cooper, who has now left the post (SNEWS). He welcomed Alison Butler as the new SNEWS Editor

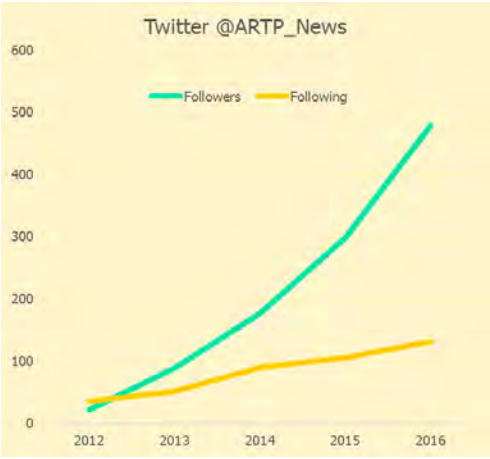
Website Statistics

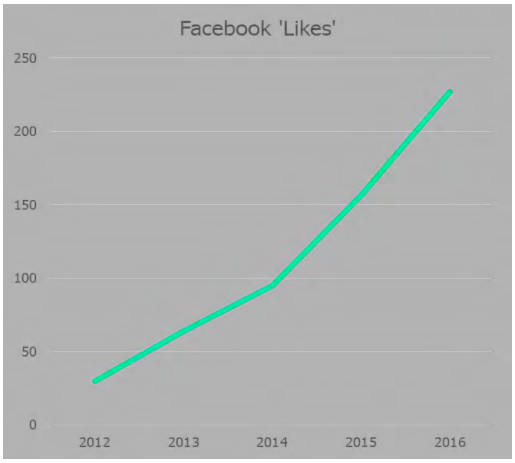
Total Number of Visits = 93,243 (~255/day)- an increase since last year. Average of 3.13 pages per visit

Website activity

Position	Most Popular Page	Most Popular Source	Country of Origin
1	Homepage	Google/Bing/Yahoo etc	United Kingdom (same)
2	Spirometry > Current Courses	NHS Careers	United States (same)
3	Patient > Exercise > SWT	Patient.co.uk	India (same)
4	Members > Log In	Facebook	Australia (up from 6th)
5	Spirometry > Full Certificate	Patient.Info	Brazil (same)
6	Spirometry > Homepage	Twitter	Canada (up from 7th)
7	Professionals > ARTP-Standards > QADS	Indeed.com	Ireland (down from 4th)

Twitter and Facebook activity





Targets for 2016 were given as:

Target	Outcome
ARTP Rebranding	Complete
Website (Re)Development, to include: Online payments and online membership data-base	Out to Tender
To enhance the patient section of the website	Ongoing – pending (re)development
ARTP Spirometry development	Tenders Received, finalising details
Obtain more data from the membership i.e. including using straw polls, etc	Semi-Successful
Develop a Conference App	Almost Complete
Ensure Publications are produced and are on time	Successful

Targets for 2017 were given as:

- **ARTP Rebranding**
- **Complete Website (Re)Development**
- **Assist in the creation of ARTP Spirometry website**
- **Assist in the creation of new e-learning Package for Spirometry Training**

Education Report

Joanna Shakespeare (JS), Education Chair detailed the current members of the Education Committee

The following courses ran in 2016:

- Basic Sleep Course
- Blood Gas Sampling Course X 2
- Physiologist Reporting Course - Cardiff
- CPET Course – Birmingham
- Masterclass Course – Glasgow

JS presented the Education and Training Courses Brochure for 2017 and introduced the new ARTP Webstore for the booking and payment of courses.

JS gave an update on spirometry and announced that the Spirometry handbook is being printed

ARTP Professional Examinations:

- To date 101 candidates registered
- 53 individuals have completed
    - 13 Associate (3 completed Level 2)
    - 43 Practitioner
- 10 Withdrawals
- 7 Fails (12.5%)

Examination dates were given as:

Associate (Level 1) & Practitioner (Level 3) Exams

- Spring – 8th April 2017
- Autumn – 14th October 2017

Scientist Training Programme (STP)

Second cohort of Respiratory and Sleep students graduated in 2016.

- 20% failure rate for lives (40% in 2015)
- 100% pass rate after resit

OSFA's 2017

- Mocks 7th February
- Lives between 3rd and 14th July

NSHCS

- Respiratory and Sleep Representative

JS stated that the intake for STP students for 2017 was reduced to 6 and encouraged departments to consider taking a student

The objectives for 2016 were reviewed:

- Develop e-Learning opportunities - ongoing
- Develop handbook to support professional examinations - ongoing
- CPAP certificate - ongoing
- Continue to support and build OSFA's - ongoing
- Adapt professional exams specifically for paediatrics - ongoing

The objectives for 2017 were set as follows:

- Ensure that the 'Improving the Quality of Diagnostic Spirometry' training programme is implemented effectively
- Continue to develop e-Learning opportunities
- Develop handbook to support professional examinations
- Continue to support the NSHCS in the assessment of STP and HSST students

ARTP Sleep Report

Dr Victoria Cooper (VC) detailed the members of the ARTP Sleep Committee and thanked them

The objectives for 2016 were reviewed:

- To (continue to) have regular meetings - complete
- To have even better communication - complete
- To deliver the basic sleep course - complete
- To develop an oximetry interpretation certificate - complete
- To develop a CPAP certificate - complete
- To develop an ARTP Sleep Handbook to cover all certificates -in progress
- To progress with professional body and state registration issues for sleep - complete

The achievements of ARTP Sleep in 2016 were detailed:

- Work with the Sleep Apnoea Alliance for sensible and clear DVLA regulation for patients with sleep apnoea.
- Representation / expertise for the National Casemix (tariffs) and CSO Strategy Meetings.
- Update of Standards of Care for Sleep Apnoea Services (CPAP) and Mandibular Advancement Devices.
- Reduced BSS membership for ARTP members

VC outlined the aims for 2017

- To deliver the basic sleep course (1st Feb & 18th Sept 2017)
- To deliver the advanced sleep course (20th -21st June 2017)
- To launch the oximetry interpretation certificate
- To launch the CPAP certificate
- To complete the CPAP certification on the first batch of devices
- To complete the ARTP Sleep Handbook to cover all certificates
- To publish Standards of Care Updates
- To provide a joint membership option for ARTP and BSS
- To progress with professional body and state registration issues for sleep

ARTP Paediatric Committee Report

Paul Burns (PB) detailed the members of the Paediatric Committee and thanked them

The objectives of the paediatric committee for 2016 were reviewed:

- Recruit a vice chair – compete
- Meet twice throughout the year with the other committee members via tele-conference – complete
- Finish the paediatrics section of the guidelines document – complete
- Deliver at least 2 paediatric spirometry courses in the year – complete
- Organise speakers and topics for 2017 annual conference for the paediatrics section – complete
- Deliver paediatric spirometry training in Northern Ireland – complete
- Continue to support the education committee and have sufficient paediatric representation – complete
- Update the paediatric section of the website to have more information and a patient and staff section – ongoing
- Structure the committee with the help of new volunteers to help represent paediatrics across the UK – ongoing

PB outlined the objectives for 2017

- Deliver the paediatric spirometry course in Wales
- Have the paediatrics section of the website fully up and running
- Pilot the 2 day paediatric respiratory physiology course
- Recruit willing volunteers from around the country to help represent paediatrics
- Continue to provide guidance and support to paediatric respiratory/sleep physiology services in the UK

Constitutional Issues

Tracey Fleming (TF) detailed the current members of the ARTP Council including the appointment of a new 'patient' non-executive director

TF asked for eligible members to vote for the following:

Chair – Karl Sylvester

- Vote to stand for another term

Vice Chair – Julie Lloyd

Role	
Chair	TBC
Vice Chair	TBC
Honorary Secretary	Tracey Fleming
Honorary Treasurer	TBC
President	Martyn Bucknall
HR/Workforce	Ken Hutchinson
Financial	Mark Hubbocks
Patient	Richard Harwood
Medical	Dr. James Hull

- Vote to stand for another term

Honorary Treasurer – Michael Lang

- New appointment

The membership accepted these nominations

TF then detailed the ARTP Board format and Committee Chairs for 2016 and outlined and thanked the members of each committee

TF mentioned that there had been minor changes made to the Articles of Association – these would be finalised and voted in at the National Strategy Day

Committee	Chair
Communications	Chris Jones
Workforce	Claire Stacey
Standards	Ian Cliff
Paediatrics	Paul Burns
Education & Training	Joanna Shakespeare
Events	Kelly Pauley
Sleep	Dr. Victoria Cooper

TF mentioned that there was an ARTP Jobs Board at the ARTP stand and encouraged members to sign up to vacant roles

Financial Report 2015-16

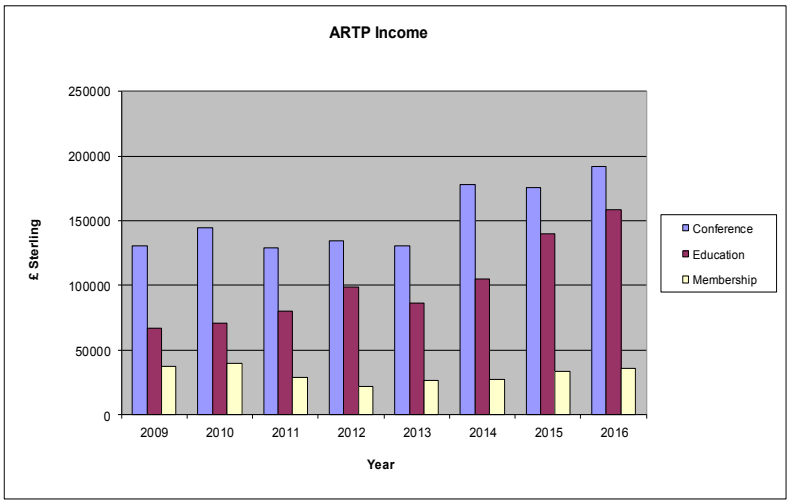
KS delivered the financial report on behalf of Emma Spence (ES), Honorary Treasurer, and explained the income and expenditure for the preceding year.

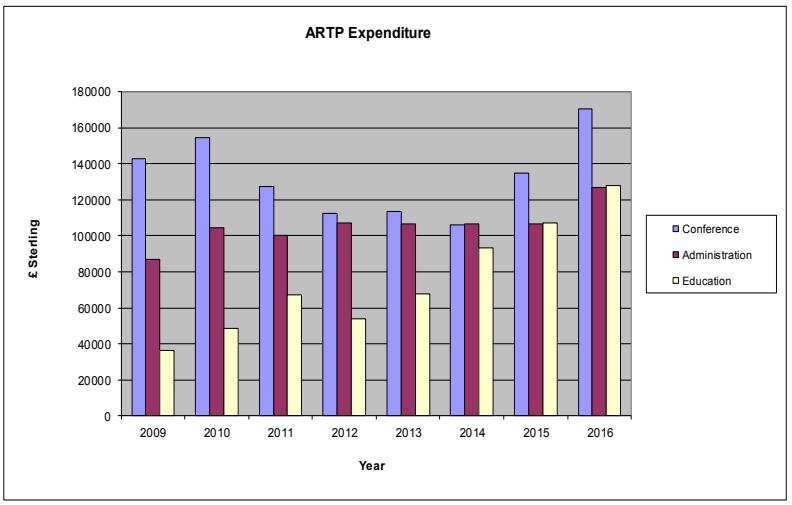
Summary:

- **Total assets around £357K**
- 2014/15 Surplus of £60K
- 2015/16 Surplus of £25K

http://www.artp.org.uk/en/members-area/accounts/index.cfm

The delegates with voting rights accepted the financial report unanimously.





The financial objectives for 2016 and their progress were reviewed as follows

- Offer 5 x £300 bursaries for the Summer BTS, along with ARTP and ERS conferences - complete and ongoing
- Review budget setting for ARTP Committees - completed and ongoing
- Continue to utilise independent financial advice - completed and ongoing
- e-merchandising and payments - ongoing
- Business planning process - completed and ongoing
- Reinvest surplus into ARTP (e-portfolios, website) -ongoing

The financial objectives for 2017 were given as:

- Review budget setting for ARTP Committees
- Continue to utilise independent financial advice
- e-merchandising and payments
- Business planning process
- Reinvest surplus into ARTP (e-portfolios, website)
- Invest in research projects

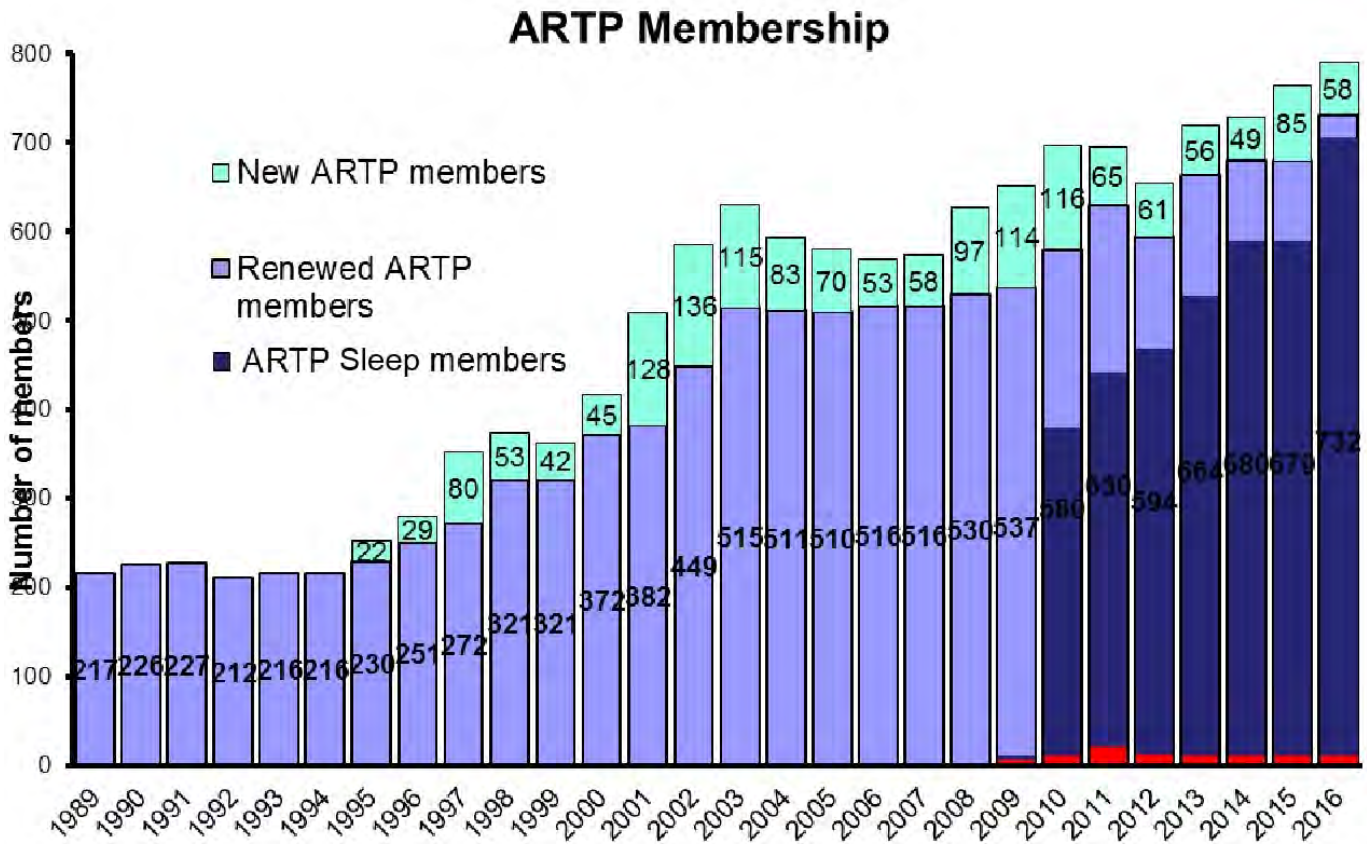
KS thanked the following:

- Membership & Manufacturers
- Mark Hubbocks (NED)
- EBS Ltd

Please contact:
treasurer@artp.org.uk

A reminder that members are able to claim tax relief for their subscriptions was given

ARTP Membership



Benefits of ARTP Membership

KS detailed the following benefits of ARTP membership

- Joint ERS & BSS membership
- Discounted Training Course fees
- Subsidised conference attendance
- Bursaries available (i.e. ARTP, ERS, BTS)
- Competitive membership fees
- e-Inspire / SNews
- Textbooks
- Email Forum
- Website Resources
- Active Committees

KS then thanked EBS, the ARTP Council, all of the ARTP Committees and working groups for their hard work over the past year.

KS asked the delegates if there were any questions. As there were none the meeting was brought to a close.

KS announced that the venue for the ARTP conference in 2018 would be in Brighton

Tracey Fleming

March 2017