Welcome to issue 148 of Respiratory Research Review.

‘Homeward Bound’ is the title of the review of the centenary of home mechanical ventilation in the 100th-year anniversary edition of Am J Respir Crit Care Med by Michael Hind, Michael Pokey and Anita Simonds. It is a well-written article reviewing the progress of ventilation, from the Spanish flu, to polio survivors, to NIV (noninvasive ventilation) in COPD.

Homeward bound could also be the theme of the selection of articles in this Research Review. Some of the most astonishing data are actually published in Yahoo finance. This is not the standard journal for doctors; however, it comes with a great video summary. Fitbit has been collecting customers’ data, promises to make them available to scientific institutions and has been releasing top-line data on 6 billion sleeps; the article does not mention privacy arrangements. It does however give amazing insights into our sleep habits, comparing women and men, north and south and commenting on ‘social jet lag’ by city. We are awaiting a scientific evaluation; however, it makes highly enjoyable reading at this stage.

Paul Greig and Rosamund Snow ask a pertinent question in their BMJ article on ‘Fatigue and risk: are train drivers safer than doctors?’: Are they reviewing the physiological effects of fatigue, how the industry is dealing with fatigue and noticing that doctors share the same physiology as train divers. “An assumption seems to exist, not based on evidence, that medical training qualifies a person to better overcome fatigue or make their own judgement about risk. …It is… terrifying how little organisation awareness of, and response to, the magnitude of the problem there is.” Helen McKenna and Matt Wilkes give some very practical advice on ‘Optimising sleep for night shifts’. Tips include avoiding sleep debt before night shifts, improving performance while on shift, when to eat, what to do between shifts and how to reset after nights.

Homeward bound is also a research focus for sleep studies. For example, using oximetry to diagnose sleep disturbance in children with the help of a neuronal network (Am J Respir Crit Care Med), my colleagues excellent work on the ‘Development and outcomes of a primary care-based sleep assessment service in Canterbury, New Zealand’ (NPJ Prim Care Respir Med), and the enhancement of mask fitting in NIV. We hope you enjoy the selection and like to point the interested reader to the dedicated Sleep Medicine Research Review by our esteemed colleagues Assoc Prof Alister Neill and Dr Karen Fallion.

At the end of the overview, we like to thank readers for their considerate feedback. Also, we would like to draw your attention towards two publications. The Chest contemporary reviews in sleep medicine, covering topics like maternal SBD (sleep-disordered breathing), oral appliances for the management of OSA (obstructive sleep apnoea). Sleep-disordered breathing in neuromuscular disease and REM sleep behaviour disorder. Last but not least, the beautifully written, clear article on quality standards for acute NIV in adults by the British Thoracic Society. It is highly relevant for clinical practice as it gives measurable quality targets like:

- NIV should be offered to all patients who meet the criteria and providers must ensure adequate capacity,
- staff who prescribe, initiate or make changes should have evidence of training and maintenance of competency,
- acute NIV should only be carried out in specified clinical areas designated for the delivery of acute NIV,
- patients should start NIV within 60 min of the blood gas result and within 120 min of hospital arrival,
- all patients should have a documented escalation plan before starting treatment.
  - clinical progress should be reviewed within 4 hours and by a consultant with training and competence in acute NIV within 14 hours of starting acute NIV, and
  - all patients treated with acute NIV should have blood gas analysis performed within 2 hours of starting acute NIV.

Thank you for your continued interest in this Research Review.

Kind regards
Professor Lutz Beckert
lutzbeckert@researchreview.co.nz
Health effects of overweight and obesity in 195 countries over 25 years

Authors: The GBD 2015 Obesity Collaborators

Summary: This analysis of data from 68.5 million individuals sought to identify trends in the prevalence of overweight and obesity over the period 1980–2015. There were 107.7 million children and 603.7 million adults classified as obese in 2015. There have been two-fold increases in the prevalence of obesity in >70 countries since 1980, with continuous increases seen for most other countries. While children have had a lower prevalence of obesity than adults, the rate of increased obesity among children has exceeded the increased rate in adults in many countries. Of 4.0 million deaths globally that were attributed to a high BMI, nearly 40% occurred in individuals who were not classified as obese, and more than two-thirds occurred because of cardiovascular disease. There has been an increased disease burden related to high BMI since 1990; however, decreases in underlying cardiovascular-related death rates have attenuated the rate of this increase.

Comment: Obesity is a strong risk factor for OSA and obesity hypoventilation syndrome; if we could treat it, we could alleviate much of this disease burden. We are starting this review with these articles; this one sets the scene and may make you consider if you really need that dessert. Based on data from 195 countries over more than 20 years, researchers report that more than 100 million children and more than 600 million adults are obese, a number that has doubled in 70 countries since 1990. Bottom line: an increased BMI accounts for 4 million deaths and 120 million disability-adjusted life-years worldwide.


Nutrition and exercise rehabilitation in obesity hypoventilation syndrome (NERO)

Authors: Mandal S et al.

Summary: Thirty-seven patients with obesity hypoventilation syndrome were randomised to standard care with or without rehabilitation in this pilot trial. Compared with the standard care only group, rehabilitation had no significant impact on percentage weight loss at 12 months (primary outcome; mean difference –5.9% [p=0.17]), but was associated with significant improvements at 3 months of greater percentage weight loss (~5% [p=0.007]), greater 6-minute walk distance (60 vs. 20m [p=0.036]) and a greater mean difference in short-form-36 general health score (10 vs. 0 [p=0.02]).

Comment: This is an investigator-initiated study driven by clinicians looking after patients with obesity hypoventilation syndrome. The authors designed an interdisciplinary, multimodality rehabilitation encompassing nutrition and an exercise programme. Unfortunately, their exclusion criteria were so stringent that only 18 patients completed the trial. The good news is that only one patient eligible declined participation and only two withdrew from the programme. Participants had improved exercise tolerance and improved quality of life. Bottom line: partially due to the limited recruitment at 12 months, there was no effect on weight loss, exercise capacity or quality of life.


Obstructive sleep apnea: the effect of bariatric surgery after 12 months

Authors: Peromaa-Haavisto P et al.

Summary: These researchers prospectively recorded standard overnight cardiorespiratory data 12 months after bariatric surgery in 132 patients with preoperative OSA. They found that at 12 months, the prevalence of OSA had decreased from 71% (baseline) to 44% (p<0.001), with an OSA cure rate of 45% and a cure/improvement rate of 78%; 20% had moderate or severe persistent OSA and 8% developed de novo OSA. There was also a significant decrease in total AHI (apnoea-hypopnoea index) from 27.8 to 9.9 events per hour after surgery (p<0.001).

Comment: “You can only heal with cold steel” is one of the quotes from ‘The House of God’ by Samuel Shem (ISBN 0-440-13368-8) published exactly 40 years ago. The surgical authors of this study of 193 consecutive patients who underwent bariatric surgery report results supporting this dogma. Within a year of bariatric surgery, patients lost about 20kg, range 6–82kg. Interestingly, about half the patients had ongoing sleep apnoea; however, the average AHI fell from 28 to 10 events per hour and most patients had mild or moderate sleep apnoea. Bottom line: bariatric surgery is an effective treatment for sleep apnoea.

Reference: Sleep Med 2017;35:85–90
Agreement between electronic and paper Epworth Sleepiness Scale responses in obstructive sleep apnoea

Authors: Chen L et al.

Summary: This was a secondary analysis of an RCT comparing electronic and paper ESS (Epworth Sleepiness Scale) scores, completed the same day, as part of a battery of sleep laboratory questionnaires in 112 Australian participants with OSA from a specialised tertiary-care clinic. No significant difference was seen between the electronic and paper ESS questionnaire scores (p=0.57) or heteroscedasticity, and there was no evidence of bias along the range of the measure.

Comment: This is a neat summer studentship supervised by our colleagues in Sydney. The ESS is a central tool in the assessment of sleepiness. It was originally developed as a paper questionnaire; however, the electronic version has advantages. Some cognitive assessment tools perform differently between paper and electronic formats, and two medical students went about to explore this for the ESS. The results are rather reassuring; in a normal population of patients with obesity and sleep apnoea, the difference between the electronic and paper version of the ESS was negligible. Bottom line: paper and electronic versions of the ESS can be used interchangeably in clinical practice.

Reference: BMJ Open 2018;8:e019255

Abstract

Predictors of sleepiness in obstructive sleep apnoea at baseline and after 6 months of continuous positive airway pressure therapy

Authors: Buthiraja R et al.

Summary: Factors associated with sleepiness at baseline and after CPAP were identified in RCT participants with OSA (n=1105), of whom 558 had been randomised to 6 months of CPAP. Nearly half the participants (49.1%) had excessive sleepiness (ESS score >10). Younger age, presence of depression and higher AHI were associated with higher ESS scores and lower mean sleep latency. The likelihood of sleepiness at 6 months was lower in participants randomised to CPAP, and the prevalence of sleepiness was significantly lower in participants who used CPAP for >4 vs. ≤4 hours per night. Among participants who displayed good adherence to CPAP, those with a baseline ESS score of >10 were significantly more likely to report persistent subjective sleepiness (odds ratio 8.2 [p<0.001]).

Comment: Sleep apnoea is the most common sleep disorder and the most common cause for excessive daytime sleepiness. These American authors report a trial of more than 1000 patients with severe sleep apnoea, who were either treated with CPAP or sham CPAP for 6 months. Some of the results are expected; for example, the more hours per night patients used CPAP, the less tired they were. However, even after 6 months of treatment, about 20% of patients reported ongoing daytime sleepiness. Bottom line: patients with a high baseline AHI, younger patients, patients with chronic pain and patients with depression are at increased risk of ongoing daytime sleepiness despite CPAP treatment.

Reference: Eur Respir J 2017;50:1700348

Abstract

Nocturnal oximetry-based evaluation of habitually snoring children

Authors: Hornero R et al.

Summary: Using single-channel nocturnal SpO_2 data from 589 patients with suspected OSA, these researchers developed and validated an automated neural network algorithm, which they prospectively evaluated with deidentified nocturnal SpO_2 data from 4191 children attending sleep laboratories around the world. Further testing in 3602 additional subjects revealed high agreement between the automatically estimated AHI values and those from conventional polysomnography (intraclass correlation coefficient, 0.785). Additional assessments using the widely used AHI cutoff points of 1, 5 and 10 events per hour revealed respective accuracy values of 75.2%, 81.7% and 90.2% and area under the receiver operating characteristic curve values of 0.788, 0.854 and 0.913.

Comment: This article from paediatric sleep centres around the world is fascinating for two reasons. Firstly, in this study of almost 5000 children who had hospital-based polysomnography oximetry data, when analysed independently, showed a high agreement with the polysomnographically derived score. The second aspect is that it was an artificial intelligence or neuronal network-based automated analysis that produced these amazing results. The outstanding performance of this artificial intelligence is amazing and scary at the same time. Bottom line: when supported by a neuronal network, overnight oximetry is a simple and effective alternative in diagnosing sleep apnoea in children.

Reference: Am J Respir Crit Care Med 2017;196:1591–8

Abstract

Development and outcomes of a primary care-based sleep assessment service in Canterbury, New Zealand

Authors: Epton MJ et al.

Summary: A Christchurch-based community sleep assessment service that used a standardised tool and overnight oximetry, and was undertaken at trained general practices, was reported in this research paper. The service involved multidisciplinary meeting discussions within a median 48 days of referral to establish one of the following four outcomes: i) severe OSA requiring CPAP; ii) further investigation with more complex studies; iii) sleep physician appointment; and iv) no or a nonsevere sleep disorder for general practice management. Assessment numbers increased from ~400 in 2007 to 1400 in 2015. A definitive answer from the first multidisciplinary meeting was obtained for 48% of the patients. Twenty-three percent of the patients were initially assessed as having severe OSA, Of the 49 assessed as needing further investigation, severe OSA was identified in a further 13%. OSA that qualified for funded investigation, severe OSA was identified in 37% of patients. Among patients with severe OSA deemed to be ‘at risk’, the median time from referral to CPAP was 49 days, and in those not ‘at risk’ it was 261 days. Polysomnography was required by 10% of patients and 4% were referred to a sleep specialist.

Comment: This study has been published by my colleagues in Christchurch. In working with our colleagues in the community of about 500,000 patients, we have developed pathways to allow patients with sleep apnoea to be identified via a standardised tool and overnight oximetry, and was undertaken at trained general practices, was reported in this research paper. The service involved multidisciplinary meeting discussions within a median 48 days of referral to establish one of the following four outcomes: i) severe OSA requiring CPAP; ii) further investigation with more complex studies; iii) sleep physician appointment; and iv) no or a nonsevere sleep disorder for general practice management. Assessment numbers increased from ~400 in 2007 to 1400 in 2015. A definitive answer from the first multidisciplinary meeting was obtained for 48% of the patients. Twenty-three percent of the patients were initially assessed as having severe OSA, Of the 49 assessed as needing further investigation, severe OSA was identified in a further 13%. OSA that qualified for funded investigation, severe OSA was identified in 37% of patients. Among patients with severe OSA deemed to be ‘at risk’, the median time from referral to CPAP was 49 days, and in those not ‘at risk’ it was 261 days. Polysomnography was required by 10% of patients and 4% were referred to a sleep specialist.

Reference: NPJ Prim Care Respir Med 2017;27:26

Abstract

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Randomized crossover trial of a pressure sensing visual feedback system to improve mask fitting in noninvasive ventilation

Authors: Brill A-K et al.

Summary: Fourteen healthcare professionals trained in mask fitting and 16 untrained healthcare professionals performed two mask fittings on the same healthy volunteer, once using standard mask-fitting procedures and once with additional visual feedback on mask pressure on the nasal bridge, in a randomised order. The requirement was achievement of mask fitting with low mask pressure and air leakage of <10 L/min. Compared with standard mask fitting, use of the feedback system was associated with lower pressure exerted on the nasal bridge in both the untrained (74.5 vs. 66.1 mm Hg [p=0.023]) and trained (67 vs. 60mm Hg [p=0.002]) healthcare professionals, along with improved self-rated confidence in the untrained group.

Comment: A poorly fitted mask for NIV can lead to withdrawal, asynchronicity from the ventilator, skin breakdown and pain. This study from London and Switzerland used real-time visual feedback on mask fitting and is another example where technology outperforms human sensing as the accompanying editorial points out. The authors recruited 30 health professionals who they familiarised with mask fitting. The health professionals fitted a NIV mask either using ‘standard’ clinical practice or a real-time computer display of high pressure areas. Bottom line: visual feedback provided by pressure sensors assisted health professionals to achieve a good mask fit without excessive pressure.

Reference: Respiratory Research 2017;22:1343–9

Educational video to improve CPAP use in patients with obstructive sleep apnoea at risk for poor adherence

Authors: Guralnick AS et al.

Summary: Patients referred by clinicians without sleep medicine expertise were randomised to view an educational video about OSA and CPAP therapy prior to polysomnography (n=99) or usual care (n=113) in this trial. There was no significant difference between the video education versus usual care group for CPAP adherence at 30 days (3.3 vs. 3.5 hours per day [p=0.44]) or during the subsequent 30 days, or for subsequent sleep clinic attendance (54% vs. 59% [p=0.41]); participants who failed to turn up to the sleep clinic did have lower CPAP adherence.

Comment: Although CPAP is the most effective treatment for OSA, between 46% and 83% of patients use it for less than 4 hours per night. Telephone follow-up, cognitive therapy and motivational enhancement have been shown to improve adherence; however, they are time-intensive. In this study the authors identified more than 200 patients with sleep apnoea and offered half video education on CPAP use prior to their CPAP titration study. All patients were followed up via the usual sleep service. After all this success of technology and neural networking, it is almost reassuring to read the bottom line: a brief educational video prior to CPAP use does not lead to improved adherence.

Reference: Thorax 2017;72:1132–9

Nasal vs oronasal CPAP for OSA treatment

Authors: Andrade RGS et al.

Summary: This was a meta-analysis of five randomised and eight nonrandomised trials (n=4563) evaluating CPAP for OSA that reported CPAP level, residual AHI and/or CPAP adherence. A random-effects meta-analysis revealed that compared with nasal masks, oronasal masks were associated with a significantly higher average CPAP level (1.5cm H2O [p<0.001]), a higher residual AHI (2.8 events per hour [p<0.001]) and worse adherence (–48 min per hour [p=0.001]).

Comment: CPAP therapy for OSA is effective, but the adherence is disappointingly low. Originally, nasal masks were used for CPAP; however, over the last decade masks covering the nose and mouth, oronasal masks, have become available. These international researchers performed a meta-analysis comparing nasal with oronasal masks. Their results are strongly in favour of the nasal only mask, and the authors speculated about mechanisms for the poorer performance of oronasal masks, like the possibility that it may push the chin and tongue backwards, worsening obstruction. Bottom line: nasal CPAP allows lower pressures, achieves lower AHI and has better adherence.

Reference: Chest 2018;153:665–74

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Independent commentary by Professor Lutz Beckert.

Professor Lutz Beckert is the Head of Department of Medicine of the University of Otago, Christchurch. He is also a Respiratory Physician at Canterbury District Health Board with particular clinical interests in interstitial lung disease, pulmonary vascular disease, respiratory physiology and COPD (chronic obstructive pulmonary disease). Lutz is happy to be contacted to discuss research ideas either as a sounding board or considering future collaborations.