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# Introduction

Welcome to the Association of Chartered Physiotherapists in Respiratory Care (ACPRC) journal for 2013. The 4 original articles in this year's journal cover a range of topics from post-operative physiotherapy to literature reviews around a hot topic at the moment looking at out of hour's services and discharge information following critical illness. Once again these articles provide dissemination of current research to enable clinicians to provide the best possible patient care.

This year saw the reoccurrence of the ACPRC conference held in Leicester. The conference programme was built around the theme of "new challenges" to reflect the rapidly changing environment at both clinical and organisational level. Day 1 provided sessions on commissioning and service delivery to inform delegates of how the new NHS structures and processes in the UK will work. Day 2 focused around advances in technology for diagnostics and new therapeutic interventions. Hopefully all of you that attended found the conference very stimulating and informative.

There were a record number of abstracts submitted to the ACPRC conference this year. The 3 abstracts presented at conference had strong clinical relevance, scientific rigour and a high standard of writing. Due to the high number, a further 4 abstracts are also included within this edition.

We hope you enjoy this issue of the ACPRC journal and hope it inspires you to get writing. One of the roles of the research officer is to offer support to novice researchers, at any stage of the research process so please feel free to utilise this service. Author guidelines with detailed instructions have been updated and can be found on the ACPRC website [www.acprc.org.uk](http://www.acprc.org.uk).

Keeping up with advances in technology ourselves, we are asking for members' opinion as to whether to move to an e-journal or if members would prefer to continue to receive a paper copy. We would be grateful if you could contact [secretary@acprc.org.uk](mailto:secretary@acprc.org.uk) to inform us of your preference for paper or e journal. Additionally, if you are not receiving emails and e-newsletters, please contact the secretary.

With best wishes

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# A retrospective analysis of the use of EZPAP positive pressure device by respiratory physiotherapists.

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## **Summary**

***A lack of clinical studies first led the author to conduct a small scale study investigating the effectiveness of EZPAP positive pressure device (Elliott, 2012). This suggested that EZPAP had the potential to be an adjunct to respiratory physiotherapy to aid sputum clearance, reverse atelectasis and reduce the work of breathing. This study analysed the type of patient being selected and the reasons why. It also reviewed the outcome of treatment. Results suggested the benefits of EZPAP in all clinical areas including critical care, paediatrics, in patient care and the possibility of managing long term conditions.***

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## **Keywords:**

**EZPAP**

**Positive Pressure**

**Ease of Use**

**Respiratory Physiotherapy**

## **Introduction**

EZPAP, see Figure 1, is a positive pressure device which amplifies an input of either air or oxygen approximately four times greater using the coanda effect. This augmentation provides a larger flow and volume with less effort than an unsupported inspiration and positive expiratory pressure is provided on expiration. It is marketed as a tool for the management of pulmonary conditions, mainly as a technique to increase lung volume and reduce atelectasis.

However, when reviewing the literature the evidence to support the use of EZPAP is predominantly based on personal testimonials (DHD Healthcare, nd; Harland, 2003) or observational studies (Kopp 2011, Daniel and Tarnow 2001, Daniel and Tarnow 2002). Though methodologically poor, these limited studies found that in clinical practice EZPAP was effective in treating atelectasis, sputum load and decreased gas exchange. Other



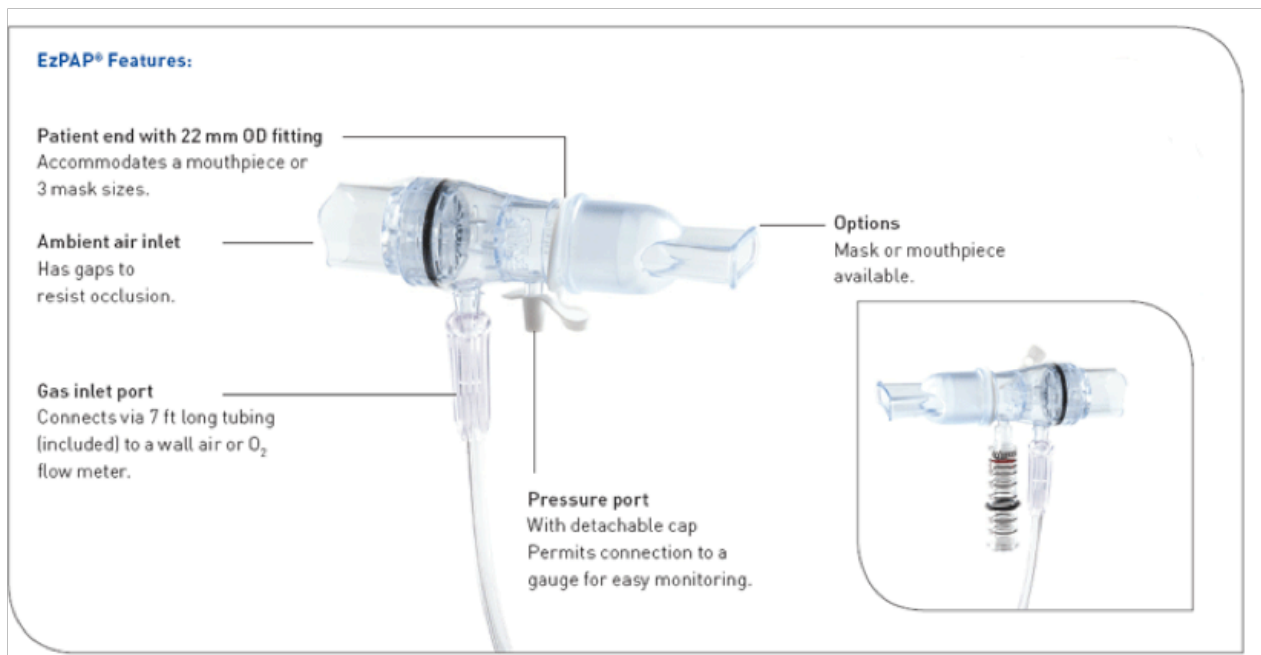


Figure 1 – The EZPAP positive pressure device (Reproduced with permission from Smiths Medical)

benefits included its ease of use and good patient compliance.

Only two clinical trials were identified during the literature search, Wiersgalla (2002) and Rieg et al (2012). Wiersgalla (2002) conducted a randomised control trial comparing EZPAP to incentive spirometry in reducing post operative atelectasis following a coronary artery bypass graft (CABG). The study concluded that EZPAP demonstrated a 100% improvement in atelectasis on radiograph compared to only a 25% improvement for incentive spirometry. The limitations of this study were the absence of a control group, small sample size (50) and the use of only one outcome measure. Rieg et al (2012) in a prospective observational study compared the effect of EZPAP compared to standard oxygen therapy delivered via a facemask in the treatment of post-operative hypoxemia by measuring SaO<sub>2</sub>. EZPAP was deemed as equally effective as oxygen delivered via a facemask and reduced the need for prolonged oxygen therapy. It was also found to be beneficial for patients deemed high risk due to obesity and pulmonary disease but identified further randomised studies were required.

Other experimental studies (Synder et al 2001, Black et al 2006) examined the inspiratory/ expiratory pressures in healthy individuals on EZPAP concluding that pressures achieved are maintained consistently and are within a clinically useful range throughout the breathing cycle. This suggests that the EZPAP is reliable in delivering positive pressure.

Due to the limited available evidence, the decision to purchase EZPAP units at Medway NHS Foundation trust was preceded by a small scale, department based clinical study (Elliott 2012). The aim was to measure the outcomes of the EZPAP in relation to increasing lung volume, sputum clearance and gaseous exchange. The results demonstrated improvements in all physiological parameters and EZPAP was subsequently purchased as an additional adjunct to respiratory physiotherapy.

This aim of this study was to review the continued use of the EZPAP device, ensuring it remained a beneficial addition to respiratory physiotherapy modalities. The aim was to review the type of patient being selected for EZPAP by the physiotherapist, the reasons why it was selected and review the outcome of treatment. The data collected would allow the

physiotherapy team to evaluate the continued use of EZPAP within Medway NHS Foundation Trust. The hospital, a district general, serves a population of 360,000 people and delivers acute services across all clinical specialities with 550 beds, including 25 critical care beds.

## **Methods**

The study design was a retrospective analysis of patients who received EZPAP in a twelve month period between October 2011 and October 2012. The study collected the following data: the patients' admitting diagnosis; the patients' respiratory problem (as identified by the physiotherapist); rationale for use of EZPAP; the number of treatments; reasons for cessation of treatment; and outcome of the intervention. This information was obtained from physiotherapists who completed a log every time EZPAP was utilised, which requested the required information. The use of logs alongside retrospective analysis of medical notes ensured a complete picture of the treatment intervention was gained.

## **Results**

There were 25 patients who received EZPAP as part of their physiotherapy treatment during the study period, 60% were males and 40% females. The age range was 9 – 91 years. Two patients were under 16 (nine years old and thirteen years old), eight patients in the age range 16-65 and the remaining fifteen patients were over 65 years old. Table 1 shows the collated audit results for the patients.





Patient No.	Patient's Admitting Diagnosis	Medical Speciality	Physiotherapy Respiratory Goal/s	Rationale for Use	Number of Treatments	Reason for Treatment Cessation	Outcome of Treatment	Other
1	Road traffic collision, spinal shock	Orthopaedics	Prevent atelectasis	Patient on bed rest, unable to mobilise	7	Patient began to mobilise	Maintained good lung volumes	Easy to set up. Patient used independently
2	Laparotomy x 3	Surgery	Increase lung volumes	Numberous general anaesthetics, poor basal expansion	7	Patient became independently mobile	Improved breath sounds on auscultation	Patient found it easy to use, but fatiguing at times
3	Advanced Parkinson's disease with chest infection	Elderly care	Clear secretions	Unable to coordinate with intermittent positive pressure breathing	5	Problem resolved	Stronger cough generated and patient able to clear secretions	Unable to use mouth piece, but worked well with face mask
4	Femoral hernia repair	Surgery	Improve gas exchange	Required positive pressure	4	Patient began to mobilise	Weaned from vapotherm after 24 hours and oxygen after 48 hours	
5	Fractured neck of femur	Orthopaedics	Increase lung volume	Unable to mobilise due to cardiovascular instability and oxygen demand (100%)	4	Patient began to mobilise	Increased lung expansion	Patient tended to hold breath
6	Anterior resection	Surgery	Increase lung volume and improve gas exchange	Required positive pressure	2	Problem resolved	Patient weaned off oxygen	Easy to use
7	Bilateral pneumonia	Medical	Improve gas exchange	Ease of use compared to IPPB	3	Problem resolved	Patient weaned off oxygen	Decreased respiratory rate
8	Post-partum haemorrhage, hysterectomy and post extubation	Gynaecology	Increase lung volume	Patient too tired to use incentive spirometry	3	Patient began to mobilise and able to use incentive spirometry	Improved air entry on auscultation	

Table 1 – Audit date for patients receiving EZPAP

Patient No.	Patient's Admitting Diagnosis	Medical Speciality	Physiotherapy Respiratory Goal/s	Rationale for Use	Number of Treatments	Reason for Treatment Cessation	Outcome of Treatment	Other
9	Pneumonia	Medical	Sputum retention	Ineffective cough	2	Problem resolved, patient self clearing secretions	Improved cough, patient able to clear secretions	Used manual techniques at the same time
10	Subtotal colectomy	Surgery	Increase lung volumes	Unable to mobilise patient due to cardiovascular instability	3	Patient began to mobilise	Improved air entry on auscultation	
11	Guillain-Barre syndrome	Neurology	Prevent atelectasis	To prevent respiratory complications	14	Improved physical function	Maintained respiratory status	Patient found easy to use and good compliance
12	Pneumonia	Medical	Sputum retention	Patient unable to expectorate secretions	1	Patient confused, unable to tolerate	No change in respiratory status	Unable to use mouthpiece or face mask due to confusion
13	Laparotomy	Surgical	Increase lung volume	Poor inspiratory effort	3	Improved strength, able to do deep breathing exercises and mobility	Improved air entry on auscultation	
14	Pneumonia	Medical	Increase lung volume and improve gas exchange	Patient drowsy	5	Patient less drowsy, participated in active treatment	Decreased oxygen demand	Managed well with face mask
15	Pneumonia	Elderly	Clear secretions	Other techniques not successful	4	Problem resolved	Good cough stimulated and secretions cleared	
16	Ischaemic lower limb	Vascular	Increase lung volume	Too drowsy to use incentive spirometry	2	Patient deteriorated and commenced Liverpool Care Pathway	Expansion visibly increased	

17	Open abdomen	Surgery	Clear secretions	Accidental decannulation of tracheostomy, trying to avoid re-intubation, patient weak and fatigued	6	Improved strength and cough, able to participate in active rehabilitation	Maintained self ventilation	Used overnight regularly by ITU nursing staff after teaching, avoiding physiotherapy on call visits
18	Cystic fibrosis	Paediatrics	Clear secretions	Daily routine of physiotherapy not effective	8	Once acute episode resolved, patient reverted to daily routine of physiotherapy	Effective cough and increased sputum cleared	Good compliance, patient keen to use at home if air supply can be achieved
19	Guillain-Barre syndrome	Neurology	Prevent atelectasis	Maintain respiratory status post extubation	16	Improved strength and mobility	Maintained respiratory status	Patient used device independently
20	Fractured pelvis	Orthopaedics	Prevent atelectasis	Patient on bed rest	8	Patient transferred to speciality hospital	Maintained respiratory status	Patient used device independently
21	Pneumonia	Paediatrics	Improve gas exchange	Patient unable to use IPPB	4	Patient discharged home	Weaned off oxygen	Good compliance
22	Caesarean section	Gynaecology	Clear secretions	Asthmatic, poor cough	2	Improved cough, patient mobile	Patient able to self manage secretions	Required pain relief prior to treatment
23	PEA Arrest, fractured sternum	Medical	Clear secretions, improve lung volume	Aspiration, unable to achieve good lung expansion independently after extubation	9	Patient opted to do active treatments / attend gym	Re-intubation avoided, good expansion and cough achieved	Painful at times, used with saline nebuliser
24	Road traffic collision, multiple trauma	Orthopaedics	Prevent atelectasis	Patient on bed rest, smoker	2	Patient non-compliant	Patient self managed chest and did not deteriorate despite non-compliance with physiotherapy	Patient non-compliant
25	Multiple sclerosis with chest infection	Medical	Clear secretions, improve lung volume	Weak cough, poor expansion	6	Discharged home	Stimulated effective cough and avoided fatigue	Patient would like to use long term to maintain respiratory status

## Discussion

### *Clinical speciality and medical diagnosis*

EZPAP was utilised across all clinical specialities within the hospital with the highest usage in surgery (24%) and medical directorates (28%). When the patient's medical diagnosis is grouped into themes, 36% of EZPAP interventions were with patients who were admitted with a respiratory condition; 32% post abdominal / gynaecological surgery and 16% orthopaedic surgery which concur with the work of Wiersgella (2002) who suggested it as a viable treatment option in pulmonary management. On two occasions it was used to manage acute exacerbations of long term conditions such as cystic fibrosis (CF) and multiple sclerosis (MS). The CF patient expressed a wish to continue with EZPAP as a long term therapy to manage sputum clearance, if an air supply could be sourced for use at home.

Analysis identified significant use of EZPAP to prevent atelectasis in patients who were on bed rest (five patients) or had neuromuscular disorders such as Guillain-Barre Syndrome (GBS) (two patients). On another two occasions EZPAP was the treatment of choice to prevent re-intubation in ITU patients. In all of these EZPAP interactions there may have been the possibility of avoiding more invasive and costly treatments or reducing length of stay in critical care by avoiding re-intubation. Daniel and Tarnow, (2002), in a small scale study utilising EZPAP as a lung expansion therapy found that four out of five patients in their study avoided intubation and ventilation and McEdwards cited by DHD Healthcare (nd) proposed that EZPAP may reduce care costs by avoiding intubation. However, at this time there is currently limited clinical evidence to demonstrate or measure these aspects adequately. Further research with appropriate robust methodology is required to support these theories.

The EZPAP has also been successfully introduced to paediatrics patients as young as nine years of age. To date there are no other

investigations, testimonials or case studies that have considered the use of EZPAP as a treatment choice with children, so EZPAP in this area of practice requires more research. An important aspect of this analysis is that the children were compliant with the treatment and were also empowered to carry out the EZPAP intervention independently throughout the day. A child with cystic fibrosis felt it would be a treatment that could be easily utilised at home, thus encouraging self management of their conditions. The Health Foundation (2011) proactively supports self management and by focusing on behaviour change at a young age it can impact on clinical outcomes and emergency service use throughout life.

### *EZPAP as a physiotherapy intervention*

Physiotherapists identified that the most common problems they used EZPAP for were to clear secretions (28%), improve lung volume (24%), to prevent atelectasis (20%) and improve gas exchange (12%). On four occasions physiotherapists selected EZPAP to treat multiple problems including to increase lung volume and improve gas exchange simultaneously and also to clear secretions and improve lung volume. There has been no consideration in the literature to date that EZPAP could be used to treat multiple physiotherapy respiratory problems as a combined therapy. No physiotherapists selected EZPAP as a technique to reduce the work of breathing - but it was noted that one patient with pneumonia had a reduced respiratory rate post treatment which may suggest that reducing the work of breathing is an additional outcome measure, but not a determining factor in treatment choice.

### *EZPAP to improve lung volume*

Interestingly, the majority (71%) of patients who received EZPAP to improve lung volume had undergone abdominal surgery. Wiersgella, (2002), also identified the benefit of EZPAP post-surgery (Coronary Artery Bypass Graft) as an effective method to reverse atelectasis



and Kopp (2011) found good compliance with post operative patients using EZPAP. The physiotherapist's rationale for selecting EZPAP as the treatment of choice for reduced lung volume was mainly poor lung expansion or reduced inspiratory effort and the patient being too weak or tired to manage incentive spirometry (IS). Boykin (2007), identified that if a patient cannot achieve a minimum of 15ml/kg of predicted inspiratory capacity then IS would not be effective. EZPAP was frequently selected over IPPB due to ease of use or patient being unable to trigger the IPPB. Kopp (2011), also found that therapists chose EZPAP as a therapy in respiratory care due to ease of use. In all cases the physiotherapist documented either improved lung expansion or increased air entry on chest auscultation. Unfortunately one patient's general condition deteriorated and they were placed on the Liverpool Care Pathway so EZPAP was ceased. However, in all other cases improvements were made and in time physiotherapy progressed to active rehabilitation and mobility for respiratory therapy as Hough (2001), advocates that exercise is the optimum treatment for increasing lung volume.

### ***EZPAP to clear secretions***

In this sample, 78% of patients who had EZPAP for sputum clearance were within the medical or elderly care speciality, and had weak or ineffective coughs on assessment or were unable to trigger the IPPB. All patients receiving EZPAP for sputum retention, except one case where therapy was ceased due to confusion, demonstrated either a stronger more effective cough, or a cough was stimulated during therapy. EZPAP was discontinued because either the patient was able to self clear their own secretions, used mobility and exercise as treatment or the problem completely resolved. The experience of physiotherapists at Medway Maritime Hospital of EZPAP for sputum clearance matches case studies by Cox and McEdwards, cited by DHD Healthcare (nd) who also reported improved cough and effective expectoration of secretions following EZPAP.

### ***EZPAP to prevent atelectasis***

Physiotherapists selected EZPAP as a preventative treatment modality to maintain respiratory function and prevent respiratory complications in patients who were either on bed rest due to orthopaedic conditions or who had GBS. One patient was non compliant with EZPAP treatment and physiotherapy as a whole, so treatment was discontinued, all other patients maintained good lung volumes and maintained their respiratory status. EZPAP was only stopped when physical function improved so mobility and exercise became the treatment of choice by the physiotherapists. None of the patients demonstrated any decline in their respiratory condition. One patient was transferred to another hospital so no further data was collected, but until transfer they were maintaining their respiratory status. Harland, (2003), advocates that EZPAP is the treatment of choice for preventing atelectasis and Mitchell, cited by DHD Healthcare (nd) proposes that EZPAP is a cost effective investment as they too reported on a neurovascular patient who did not require intubation due to the regular use of EZPAP. However, further randomised controlled trials would need to be utilised to determine if EZPAP was the key aspect of therapy in such situations.

### ***EZPAP to improve gas exchange***

The physiotherapists' rationale for choosing EZPAP to improve gas exchange was the need for positive pressure interventions in all but one case. In the remaining patient EZPAP with a face mask was selected due to the patient being too drowsy to co-operate with other treatment interventions. Physiotherapists chose the EZPAP device as it was easier for both the therapist and patient to use compared to IPPB, which Kopp, (2011) also found. All patients were successfully weaned from oxygen. However, it is impossible to draw firm conclusion that the improvement in gas exchange and the weaning of the oxygen was due to the EZPAP intervention or the result of the resolving respiratory condition and further



randomised controlled trials would need to be conducted to prove this.

### ***Additional Information***

Both physiotherapists and patients agreed that the EZPAP was easy to use, comfortable and so afforded a good compliance rate (92%). Only two patients did not comply with EZPAP intervention. One patient was confused and unable to correctly use the device. The other patient declined all physiotherapy input. It was noted that one patient complained of fatigue and another patient tended to hold their breath, so it is imperative that the technique is taught effectively and the patient observed carefully. Physiotherapists utilised the facemask as well as the mouthpiece and included nebulisation and manual techniques as indicated which may have increased the positive treatment outcomes that were recorded.

### ***Number of Treatments***

The average number of physiotherapy led sessions that a patient received EZPAP was 5.2, with the range from 1 to 16. Unfortunately treatment sessions supervised by nursing staff or independently carried out by the patient were not documented accurately and this will need to be addressed in any future study. If documented, it would allow physiotherapy department to analyse if expensive on call visits were being avoided if nursing staff and patients were taught how to carry out on going treatment, the initial set up and effectiveness being assessed by the physiotherapist.

The mean number of treatments increased to 5.2 from 2.8 compared to the previous study by Elliott (2012), but in comparison the EZPAP was being utilised more to manage long term conditions, as a preventative treatment for both patients on bed rest and those with neurovascular disorders. If these patients are excluded, in order to compare with the results of the previous study, the mean number of treatment sessions a patient receives was 4. Additionally it has been implemented

successfully in ITU and paediatrics - clinical areas where it previously had not been utilised. On one occasion EZPAP was only used once as the patient was unable to co-operate due to confusion and another occasion where EZPAP was trialled twice then discontinued due to poor compliance. Further monitoring is needed to ensure physiotherapists continue to use clear clinical reasoning for their treatment options rather than 'just trying' EZPAP as it was a new modality. With the remaining patients, EZPAP was ceased because the problem resolved, patient was discharged home, patient progressed to incentive spirometry or physiotherapy utilised mobilisation and exercise as their treatment choice for respiratory care.

## **Conclusions**

This retrospective analysis suggests that EZPAP positive airway device can be a useful adjunct to respiratory physiotherapy in aiding clinical improvements in lung expansion especially with post operative patients with poor inspiratory effort, preventing atelectasis in bed bound patients and neurovascular disorders such as GBS and MS. It appears to aid clearance of secretions with patients who have a weak, ineffective cough and may be a tool to prevent intubation / re-intubation within a critical care unit when patients are demonstrating signs of fatigue. Physiotherapists identified that it was easier to use than IPPB when delivering a positive pressure treatment to improve gas exchange. EZPAP was not selected as a treatment to reduce work of breathing but may reduce respiratory rate and patient's perceived breathlessness in some cases. Both physiotherapists and patients found the device easy to use which leads to a high compliance rate. It is possible to teach nursing staff or the patient to carry out this treatment after initial set up which may reduce physiotherapy on call costs, but this requires further investigation.

Overall, this study at Medway NHS Foundation Trust found that EZPAP was used in a variety of different patient groups for a range of respiratory problems and so justifies the



ongoing purchase and feasibility as a respiratory physiotherapy modality at our hospital.

## Limitations and Recommendations

- It is acknowledged that a limitation of this study was a lack of objective outcome measures to determine the effectiveness of EZPAP, further research such as prospective studies and case studies with clearly defined outcomes should be considered.
- In order to identify cost effectiveness for avoiding physiotherapy on call visits, the number of EZPAP sessions completed by nursing staff or the patient need to be analysed, not just in terms in numbers but effectiveness of technique.
- Although this study demonstrated clinically positive outcomes as assessed by physiotherapist it is limited to physiotherapy intervention only and more information could have be gained by considering other multidisciplinary involvement.

## Key points

- EZPAP is effective in aiding clinical improvements of lung expansion in post abdominal surgery patients
- EZPAP can be used in the prevention of atelectasis in bed bound patients and those with neuromuscular disorders
- EZPAP aids sputum clearance in patients with ineffective cough
- EZPAP provides positive pressure to improve gas exchange
- EZPAP is easy to set up and has a good compliance rate
- EZPAP can be used for all ages in acute and long term care

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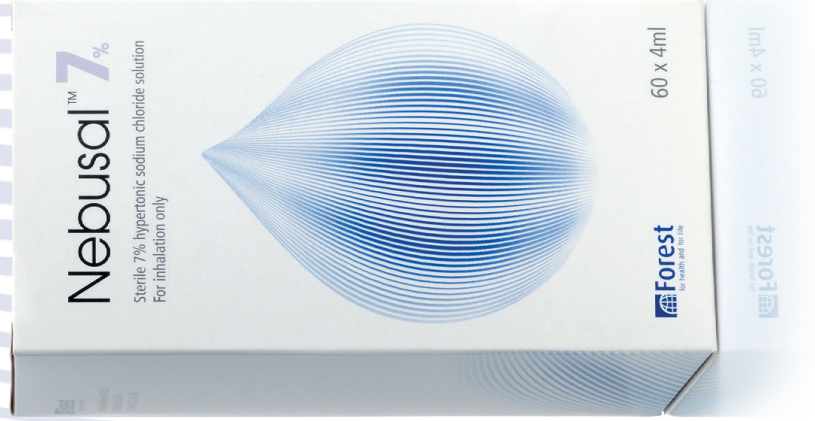




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# What information or education should clinicians provide to patients following discharge from hospital after critical illness? A comprehensive review.

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### Summary

***This review aims to describe the content, method of delivery and effectiveness of information or education delivered to patients***

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### Keywords:

Education

Information

Critical Illness

Home or Community

***and their families or carers following discharge from hospital after critical illness. It provides clinicians with information that may help the development of educational interventions in order to enhance outcomes following discharge from hospital after critical illness.***

### Introduction

The NICE (2009) guidelines categorise the rehabilitation care pathway after critical illness into five key stages and advocate seamless rehabilitation across these:

- (1) during the critical care stay;
- (2) before discharge from critical care;
- (3) during ward-based care;

- (4) before discharge to home or community care;
- (5) 2-3 months after discharge from critical care (home or community).

Patients have identified 'information and education' as one of the key components that should be included in their rehabilitation (Deacon 2012). One section of the NICE (2009) guidelines reviewed evidence for the information needs of patients and their families or carers during and after a period of critical illness. The guidelines provide recommendations that link to the first four stages of the rehabilitation pathway. At stage 5, NICE (2009) recommend that assessment be used to determine if continued support be given if the patient is not recovering as quickly as anticipated. However, there is a lack of guidance for clinicians wishing to address information or education needs specific to this stage.

Recovery from critical illness is associated with physical, mental and cognitive sequelae which may continue for up to five years following hospital discharge (Herridge et al 2011, Cuthbertson et al 2010). The mortality rates of these patients have been reported to be above that of the general population for at least 15 years after discharge (Williams et al 2008). There is also significant negative impact on those who care for survivors of critical illness following their discharge home (Johnston et al 2001). This data highlights the importance of post hospital rehabilitation (stage 5). However, it is unclear what components should be included at this stage and how they should be delivered (O'Neill and McAuley 2011). Studies including exercise-based rehabilitation following hospital discharge are emerging; however few have included education. Investigation into the components of other non-exercise based rehabilitation including education and on-going management has been recommended (Connolly et al 2012).

Many of the recommendations at the earlier

stages of the rehabilitation care pathway refer to issues that may only surface for patients once they leave hospital (NICE 2009). These include, e.g. getting back to everyday routine, managing activities of daily living, information about diet, driving, returning to work, housing and benefits. There is also concern that it may not be appropriate to deliver too much information relating to recovery after discharge too early. Patients have reported wanting to be 'drip-fed' information at different stages in their recovery (Bench et al 2011).

Awareness about the specific content and method of delivery of information or education at stage 5 would enable clinicians to administer educational interventions which could help to improve long-term outcomes following critical illness. This review aims to describe the content, method of delivery and effectiveness of information or education delivered to patients and/or their families or carers following discharge from hospital after critical illness (stage 5).

## Objectives

The objectives of this review are:

- a) To describe the content of information or education delivered to patients and/or their families or carers at stage 5 and to make comparisons to the NICE (2009) guidelines.
- b) To describe the method of delivery of information or education delivered at stage 5.
- c) To examine the effectiveness of information or education delivered at stage 5.

## Methods

An electronic literature search of relevant databases was conducted from inception until January 2013 using key words. The titles and abstracts were screened and those that appeared relevant were selected and the full text was retrieved. Further literature was



obtained by hand searching the reference lists of articles identified in the search. Studies were selected based on the following criteria;

Inclusion criteria:

- Provision of information or education to patients and/or their families or carers at stage 5.
- Description of the content and/or methods of delivery and/or effectiveness of information or education at stage 5.
- Patients aged  $\geq 16$  years with any length of stay in critical care.

Exclusion criteria:

- Follow up consultations where it is not clear that information or education was provided.
- Information or education relating to self-directed exercise or structured exercise programmes alone.
- Information or education relating to the critical care experience alone, e.g., critical care diaries.
- Studies involving specific conditions, e.g. head injury, COPD or cardiac problems where there would be an alternative opportunity for information or education.
- Not available in English.

Where studies included information or education in written format, this was also obtained. Data was extracted relating to the objectives. The research team reviewed the NICE (2009) guidelines on rehabilitation after critical illness and content that was considered primarily pertaining to information or education needs at stage 5 was extracted. The content of the information or education in the included studies was then cross matched to the NICE (2009) content areas to allow comparisons to be made.

## Results

Seven studies met the inclusion criteria: one randomised controlled trial (Jones et al 2003), one cohort study (McWilliams et al 2009), and five studies of descriptive designs (Petersson et al 2011, Peskett and Gibb 2009, Samuelson and Corrigan 2009, Crocker 2003 and Cutler et al 2003).

### ***Content of information or education***

The research team reached consensus on 17 content areas in the NICE (2009) guidelines that primarily pertained to stage 5 of the rehabilitation care pathway (Table 1).

All studies (n=7) described the content of information or education delivered following discharge from hospital after critical illness (stage 5), although specific details were often lacking. In one study access to the written information provided allowed more detailed content to be extracted (Jones et al 2003). This study covered the majority (n=14/17) of the NICE (2009) content areas. Additional content included changes in appearance and smoking cessation. All of the remaining studies describe the content in limited detail only, and covered 6 or less of the 17 NICE (2009) content areas. Although studies stated that information needs were addressed, overall any further detail regarding the content is limited.

Information or education content areas (n=17) (NICE 2009)	Jones et al 2003	McWilliams et al 2009	Petersson et al 2011	Peskett and Gibb 2009	Samuelson and Corrigan 2009	Crocker 2003	Cutler et al 2003
<b>Rehabilitation goals</b>	NR	NR	NR	NR	NR	NR	NR
<b>Physical problems</b> Weakness, mobility, fatigue, pain, breathlessness, swallowing difficulties, incontinence, self care	✓ Mobility, tiredness	✓ Managing breathlessness	NR	NR	NR	NR	✓ Mobility, wound healing
<b>Physical recovery</b>	✓ Importance of exercise, fitness	✓ Benefits of exercise	NR	NR	NR	NR	NR
<b>Sensory problems</b> Vision, hearing, pain, altered sensation	✓ Taste changes, pain from scars/injuries	NR	NR	NR	NR	NR	NR
<b>Communication problems</b> Speaking, language, writing	NR	NR	NR	NR	NR	NR	NR
<b>Social care or equipment needs</b> Mobility aids, transport, housing, benefits, employment, leisure	✓ Getting out and about on your own	NR	NR	NR	NR	NR	NR
<b>Anxiety, depression and post traumatic stress related symptoms</b> Somatic symptoms e.g. palpitations, irritability and sweating, depression, sleeping problems, nightmares, hallucinations, delusions, flashbacks, intrusive memories, panic	✓ Sleeping, nightmares, hallucinations, phobias, mood changes, worrying, anxiety, panic attacks, depression, stress symptoms and causes, anti-stress tactics, relaxation	✓ Anxiety management, relaxation	NR	NR	NR	NR	✓ Sleeping, mood

Table 1 – Content of information or education delivered following discharge from hospital after critical illness (stage 5) compared to the NICE (2009) recommendations

Information or education content areas (n=17) (NICE 2009)	Jones et al 2003	McWilliams et al 2009	Petersson et al 2011	Peskett and Gibb 2009	Samuelson and Corrigan 2009	Crocker 2003	Cutler et al 2003
<b>Behavioural and cognitive problems</b> Memory loss, attention deficits, sequencing and organisational problems, confusion, apathy, disinhibition, insight	✓ Memory loss, scheduling	NR	NR	NR	NR	NR	NR
<b>Other psychosocial or psychosocial problems</b> Self esteem, self image, body image, relationships	✓ Family and relationships, stress in marriage	NR	NR	NR	NR	NR	✓ Relationships
<b>Diet and nutrition</b>	✓ Nutrition, food, eating normally again, feeling sick, weight loss	NR	NR	NR	NR	NR	✓ Eating
<b>Any other continuing treatment</b>	✓ Medicines and side effects	NR	NR	NR	NR	✓ Current medications, procedures and progression	NR
<b>The rehabilitation care pathway</b>	NR	NR	✓ Current health, illness or injury trajectory	NR	✓ Rehabilitation time and long term health	NR	✓ Advice and help on future recovery
<b>Activities of daily living including self-care and re-engaging with everyday life</b>	✓ Overworking, rushing	NR	NR	NR	NR	NR	NR
<b>Driving, returning to work, housing and benefits</b>	✓ Control of workload	NR	NR	NR	NR	NR	✓ Ability to return to work

Information or education content areas (n=17) (NICE 2009)	Jones et al 2003	McWilliams et al 2009	Petersson et al 2011	Peskett and Gibb 2009	Samuelson and Corrigan 2009	Crocker 2003	Cutler et al 2003
<b>Local statutory and non-statutory support services</b>	✓ Smoking support, who to ask	NR	NR	✓ Reassurance and guidance in raising matters with appropriate professionals	NR	✓ Suggest sources of help	NR
<b>General guidance especially for the family/ carer on what to expect and how to support the patient at home</b>	✓ Coping with setbacks, living alone	NR	NR	NR	NR	NR	NR
<b>Sexual dysfunction</b>	✓	NR	NR	NR	NR	NR	NR
<b>Number of content areas covered</b>	n=14/17	n=3/17	n=1/17	n=1/17	n=1/17	n=2/17	n=6/17
<b>Additional content</b>	Smoking cessation, changes in appearance including hair, skin and nails	Smoking cessation	Review of the critical care stay, individual content	Review of the critical care stay	Review of the critical care stay, identify existing problems	Review of the critical care stay	Review of the critical care stay, discuss perceived problems, facilitate interpretation of complex information, scarring

NR = not reported



### ***Method of delivery of information or education***

All studies (n=7) described the method of delivery of information or education delivered following discharge from hospital after critical illness (stage 5) (Table 2). The majority of interventions were delivered to individual patients (n=5/7): either face-to-face during follow up appointments (n=4), or by incorporating written information as part of self-directed rehabilitation (n=1). Two studies used a group format: formal group education classes incorporated in a 6 week rehabilitation programme (n=1) or informal drop in sessions (n=1). In general the interventions were delivered in a hospital outpatient location (n=5/7). The interventions were generally nurse led (n=5/7) and with multidisciplinary team input (n=5/7) including physiotherapists, occupational therapists, dieticians and physicians. Family members were involved in the majority of studies (n=6/7).

The written information in the study by Jones and colleagues (2003) was divided into weekly sections for six weeks following discharge from hospital, and Cutler et al (2003) delivered information at 3 and 6 months after hospital discharge. The specific timing of the intervention following discharge from hospital is unknown in the remaining studies. In three of these studies the interventions took place at different time points between 2 and 6 months post discharge from critical care. Therefore, the timing after hospital discharge was variable for patients depending on the length of stay in hospital. Generally studies included information or education as a component of other post critical care rehabilitation interventions, i.e. follow up programmes (n=4/7) and exercise-based interventions (n=2/7). Four studies also included information delivery at earlier stages of the rehabilitation pathway. In the remaining studies it is unknown whether patients received earlier education interventions.



Table 2 - Method of delivery of information or education delivered following discharge from hospital after critical illness (stage 5)

Reference and study design	Method of delivery of information or education
<p><b>Jones et al 2003</b></p> <p>Randomised controlled trial</p>	<p><b>Format:</b> Intervention group: Written information in a rehabilitation manual. Included a self directed exercise programme; ward visits; 3 telephone calls at home to reinforce the use of the manual; follow up clinic appointments. (Control group: ward visits, 3 telephone calls at home, follow up clinic appointments.)</p> <p><b>Delivery:</b> Individually delivered. Introduction of the manual took place on the general wards approximately 1 week after critical care discharge. Self directed at home for 6 weeks after hospital discharge.</p> <p><b>HP:</b> Research nurse using a printed training schedule.</p> <p><b>Family involvement:</b> Yes.</p> <p><b>Information or education at earlier stages:</b> No. NB. Manual introduced during ward-based care (stage 3).</p>
<p><b>McWilliams et al 2009</b></p> <p>Cohort study</p>	<p><b>Format:</b> Group education, one hour per week. Component of a 6-week rehabilitation programme that also included a one hour supervised exercise class and two unsupervised exercise sessions per week.</p> <p><b>Delivery:</b> Group based in an outpatient hospital gymnasium.</p> <p><b>HP:</b> Physiotherapy led. Group discussion with a specialist critical care follow up nurse.</p> <p><b>Family involvement:</b> NR</p> <p><b>Information or education at earlier stages:</b> NR</p>
<p><b>Petersson et al 2011</b></p> <p>Descriptive design</p>	<p><b>Format:</b> Follow up consultations. Component of follow up programme that included 3 contacts.</p> <p><b>Delivery:</b> Individually delivered at 2 and 6 months after critical care discharge in a clinic located close to the critical care unit.</p> <p><b>HP:</b> Nurse led. Clinic was run by 4 nurses with critical care experience and special education in therapeutic conversation. Patients were offered a meeting with a physician if requested or had questions concerning medical issues.</p> <p><b>Family involvement:</b> Yes</p> <p><b>Information or education at earlier stages:</b> Yes, during ward-based care (stage 3).</p>
<p><b>Peskett and Gibb 2009</b></p> <p>Descriptive design</p>	<p><b>Format:</b> Informal support group. Drop in sessions held for 2 hours and patients/relatives could come and go during that time.</p> <p><b>Delivery:</b> Group delivered in a community setting.</p> <p><b>HP:</b> Nurse members.</p> <p><b>Family involvement:</b> Yes.</p> <p><b>Information or education at earlier stages:</b> NR</p>
<p><b>Samuelson and Corrigan 2009</b></p> <p>Descriptive design</p>	<p><b>Format:</b> 90 minute follow up consultation as a component of a follow up programme. Also included ward visits; an information pamphlet distributed at the ward visit; an answering machine telephone helpline to the after-care nurse.</p> <p><b>Delivery:</b> Individually delivered 2-3 months following critical care discharge at a hospital clinic.</p> <p><b>HP:</b> Nurse led, with MDT including a physician, psychologist and nurse consultant.</p> <p><b>Information or education at earlier stages:</b> Yes, during ward based care (stage 3).</p>
<p><b>Crocker 2003</b></p> <p>Descriptive design</p>	<p><b>Format:</b> Component of a MDT follow up clinic lasting 60 minutes.</p> <p><b>Delivery:</b> Individually delivered at a hospital clinic 2 and 6 months after discharge from critical care.</p> <p><b>HP:</b> MDT (nurse, intensivist, physiotherapist, occupational therapist).</p> <p><b>Family involvement:</b> Yes.</p> <p><b>Information or education at earlier stages:</b> Yes, during ward-based care (stage 3).</p>
<p><b>Cutler et al 2003</b></p> <p>Descriptive design</p>	<p><b>Format:</b> Component of a follow up service approximately 3 and 6 months after hospital discharge. Written and verbal information.</p> <p><b>Delivery:</b> Individually delivered in a hospital clinic setting.</p> <p><b>HP:</b> Nurse led, with MDT including dietetic, physiotherapy, anaesthetic and pharmacy staff.</p> <p><b>Family involvement:</b> Yes</p> <p><b>Information or education at earlier stages:</b> Yes, during ward-based care (stage 3).</p>

HP = Healthcare professional(s) MDT = Multidisciplinary team NR = Not reported



## Effectiveness of information or education

No studies used objective outcome measures to determine the effectiveness of information or education delivered following discharge from hospital after critical illness. Four studies of descriptive designs used open response questionnaires developed by the authors (n=2/4) or informal discussions (n=2/4) to evaluate the effects of the information or education provided (Table 3). These studies reported positive results relating to the general satisfaction and perceived benefit of the interventions. Patients in a group setting also reported a benefit in sharing experiences with others who had been critically ill.

## Discussion

Information or education is recommended as an important component of rehabilitation after critical illness. This review identified specific content of information or education primarily pertaining to post hospital discharge (NICE 2009) and highlighted that few studies have included this. Delivery of information or education is mostly to individual patients, and this seems appropriate as the content should be based on individual assessment (NICE 2009). No studies used objective outcome measures to determine the effectiveness of information or education provision at this stage of rehabilitation.

Table 3 - Effects of information or education delivered following discharge from hospital after critical illness (stage 5)

Reference	Outcome measure(s) and timing	Effect(s)
<b>Petersson et al 2011</b>	Evaluation questionnaire developed by the authors. Overall impression of follow up and space for own comments.  Following the 6-month contact, patients returned the questionnaire in a pre-paid envelope.	The overall impression of the clinic was good or very good. It is stated that patients appreciated the follow-up, expressed gratitude to the competent and obliging staff. They received information, an opportunity to talk, increased knowledge and re-evaluated memories and experiences.
<b>Peskett and Gibb 2009</b>	Informal discussions.  Timing NR.	Feedback indicated that further support was needed following discharge from hospital. Patients and families found benefit in sharing experiences with others who can empathise, having been through critical illness themselves.
<b>Samuelson and Corrigan 2009</b>	Evaluation questionnaire developed by authors. Visual analogue scale (VAS) for satisfaction (a 10cm line ranging from poor to excellent). Comments were also invited.  At the end of the follow up clinic to complete at home.	The follow up consultation achieved a median VAS rating of 9.8 from both patients and next of kin. No significant differences in VAS ratings between patients and next of kin. It is stated that the written comments were all positive, testifying to the support, care and understanding received.
<b>Cutler et al 2003</b>	Brief semi-structured telephone interviews, open questioning style.  Timing NR.	Patients had their questions answered, were well treated by clinic staff and an almost unanimous lack of suggestions for improving the clinic.

NR = Not reported

Overall the majority of the NICE (2009) recommendations pertaining to stage 5 were not covered in the included studies, however, reporting of specific details was often lacking. Given the heterogeneous critical care population it seems appropriate that the content should be based on an individual assessment (NICE, 2009). A menu driven approach could help clinicians to utilise a range of resources to deliver appropriate information or education based on the results of individual assessment. This would facilitate delivery of an individualised, yet standardised intervention that could be reproduced. For example, when assessment identifies problems with memory loss or flashbacks, then resources could be used to provide specific information or education on these aspects. Menu driven approaches have been recommended in other populations e.g. cardiac disease (BACPR 2012). The 17 content areas highlighted in Table 1 of this review (NICE 2009) may be useful in the development of a menu-driven educational intervention.

Few studies in this review included written information, yet patients have identified the desire for verbal information to be supplemented with written material (Lee et al 2009). This has also been identified in other patient populations (Wilson et al 2007). Jones et al (2003) provides a good example of the delivery of written information including content pertinent to stage 5. Additional information leaflets have been located online (Intensive Care Society 2011, ICUsteps 2010, Society of Critical Care Medicine 2007). These may provide a useful resource for clinicians and could be adapted for use at the different stages of recovery. While written information has been provided at earlier stages of the rehabilitation care pathway in other studies (Bench et al 2011, Paul et al 2004) it may be important to repeat it following hospital discharge focusing on the relevant individualised content.

An awareness of the information delivered at earlier stages of the rehabilitation pathway is important, as this may inform the content to be delivered post hospital discharge.

Communication between healthcare professionals across the stages, in particular stage 5, where a transfer to the community or outpatient setting is required, would help to facilitate seamless delivery.

Current constraints with clinical services may present a challenge for clinicians to deliver comprehensive information or education after discharge, and additional resources may be required to facilitate this. In this review, information at stage 5 was usually delivered in a one-to-one format, often during a follow up clinic. Critical care follow up clinics may provide a platform for the delivery of individualised information or education following discharge from hospital. Alternatively, follow up clinics with a standardised approach could facilitate assessment and onward referral for further specific information or education.

Well established disease specific rehabilitation strategies, including cardiac and pulmonary rehabilitation, include education embedded with physical rehabilitation. A growing number of studies are emerging on the outcome of patients receiving exercise-based rehabilitation following discharge from hospital after critical illness. Education has generally not been included. One exercise-based study in this review (McWilliams et al 2009) delivered group education sessions with topics including breathlessness and smoking cessation. Group education would allow peer support which patients have found beneficial (Peskest and Gibb 2009). However, caution should be used in applying standard education topics to the post-critical illness population due to their heterogeneity (Connolly et al 2012). Rehabilitation programmes that include education sessions should carefully consider how individual information needs can be met and this is an area of further investigation.

It is difficult to determine the outcome measures that should be included to evaluate the effectiveness of information or education at stage 5 from the studies reviewed, as these only briefly explored views about the general



satisfaction and perceived benefit. Satisfaction is central to the success of patient education; however knowledge, understanding and self-efficacy are also key to this success. Ways to assess all of these constructs should be embedded in educational interventions. Additional outcome measures utilised should reflect the goals of the intervention and are likely to differ based on the individual assessment. The Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith 1983) is one example of an outcome measure that may be appropriate when the goal is to decrease anxiety and/or depression symptoms.

In the studies that were located, limited specific detail was given, making it difficult to provide direction on the detailed content that may be useful. It is likely that these results are biased by this limited detail due to reporting restrictions for publication. Contacting the authors for a more detailed description, including details of individualised information may have validated the findings. It is important for future studies to provide comprehensive detail on the content, method of delivery, and any information that was provided at other stages. Outcome measures that reflect the specific goals of information or education should also be used. It was beyond the scope of this paper to review information specifically relating to the critical care experience, e.g., critical care diaries (Backman et al 2010). It may be important to incorporate these into menu-driven educational interventions at an appropriate stage of the patients' recovery pathway.

## Conclusion

Few studies have explored the delivery of information or education following discharge from hospital after critical illness. It is important that information or education addresses the patients and their families or carers needs at this stage of recovery. The NICE guidelines on rehabilitation after critical illness (NICE 2009), contain a range of content areas pertaining to post hospital discharge. These content areas

may be useful in the development of a menu-driven educational intervention for patients and their families or carers following discharge from hospital after critical illness. This would facilitate an individualised yet standardised delivery of appropriate information or education. Continuity of care and an awareness of the information delivered at earlier stages are important to facilitate a seamless rehabilitation pathway. Relevant outcome measures should focus on determining whether the aims of education at this stage of rehabilitation are achieved.

## Key Points

- This review identified specific content of information or education primarily pertaining to post hospital discharge (NICE 2009) and highlighted that few studies have delivered this.
- A menu driven approach may facilitate an individualised yet standardised delivery of information or education to patients and their families or carers based on individual assessment.
- Continuity of care and an awareness of the information delivered at earlier stages are important to facilitate seamless rehabilitation.
- Relevant outcome measures should focus on determining whether the aims of education at this stage of rehabilitation are achieved.

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# The effectiveness of out-of-hours respiratory physiotherapy services: A review of the literature

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## Summary

***The NHS aspires towards a service which delivers a consistently high standard of care 24 hours per day. Respiratory physiotherapy services have come under scrutiny as discrepancies emerge in the training and competency of on-call respiratory physiotherapists, particularly those whose usual specialty lies outside respiratory care. This review identifies research that has investigated the effectiveness of out-of-hours respiratory physiotherapy interventions.***

## Introduction

In the United Kingdom, the most common

approach to providing emergency on-call cover, at nights or weekends, is that medical staff (including physiotherapists) who ordinarily work in other clinical areas are obliged to contribute to on-call duties. Evidence suggests that there is an increased risk of poorer outcomes and mortality associated with out of hours admissions and care (Laupland et al 2008, Cavallazzi et al 2010). The 2009 report from the National Confidential Enquiry into Patient Outcome and Death found instances of poor decision-making and a lack of input from senior staff, particularly in the evenings and at night (NCEPOD 2009). While these were not directly related or attributable to physiotherapy care, independent research has shown that physiotherapy competence is mandatory if adverse events in the ICU are to be avoided (Zeppos et al 2007). Safe and effective delivery of hospital care at night and out of hours is a major challenge, affecting many areas of acute health care delivery. It has led to the introduction of a clinically driven



and patient focused NHS 'Hospital at Night' programme, which aims to provide 24 hour access to multidisciplinary teams who have the full range of skills and competencies to meet the immediate, complex and variable needs of patients.

Significant fluctuations in cardiovascular stability, in critically ill patients, can contribute to organ failure or lung damage (Stiller 2000). It is not uncommon for some ventilated patients to exhibit short-term deteriorations in lung function following physiotherapy treatments even when administered by specialist ICU staff. It is likely that the risk of significant deterioration is increased when inexperienced on-call staff perform such interventions (Main et al 2004).

Concerns regarding on-call respiratory physiotherapy were first voiced more than 20 years ago, when on-call duties were identified as a key source of stress amongst newly qualified staff (Mottram and Flin 1988). Such apprehensions have become a recurring feature of the Chartered Society of Physiotherapy's (CSP) interactive forum (i-CSP), indicating that this remains a difficulty within the profession that is showing no signs of being resolved. Between 2008 and 2011 there were approximately 348 separate threads in the i-CSP, relating to which therapists should or should not be exempt from the on-call rota (for example, static musculoskeletal physiotherapists), how competence could best be measured and assessed and how one could put forward a case to support a threatened on-call service. Amongst novice practitioners, working in isolation, outside their normal area of expertise and specifically in the intensive care unit have been identified as key sources of stress (Dunford et al 2008). These concerns may be shared amongst more senior staff whose length of service away from respiratory care, combined with inadequate maintenance of specific skills within the acute care practice setting, can result in a gradual drift in levels of respiratory physiotherapy competence.

A physiotherapy National On-Call project attempted to address this matter by publishing the emergency duty guidelines (CSP 2004) and a self-evaluation competence questionnaire (Thomas et al 2008). A pilot study subsequently used this questionnaire to compare self-evaluation of competence in physiotherapists who had read the emergency duty guidelines, with those who had not (Broad et al 2007). Data were analysed by calculating sum scores for each group and comparing them using Mann Whitney U Tests. No significant differences were noted in overall scores for self-perceived competence levels between the two groups (no p-value available in the pilot study). This provided rather sombre proof that improving competence (or perceived confidence) may not be achievable by providing practitioners with documentation alone. However, this was not the primary aim of the emergency duty guidelines. The authors suggested that the questionnaire could be used as a basis for appraisal and discussion with respiratory staff prior to undertaking on-call duties, not as a global outcome measure (Broad et al 2007).

There may in addition be a powerful argument that self-evaluation of levels of stress or competence or confidence is irrelevant and superfluous to providing safe, high quality hospital care. What physiotherapists actually do in a clinical setting is far more important than what they think they know or can do. Actual and applied competence in day to day circumstances is what is important to the physiotherapist, to patients and to other health care providers. An individual who is unconsciously incompetent for example may not realise that they do not have the necessary skills for delivery of safe and effective on-call care. It is insufficient to purely trust in perceived levels of confidence and competence. It is, essential that in addition to evaluating competence, the primary effectiveness of on-call physiotherapy is assessed. This literature review seeks to identify research that has specifically addressed the efficacy of out-of-hours on-call respiratory physiotherapy services.



## Methods

Electronic MEDLINE, PUBMED and EMBASE searches were conducted, complemented by manual searches from the relevant reference lists of selected articles. The keywords 'on-call,' 'out-of-hours,' 'physiotherapy' 'physical therapy' and 'respiratory' were entered in combination using the AND/OR logical operators. The first and last authors from selected articles were also searched separately to ensure that no follow-up papers were missed. Articles were excluded if they did not relate to the effectiveness of out-of-hours respiratory physiotherapy, if they were not written in the English language or if they represented a comment or editorial rather than a primary research study. Articles from the earliest possible date to the present day were included in the review.

## Results

A total of 76 results were generated from the databases, between 1992 and 2012. After duplicates were removed, and papers that did not meet the inclusion criteria excluded, 11 papers remained. Further papers were excluded if they were surveys or literature reviews, leaving 3 papers which are presented below, with the most recent study first.

Babu et al (2010) is the only recent prospective randomised study to compare outcomes when one group of patients received on-call physiotherapy, while a control group did not. Their study was conducted at a secondary level hospital in rural India. Thirty eight patients, admitted with an exacerbation of chronic obstructive pulmonary disease, were randomly assigned to either the intervention group (n=19) or a control group. Both groups received physiotherapy care during the day, consisting of positioning, relaxation, breathing control and airway clearance techniques. The intervention group received additional on-call physiotherapy as deemed necessary by the medical or nursing team. The group receiving on-call physiotherapy had a significantly faster peak expiratory flow (PEF) and greater six

minute walk at discharge, compared with the control group. Mean (SD) PEF at discharge was 212 (51) L/min and 160 (68) L/min for the intervention and control groups respectively ( $p=0.01$ ), mean differences and confidence intervals were not reported. Six minute walk test results were 388 (110) versus 289 (103) minutes ( $p=0.004$ ) respectively. There was no significant difference in the length of hospital stay between groups, being 4.3 (2.5) and 5.1 (2.4) days ( $p=0.36$ ).

Non-statistically significant differences between the two groups at baseline suggested that the intervention group were older, and had a lower baseline PEF and therefore may have been the slightly more vulnerable subgroup. This may have contributed to the increased number of ICU admissions in the intervention group (n=6 versus n=2).

Berney et al (2002) conducted a retrospective case control audit on 14 patients who had been admitted to the ICU with acute cervical cord lesion and quadriplegia (Berney et al 2002). The authors compared seven patients treated with intensive physiotherapy (Group A), with a group of seven patients, matched for age, level of injury and respiratory history, who had undergone tracheostomy (Group B). Group A received physiotherapy during the day and additional call-outs at night as required. Group B also received physiotherapy during the day, but nursing staff performed all airway management procedures at night.

Results showed that Group A had fewer days on mechanical ventilation, with median (range) 4.7 (3.1 to 6.3) days compared to 12.7 (7.8 to 17.6) days in Group B ( $p=0.02$ ). A significantly reduced length of stay on the ICU of 6 (5 to 7) days compared to 13 (9 to 18) days was also reported ( $p=0.02$ ). Nineteen (13 to 23) ICU physiotherapy treatments were recorded for Group A, whereas Group B required 26 (20 to 37) treatments, most likely due to the significantly increased length of stay ( $p=0.05$ ).

Finally, Ntoumenopoulos and Greenwood





investigated the effect of an additional evening physiotherapy treatment on intrapulmonary shunt and pulmonary complications in patients following abdominal surgery (Ntoumenopoulos and Greenwood 1996). Thirty one patients admitted to ICU after surgery were randomly assigned to receive either daytime physiotherapy with an additional evening treatment (Group A), or daytime only physiotherapy (Group B). No significant differences were found between the groups in terms of the development of acute atelectasis, duration of intubation or intrapulmonary shunt immediately after physiotherapy. Significantly lower values of intrapulmonary shunt were recorded in the 18 and 24 hours following surgery in Group A, compared with Group B ( $p < 0.05$ ), although given the small sample size, the study was under-powered (Ntoumenopoulos and Greenwood 1996).

## Discussion

Despite the perceived importance of on-call physiotherapy, this review demonstrates an extreme paucity of studies. Although all three studies demonstrated tentatively positive results to advocate the use of additional out-of-hour physiotherapy, small sample sizes mean the studies were likely to be underpowered and as a result, findings should be interpreted with extreme caution.

Furthermore, differences in undergraduate training, levels of autonomy and the management of COPD patients between countries makes it difficult to extrapolate the findings of Babu et al (2010) to the UK on-call scenario.

The retrospective nature of the data collection process by Berney et al (2002) raises further questions since the patients who received a tracheostomy may well have exhibited different characteristics to warrant this intervention (i.e. are likely to have been more unwell), compared to the physiotherapy only group. The implications of a tracheostomy on the length of stay in ICU, regardless of physiotherapy

intervention, were not documented. The study population is also not directly akin with those patients that physiotherapists are likely to be regularly called to see when on-call (Lim et al, 2008).

In both the Ntoumenopoulos and Greenwood and Berney et al studies, on-call physiotherapy treatments were provided by physiotherapists who worked in the clinical area in which the study was set, whereas it is unclear from Babu et al (2010) which physiotherapists delivered the out-of-hours treatments. Ntoumenopoulos and Greenwood (1996) utilised the same physiotherapist to administer both daytime and evening treatments, avoiding complications relating to the variability of expertise and treatment styles between individual physiotherapists (Shannon et al 2009). Therefore none of these studies reflects or represents the typical UK on-call staffing pattern whereby less experienced physiotherapists may treat patients during evenings or weekends. Finally, the evening sessions could be described as 'planned' call-outs since the physiotherapist had prior knowledge that the patient would require a treatment. By contrast, many call-outs are unplanned emergencies and are therefore unpredictable by nature. This inevitably leads to increased stress for the on-call physiotherapist (Harden et al 2005).

The above papers fail to address the efficacy of a heterogeneous on-call rota which may consist of physiotherapists whose usual area of expertise lies outside the respiratory specialty, or where physiotherapists who usually treat adult patient are providing out-of-hour care to paediatric patients, as was the case in 68% ( $n=136$ ) of hospitals surveyed by Harden et al (2005).

There is no currently published evidence that this traditional on-call system provides patients with optimal care out of normal working hours. Furthermore, given the variation in on-call preparation, training and support nationally, the quality of on-call physiotherapy



is likely to be very variable both nationally and internationally (Gough and Doherty 2007). A survey of 75 NHS Trusts suggested that while all Trusts support some form of on-going on-call training, the nature of training ranges from self-directed learning to supervised observation, buddy systems and group in-service training (Gough and Doherty 2007). More recently, Gough et al conducted a survey to investigate the extent to which simulation-based education is currently utilised for on-call training (Gough et al 2012). With a reasonable response rate of 55% (155/280), results suggested that this is an area gaining in popularity, with 61 Trusts (39%) incorporating simulation-based education into their on-call training. This is an exciting area of research which may help to bridge the gap between theoretical, paper-based case studies and the real clinical environment. Further work is required, however, to investigate the effectiveness of such an approach in terms of the transfer of skills into clinical practise. The heterogeneity of training styles raises questions about whether annual competency assessment is adequate, or whether alternative models of on-call training would be more effective. There is also now a move towards 7 day working of some hospitals, and extended working days in others. Such changes are likely to have an important, but as yet unknown, impact on the on-call issue.

Delivery of an effective on-call service depends upon physiotherapists having a sound knowledge base, relevant clinical experience, high quality clinical reasoning and decision-making abilities as well as coordinated, skilfully applied manual physiotherapy techniques. It is currently unknown whether it is the physiotherapists' problem-solving skills or knowledge base that is the cause for concern when treating patients in an on-call setting, or their clinical skills and experience. Further research attempting to address each of the above components in order to identify specific areas of weakness, or differences between on-call and respiratory physiotherapy treatments would potentially enable an informed approach

to future training strategies. This would also help to clarify which physiotherapists are best placed to contribute to the on-call service, after taking logistical and financial constraints into account.

## Conclusion

To conclude, given the widespread usage of on-call respiratory services both in the UK and around the world, it is surprising that research to specifically address its efficacy is so lacking. The three studies that have attempted to investigate the value of additional out-of-hours physiotherapy have produced results, which are limited by small sample size, study design limitations and a failure to address current concerns regarding the use of non-respiratory physiotherapists to provide respiratory on-call care. There is an urgent need for high quality research to address this problem, taking into account the heterogeneity of on-call physiotherapists' skills and experience.

## Key Points

- There is a distinct lack of research into the effectiveness of out-of-hours respiratory physiotherapy services
- Research that has been produced has not addressed potential discrepancies in the delivery of physiotherapy when patients are treated by non-respiratory on call staff
- There is an urgent need to address this paucity of evidence with high quality research

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# Post-Operative Physiotherapy Following Video-Assisted Thoracoscopy - Routine or Referral Only? A Service Review.

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## Summary

***Background: Following a national benchmarking exercise it was established that 30% of physiotherapists working in cardiothoracic units in the UK still routinely assess and treat patients post operatively following VATs (Video Assisted Thoracoscopy) procedure. The aim of this service review was to establish whether those patients having had a VATs procedure could be seen on a referral basis only.***

***In this study, findings from the two month retrospective notes review and the three month prospective service review indicate that most patients undergoing VATs procedure do not warrant routine regular post-operative physiotherapy and should therefore be seen on a referral basis only***

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Thoracotomy  
Post-operative Pulmonary  
Complications  
Service Review  
Change of Practice**

## Introduction

Video Assisted Thoracoscopy procedure (VATs) is becoming a recognised and widely used treatment option not only for diagnostic purposes such as lung biopsy, but also for more complex surgeries such as lobectomy which would have otherwise been undertaken by a postero-lateral thoracotomy approach (Nakata et al 2000). Open thoracotomy brings with it an increased risk of post-operative pain, shoulder dysfunction and post-operative pulmonary complications due to the more traumatic approach. With the VATs procedure, two to three small incisions are made therefore preserving muscle tissue and decreasing post-operative pain and complications, preserving function and enhancing post-operative recovery. Whilst the postero-lateral thoracotomy approach is widely used, VATs procedures have become a useful alternative in those groups of patients

that are older and frailer and would therefore not cope well with an open thoracotomy due to existing co-morbidities and poor respiratory reserve (Li et al 2003).

It is widely documented that the division of major muscle groups as well as rib resection and pain leading to decreased thoracic wall compliance may result in atelectasis, consolidation, and sputum retention. Recurrent air leaks are also commonplace following open thoracic surgery leading to a decrease in functional ability and therefore prolonged hospital stay (Reid et al 2010, Nakata et al 2000). It is also acknowledged that due to the nature of the surgery this group of patients often require intense physiotherapy input, with a variety of interventions utilised, in order to successfully treat these complex and resistant complications comparative to those patients undergoing VATs procedure. It is also fair to suggest that patients with greater post-operative pain may have greater difficulty in complying with post-operative physiotherapy including early mobilisation in order to prevent early post-operative respiratory complications (Li et al 2003).

Reeve et al (2007) highlights the benefits of VATs procedure over open thoracotomy with regard to complications for the patient and also cost implications in terms of hospital length of stay.

It is evident that physiotherapy resources are being focussed on those patients presenting with post-operative complications following the open procedure (Reeve et al 2008), whilst most patients having undergone VATs procedure require less analgesia (Reeve et al 2007), have a faster recovery and decreased morbidity in the initial post-operative period (Nakata et al 2000) and therefore require less physiotherapy input. With these points in mind, physiotherapists are able to review current practises and treatment options in order to consider change (Reeve et al 2007).

In order to undertake a service review, the aims of this study include:

- Looking at current practice in comparable centres nationally
- Analysing current outcome data between patients undergoing VATs and thoracotomy.
- Evaluating clinical outcomes following a change in practice over a three month period where patients having undergone postero-lateral approach will be seen routinely by a physiotherapist post operatively and patients having had VATs procedure would be seen on referral only.

## Method

Cardiothoracic units throughout the UK were identified and a benchmarking process was undertaken in the form of a questionnaire to establish current practice in comparable centres. The questionnaire aimed to establish which common thoracic procedures were being seen, if patients undergoing open thoracotomy and VATS were being routinely seen post operatively, if a screening tool was in operation to identify those patients in a high risk category for post-operative pulmonary complications and which physiotherapy techniques were most often utilised in this group of patients post thoracic and VATs surgery. A two month window was allowed for questionnaire return.

Following the benchmarking process, a retrospective notes review was undertaken with a convenience sample of 70 patients over a two month period all having undergone thoracic surgery. Patients were then sub divided into two groups: open thoracotomy (41 patients) and VATs procedures (29 patients).

Mean age, length of HDU stay, length of hospital stay, post-operative complications and time of onset, type of physiotherapy intervention, levels of inspired oxygen on return to the ward setting, and total physiotherapy attendances



prior to discharge were observed looking for differences between the groups.

After analysis of data from the two month review, it was deemed safe to carry out a change of practice whereby those patients undergoing open thoracotomy would have routine post-operative physiotherapy and those patients undergoing VATs would be seen on referral only, according to an agreed referral criteria of which all members of the MDT were made aware (Table 1). The impact of this change in physiotherapy practice was then evaluated in a three month prospective service review carried out between September and December 2011 by physiotherapists working in cardiothoracics.

Referral Criteria for VATs Patients
- Requiring $F_iO_2$ of 0.35 and above
- Requiring extra ventilator support e.g. High Flow Nasal Cannulae or CPAP
- Retained secretions with difficulty expectorating
- Deteriorating ABG's with increasing $O_2$ requirements
- Mobility issues

Table 1 - Referral Criteria for VATs patients included in three month service review

In completing the questionnaire physiotherapists gave their informed consent. The initial retrospective study was a notes review therefore ethical approval was not sought. Consultant approval was gained prior to a change in service provision.

## Results

### *Benchmarking data prior to the notes review*

15 questionnaires were sent out nationally with 10 replies received giving a 67% response rate. Common procedures seen within each cardiothoracic centre were similar across the board. 80% of physiotherapists did not carry out a pre-operative assessment with their patients. 70% of physiotherapists questioned did not see patients undergoing VATs procedure routinely,

whilst of the 30% who did, most commented that this was due to historical reasons.

Post-operative physiotherapy for this particular patient group was also similar nationally with interventions including ACBT/FET, breathing control, early or graduated mobilisation, upper limb and thoracic spine mobilisation, IPPB/PEP/incentive spirometry, exercise bike, stairs and discharge advice.

### *Two month retrospective notes review*

Table 2 represents the differences between the two groups with reference to mean age, mean total length of hospital and HDU stay, post-operative complications and time of onset, duration of physiotherapy and percentage of inspired oxygen received on discharge from high dependency to the ward.

Of the patients in the thoracotomy group, 57% were either smokers or had pre-existing lung pathology, 9% had both. Of the VATs patients, 48.3% were smokers or had a lung pathology but none had both.

Figure 1 demonstrates the physiotherapy intervention received by patients in each group.

VATs patients stayed on average 4.8 days compared to 10.45 days for the thoracic group. This is also reflected in the total number of days seen by a therapist between each group (VATs 5.27 days, thoracotomy 12.3 days).

It was concluded from these results that it would be safe to undertake a service evaluation where VATs patients undergoing minimally invasive surgery would be seen on referral only and a three month prospective review followed.

Three month prospective service review follow up results:

Data for 67 patients undergoing VATs procedure was analysed in the three month period from September to December 2011. Of these patients, only 11 were referred to



	VAT procedures (n=29)	Open Thoracotomy (n=41)
Mean age	58	68
Mean length of stay (days)	4.8	10.45
Mean length of HDU stay (days)	1.8	2.66
Days of physiotherapy input	5.27	12.3
Number of patients developing respiratory complications	2	8
Number of patients developing other complications	1	5
Onset of complications (days)	3	3
Level of supplemental O2 on discharge to ward	2 Litres/min	2 Litres/min

Table 2 - Data from two month retrospective notes review

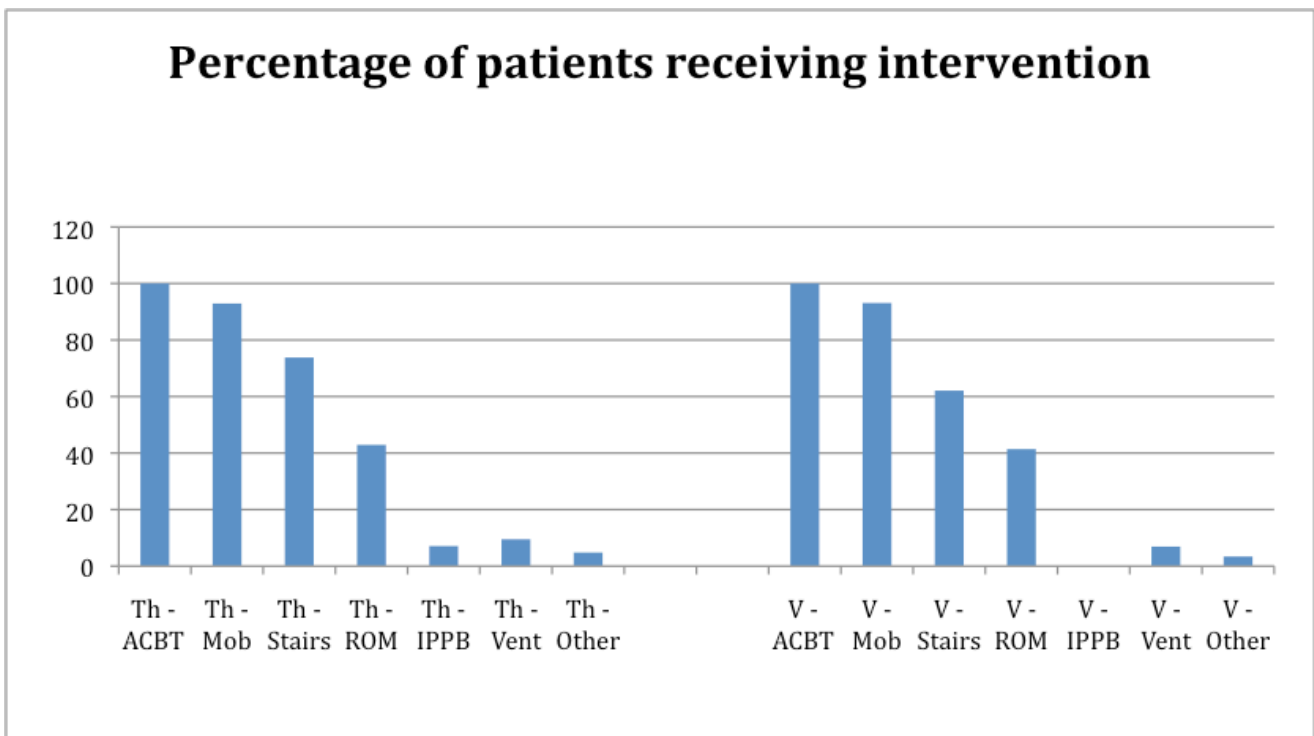


Figure 1 - Physiotherapy interventions used in Thoracotomy and VATs groups during two month retrospective review

physiotherapy post operatively using the pre-set referral criteria. Of the patients referred, seven were deemed appropriate referrals, whilst three were classed as inappropriate. Data for one patient was not clear therefore could not be included.

Table 3 demonstrates the reasons why patients were referred for physiotherapy following VATs procedure, as well as the type of procedure

referred.

The mean number of physiotherapy contacts for this patient group was 17.5, with a median of five contacts. Physiotherapy intervention included ACBT, sitting out of bed, IPPB, suction, delivery of CPAP, graduated mobilisation, and liaison with the pain team.

Fig 2 represents the difference in mean

length of hospital stay of the patients seen by physiotherapy and those not referred.

## Discussion

Video Assisted Thoracoscopy (VATs) remains a relatively new procedure in thoracic surgery and accounts for approximately 2 to 3% of lobectomies in the United Kingdom (Jones et al 2008). The procedure is seen as a much more attractive option for the elderly population with co morbidities that are deemed more at risk of post-operative pulmonary complications (PPC). One of the predictors for PPC for patients undergoing invasive thoracotomy is older age (Yim et al 2001). In this two month retrospective review of thoracic services it is interesting to note that the average age of patients undergoing VATs was 10 years younger than the average age for patients having open thoracotomy. It can be argued that in this review VATs patients were younger and because of that, developed less post-operative complications. It can also be said that data may have been skewed by the younger population having VATs especially procedures such as pleurodesis for recurrent pneumothorax, common in the younger age group. Other predictors for PPC are smoking and a pre-existing lung disease. It is interesting to note that of those patients who underwent thoracotomy there were some who were both smokers and had a pre-existing lung pathology.

Of those patients undergoing VATs procedure none were both.

Whilst 70% of physiotherapists who completed the questionnaire did not routinely see VATs patients post operatively, 30% of therapists who did reported that this was due in part to historical reasons or a senior decision not to alter practice. Reeve et al (2007) states that the physiotherapy management of patients having had VATs procedure is consistently different to that of a patient having undergone thoracotomy in terms of degree of input, and time to discharge. It is also widely accepted that patients in the post-operative period following thoracotomy utilise more physiotherapy resources in terms of treatment intensity and duration. In this retrospective review, patients in the VATs group were seen by a physiotherapist for a much shorter duration compared to those in the thoracotomy group. This was also reflected in total length of hospital stay, with those in the VATs group staying on average 4.8 days compared to 10.45 days for those having had a postero lateral approach. This difference in length of stay and input between the two groups could be attributed to the less invasive nature of the surgery. Patients are able to mobilise earlier, helping to prevent post-operative respiratory complications.

Reason for referral	Frequency
Post operative secretion retention	5
$P_aO_2 < 9\text{kPa}$ on $F_iO_2 0.4$	2
High Flow Nasal Cannulae	2
Mobility	2
<b>VATs Procedures Referred</b>	
Wedge Resection	2
Biopsy	1
Bullectomy	1
Pericardial Fenestration	1
Lung Reduction Surgery	1
Lobectomy	1

Table 3 - Three month prospective service review : reasons for referral and types of procedure referred, n=7 (note some patients were referred with more than one indication for physiotherapy intervention)



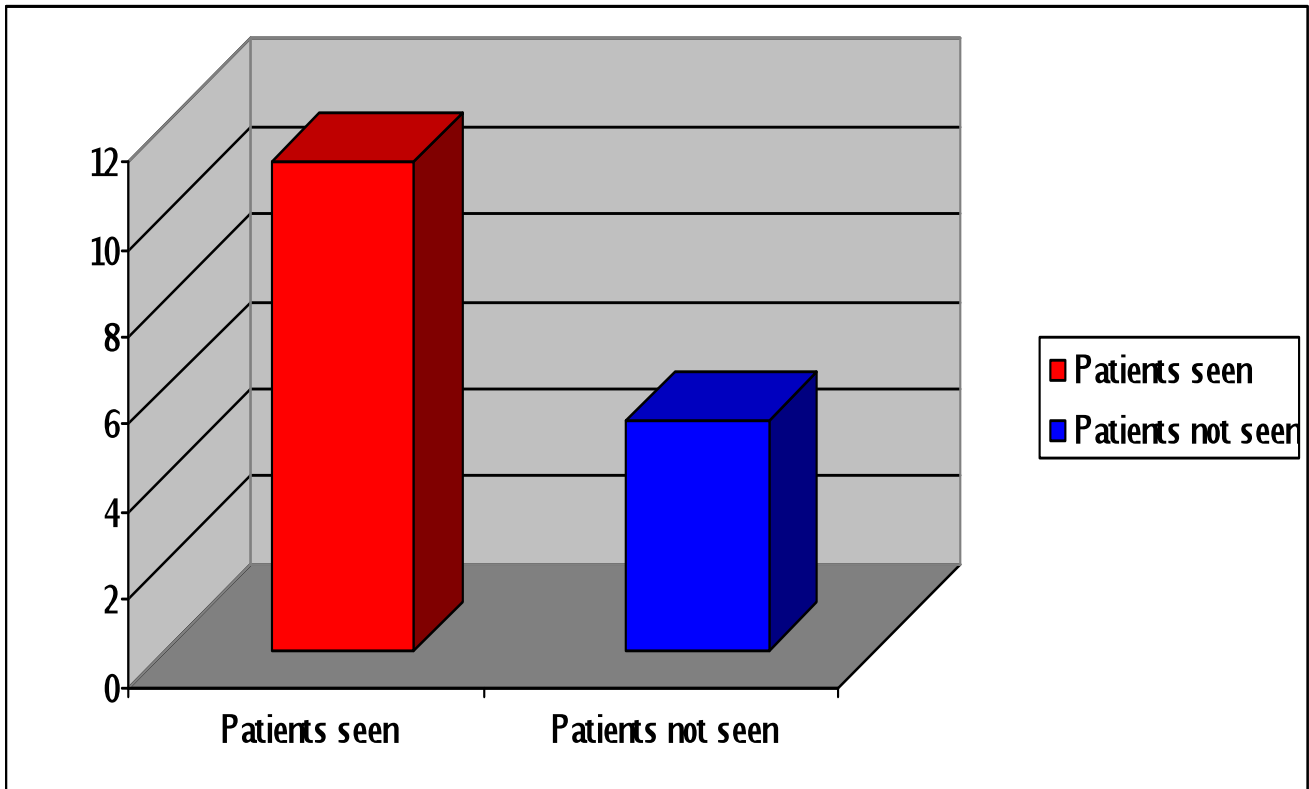


Figure 2 - Mean hospital length of stay for VATs patients seen and not seen, n=67

Reeve et al (2007) reports a consistent pattern of faster mobilisation with VATs patients to enable earlier discharge from hospital. In this study the majority of patients in both groups were mobilised early.

Reeve et al (2010) suggest that the most common causes of an increase in mean length of hospital stay are persistent air leaks, wound infections, drains and respiratory complications which are common in patients following thoracotomy. This is supported by Ikeda et al (2013) who suggest that VATs have shorter chest drain insertion and therefore shorter hospital length of stay.

For both patient groups in this study PPC peaked at three days. This is reflected in current literature. In a study by Reid et al (2010), observing patients following open thoracotomy, there was a five day post-operative incidence of atelectasis, lung collapse and consolidation, peaking at two to three days post op. It may be suggested that this is due in part to the nature of the surgery and also due to the build-up of post-operative

pain leading to immobility. There may also be additional compounding complications not directly related to physiotherapy such as pleural effusion or pneumothorax (Reid et al 2010). In this study however, only 10% of patients in the VATs patient group had post-operative complications, 6.6% of which were respiratory, compared to patients in the thoracotomy group. It is surmised that this is due in part to the less invasive nature of the VATs procedure. It could also be suggested that this may be due to the younger patient group and also the fact that none of the VATs patients were both smokers and had a pre-existing chest pathology. Nakata et al (2000) also observed a much better FVC and FEV1 in patients following Vats than after thoracotomy due to less damage to the thoracic wall. Patients would be able to comply more easily with deep breathing and early mobilisation.

Physiotherapy management of patients undergoing VATs procedure consistently differs from those patients having had open thoracotomy with regards to treatment intensity and duration. Reeve highlights

significantly reduced levels of physiotherapy input occurring in those patients having undergone VATs procedure, with some patients receiving pre-operative assessment or a screening of notes prior to theatre only, occurring as a consistent pattern (Reeve et al 2007).

In this two month retrospective review similarities were noticed in three areas: mobilisation, shoulder assessment and stair assessment prior to discharge.

No VATs patients required the use of IPPB but some went on to need some form of extra ventilatory support, demonstrating that there are a small percentage of patients undergoing VATs procedure presenting with complex post-operative pulmonary complications requiring intensive intervention. It must be reiterated that, it is of particular benefit for elderly patients who already pose a high risk for the open procedure.

In the three month prospective service review that followed, 83.6% of patients undergoing VATs procedure were not referred to physiotherapy post operatively. These patients would have previously been seen routinely. None of these patients were referred at a later date in their admission. It can only be assumed therefore that no complications arose through lack of routine physiotherapy.

This data falls in line with current literature in so much as these patients on the whole require much less physiotherapy intervention and less often. There is an emerging body of evidence to suggest that apart from early mobilisation other physiotherapy interventions may not provide any more beneficial to patients post VATs in preventing PPC (Reeve, 2007). Certainly there is an increasing level of uncertainty as to the effectiveness of conventional physiotherapy techniques above and beyond mobilisation in this patient group (Reid, 2010). However, there are a small percentage of VATs patients who do require more intensive post-operative physiotherapy and certainly in this review

five patients had secretion retention which warranted regular physiotherapy, including two who went on to need extra ventilatory support.

No differences were observed between the two groups with regards to level of mobility which reflects contemporary physiotherapy practice.

Data for the average number of physiotherapy contacts for this patient group was severely skewed by two patients who required regular intensive physiotherapy. One patient having had a pericardial fenestration had 25 physiotherapy contacts, the other (lung reduction surgery) 63 contacts.

No one type of VATs surgical procedure could be highlighted as causing post-operative pulmonary complications over another that would warrant routine referral to physiotherapy (Table 3). There is evidence in related specialties to suggest that routine targeted physiotherapy does not reduce the incidence of PPC, (Reeve et al 2007). However, a larger sample size may throw up trends.

Of those patients not referred average length of stay was nearly half of that of those patients referred, although the length of stay for those patients referred was skewed by the two patients requiring intensive physiotherapy. However, it can be suggested from these results that the most appropriate patients were being referred following VATs and highlights the importance of targeting patients who are going to benefit from physiotherapy intervention the most.

VATs procedures because of the benefits that they offer have become more widely used and accepted as a treatment choice for many thoracic patients and whilst those patients having surgery via the postero lateral approach may require routine post-operative physiotherapy assessment and treatment to prevent PPC particularly in the immediate post-operative phase, this review has demonstrated that there is clear evidence to suggest that

whilst there will be patients who will need referral for intense physiotherapy having had VATs procedure most do not require routine post-operative physiotherapy intervention and can be seen on a referral basis only. VATs patients with post-operative mobility issues or shoulder dysfunction should be referred on an individual basis.

## Limitations

It is acknowledged that both the two month retrospective notes review and the three month prospective service change following this was a short period of time therefore sample sizes for both were small, however, carrying out the two reviews over a longer period may yield the same trends in data but with larger numbers.

The provision of post-operative shoulder/thoracic ROM exercises for both patient groups was touched on due to the level of dysfunction that can occur following both types of surgery but it is not within the realms of this review to expand further than this and is therefore for a future study.

There was no measurement of patients perceived pain scores in either of the two groups as this was not recorded consistently. The literature abounds with reference to difference in pain between the two types of surgery and the author feels that it would have been interesting to examine this data.

## Recommendations

This study may enable physiotherapists still routinely seeing patients following VATs procedures to review their current practice as this data could be extrapolated to similar centres looking to re-evaluate current physiotherapy practice.

## Conclusion

30% of physiotherapists nationally routinely assess and treat patients post operatively following VATs procedure. The two month retrospective notes review highlighted

differences between patients having VATs and those having a postero lateral approach in terms of physiotherapy treatment and number of contacts, percentage of patients developing post-operative pulmonary complications, and hospital length of stay. From this it was concluded that it would be safe to initiate a change of practice meaning that VATs patients were seen on referral only within a three month prospective service change. The data from this reinforced the findings from the previous two months notes review.

This study indicates that most patients having had a VATs procedure do not warrant routine regular post-operative physiotherapy and should be seen on referral only according to an accepted referral criteria. There should however be an awareness that there will be those VATs patients who will require intensive intervention but these numbers are small.

## Key Points

- Physiotherapy for those patients having VAT's procedure consistently differs from those having open thoracotomy.
- The majority of patients having undergone VAT's procedure do not need to have routine physiotherapy and could be seen on referral only.

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# Peak Cough Flow via tracheostomy - A useful assessment tool before decannulation?

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## Background

The decision to remove a tracheostomy tube (TT) balances the risk of premature decannulation and the benefit of minimising cannulation time. Objective criteria guiding this decision are lacking. A critical peak cough flow (PCF) of 160 L/min following TT removal is considered highly predictive of decannulation outcome. The aim of this study was to ascertain the relationship of PCF measured via TT (PCF1) to PCF measured via oronasal mask following decannulation (PCF2), and determine a predictive model for PCF2>160 based on PCF1 and other potentially influential variables.

## Method

A retrospective case note review was undertaken of tracheostomy care proformas completed in a hospital where PCF was measured pre- and post-decannulation. Twenty-three case notes were identified for inclusion.

## Analysis

A Bland-Altman plot assessed agreement between PCF1 and PCF2, and Spearman

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rank correlation coefficients assessed their association. Stepwise logistic regression was used to determine a predictive model for PCF2>160. Analyses were performed using SPSS 20.0

## Results

PCF1 and PCF2 had a fair positive relationship ( $r_s=0.42$ ,  $p<0.05$ ). Only 13.6% of the variation in PCF2 could be explained by PCF1 variation, with further variance not explained by other study variables. PCF2 was significantly greater than PCF1 (median difference 53.4 L/min,  $p=0.002$ ), although PCF2-PCF1 difference varied highly. PCF1 in combination with other variables was not predictive of PCF2>160. For 8 patients with PCF2<160, 7 were successful decannulations.

## Conclusion

In the small heterogeneous study population, PCF1 was not a useful assessment tool to predict a PCF2>160 L/min. The significant PCF1-PCF2 relationship and diminished specificity of the PCF<160 threshold to predict outcome warrants further study.



# Physiotherapy intervention improves quality of life in patients with severe asthma

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## Background

Breathing pattern dysfunction (BPD) is highly prevalent in asthma (Thomas et al 2008) with significant impact on Quality of Life. Physiotherapy breathing pattern retraining (BPR) is an advocated treatment in patients with both asthma and breathing pattern dysfunction (Bott et al 2009). However, its benefit in patients with severe asthma remains unproven. The aims of this study were to assess the effects of BPR in severely asthmatic patients and to compare these effects with a control group of patients with BPD but no asthma.

## Method

Physiotherapy referrals for patients with severe asthma and/or BPD over 8 months were included (n=26). Patients were consultant referred and had a BPD diagnosis based on clinical evidence. Asthma diagnosis was made following a systematic asthma assessment. Primary outcome measures were Asthma Quality of Life Questionnaire (AQLQ), Dyspnoea 12 (D12) (validated in asthma) and Nijmegen Questionnaire (NQ) (validated for BPD in non-asthmatics). Measures were completed pre

and post 3-4 BPR sessions. Asthma patient subgroup data was analysed (n=17) with the paired T-test to assess overall change in values of the AQLQ, NQ and D12 post intervention. NQ and D12 data was compared by the 2 sample T-test to a subgroup of patients with BPD (n=9).

## Result

Asthma patients showed statistically significant improvements in total AQLQ, NQ and D12 scores (p=0.05; 0.04; 0.001 respectively). The BPD group showed statistically significant improvements in NQ and D12 scores (p=0.02 and 0.01 respectively). Improvements in NQ and D12 scores were comparable between subgroups (p= 0.62; 0.07 respectively).

## Conclusion

Findings may suggest that BPR provides relevant symptom improvement for patients with severe asthma and/or BPD. Improvements in NQ and D12 scores were comparable between asthma patients and patients referred with BPD. This highlights the need for further robust clinical trials into breathing retraining in patients with severe asthma.



# Does the effectiveness of a seven week, community gym based PR programme, on exercise tolerance and health related quality of life, vary according to severity of COPD, as classified by MRC grade?

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## Background

Pulmonary Rehabilitation (PR) is a proven non-pharmalogical method of treatment for people with lung disease. It has proven to result in statistically and clinically meaningful improvements in health related quality of life, and exercise capacity (NICE COPD Guidelines, 2010). The aim of this study was to investigate if changes in exercise tolerance and health related quality of life that occur during a 7 week Pulmonary Rehabilitation programme are directly related to patients severity of disease, as classified by their MRC grade.

## Method

490 patients were enrolled in the PR Service in Oxford Health NHSFT and commenced a 7 week PR course at a local leisure centre or hospital, between April 2011 and March 2012. All patients completed Incremental Shuttle Walk Test (ISWT) to measure exercise tolerance and St Georges Respiratory Questionnaire (SGRQ) to measure health related quality of life, before and after the PR programme.



## Results

A total of 383 patients (78%) completed the programme. 218 (57%) were male and 165 (43%) female. Of these completers, 179 (47%) patients were classified as MRC 3 (mean age 70.3), 173 (45%) MRC 4 (mean age 70), and 31 (8%) MRC 5 (mean age 75.3).

Literature recognises that the minimally important clinical difference (MICD) for the ISWT is 47.5 metres (Singh et al 2008) and a reduction of 4 points on the SGRQ (Jones et al 2002). Figure 1 illustrates the results in terms of MICD.

## Conclusion

Exercise capacity improves most after PR in patients with less breathlessness at baseline. However, even patients with severe breathlessness achieve similar clinically significant improvements in HRQL and should be referred for PR.

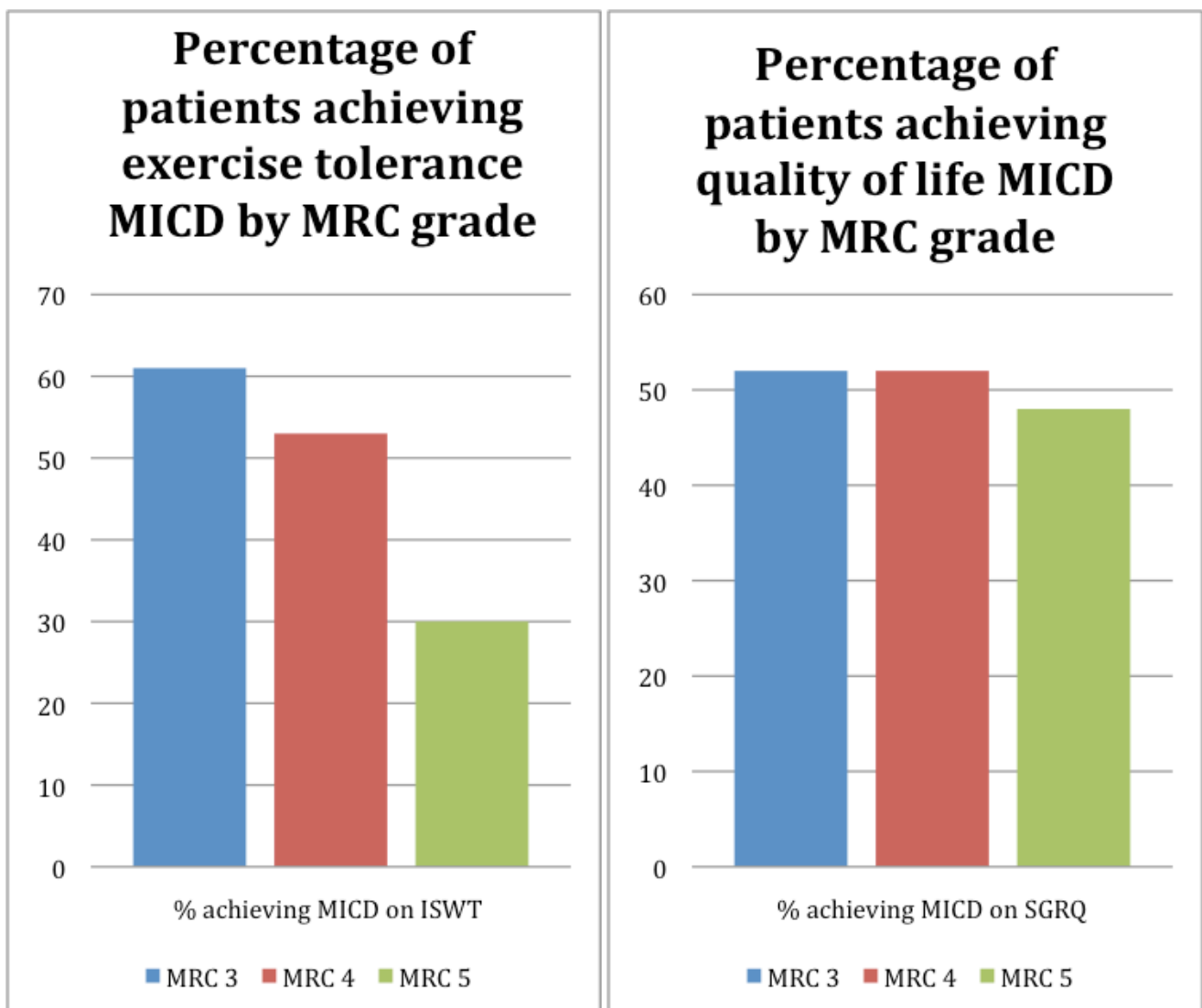


Figure 1 - Percentage of patients achieving MICD for ISWT and SGRQ



# Reliability and validity of peak cough flow measured via face mask

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## Background

Measurement of peak cough flow (PCF) is integral to assessment of patients with neurodegenerative conditions to determine use of assisted cough strategies. The manoeuvre can be performed through mouthpiece or face mask, yet there is no evidence for the reliability or validity of the measure. The aim of this study was to determine the reliability and validity of measuring PCF via face mask in a healthy population.

## Method

Study design was within-day intra-tester reliability, and validity was assessed by comparing facemask with mouthpiece measurements. 23 subjects were recruited from Cardiff University. Subjects performed 3 PCF (face mask) and 1 PCF (mouthpiece) measurements in one day in a laboratory. Each measurement was the highest of 3 manoeuvres. Reliability was assessed by intraclass correlation (ICC) and limits of agreement (LOA); validity by Pearson correlation coefficient and LOA.

## Results

Within-day intra-tester reliability had excellent reliability, ICC=0.931. Mean difference between first and third measures was -4.09 L/min, 95% LOA were 62.12, -70.30 L/min. The relationship between PCF (face mask) and PCF (mouthpiece) was statistically significant  $r=0.929$ ,  $p < 0.001$ . Mean difference between face mask and mouthpiece measurements was 12.17 L/min, 95% LOA were 107, -83.46 L/min.

## Conclusions

PCF measured via face mask is a reliable and valid measure in healthy subjects. Although the mean difference between the 2 methods was 12.17 L/min, the broad LOA would suggest the two methods should not be used interchangeably. Further research needs to be carried out to assess reliability in people with neurodegenerative conditions to ensure external validity.



# Strategies to increase recruitment in AHP clinical trials: lessons from the REVIVE study, ‘Effectiveness of a programme of exercise on physical function in survivors of critical illness following discharge from the Intensive Care Unit’.

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### **Background**

Clinical trials are at risk of not recruiting to target on time which can have important implications for resources and study power. It has been recommended that researchers describe their experiences and strategies for recruitment as well as publishing their results. The aim of this study was to describe strategies implemented in the REVIVE study to optimise recruitment.

### **Methods**

The REVIVE trial is investigating the effectiveness of a programme of exercise in patients after critical illness. Strategies to optimise recruitment were generated using publications and the research team expertise.

### **Results**

Development of effective communication was a key strategy and included: weekly screening updates; regular local site meetings to provide timely resolution of eligibility queries; effective patient tracking procedures and positive reinforcement for the whole team,

e.g. 'good news' emails and certificates of achievements. Other strategies used included a multidisciplinary approach; adoption into a clinical trial network which facilitated access to trained research staff who received regular study conduct updates; expansion from a single-site trial to a 5-site multicentre trial; early identification of reasons for patient decline and mechanisms to minimise patient barriers to recruitment; flexibility regarding location of intervention; provision of patient travel expenses; and high quality study conduct and monitoring procedures. The recruitment rate to the study increased across the first year, however, it is currently still below target. Challenges have included set up time at each additional site and a small proportion of the total critical care population meeting our inclusion criteria.

## **Conclusions**

Researchers in clinical trials should give adequate consideration to recruitment strategies and report these to inform future studies. The use of rigorous pre-study feasibility assessment based on objective data will increase the potential of recruitment to target on time.

The REVIVE study is funded by the Northern Ireland Regional Intensive Care Unit, Royal Victoria Hospitals charity 'REVIVE'.



# How do Mechanical Insufflation: Exsufflation (MI:E) settings influence flow rates and sputum movement? A bench study using a paediatric lung model.

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## Background

Cough is an essential defence mechanism. Paediatric patients with neuromuscular disease may have reduced cough effectiveness, causing increased risk of regular chest infections. Cough augmentation strategies are essential to maintain health; MI:E is one such technique used in this patient group. To date studies have examined the effects of MI:E pressure and time settings. It is not known what the effect of repeated insufflations is on generated flow rates. No studies to date have used the NIPPY Clearway MI:E device.

## Methods

MI:E was attached to a paediatric test lung. Resulting flows, pressures, volumes, and sputum movement were measured at the airway opening of the test lung at 3 set I:E ratios (1:1, 3:1 and 5:1). The effects of repeated insufflations

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on generated flow rates and sputum movement were analysed using ANOVA and regression analysis.

## Results

A significant reduction occurred between set and generated insufflation pressures. Repeated insufflations significantly influenced generated flow rates, with increasing repetitions of insufflations creating an inspiratory flow bias and potentially embedding secretions, and a non-significant influence on sputum movement.

## Conclusions

Increasing insufflation repetitions during MI:E has the potential to further embed secretions when tested in a paediatric test lung model. Whether these results can be extrapolated into a clinical environment is an area that requires further investigation.



# A literature review of light weight and traditional portable oxygen systems in a COPD population with exertional hypoxemia.

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## Background

The short term benefits of ambulatory oxygen (AO) for patients with COPD and exertional hypoxemia have been established. However, the efficacy of lightweight (LW) oxygen conserving devices remains contentious, since prescribed equipment is often underutilised. A PRISMA approach was used to systematically review the literature in this population, to identify any impact, on activity and other important clinical factors.

## Method

Data sources were: CENTRAL, CINAHL, AMED (via the EBSCO platform) EMBASE, MEDLINE and PEDro electronic databases; articles that met inclusion criteria between January 2005 and 2012. Search terms included terms: “ambulatory oxygen” “portable oxygen” “lightweight oxygen” “portable AND oxygen” or “conserv\*”.

## Results

Thirty five abstracts were identified. Thirteen articles with PEDro quality score of  $\geq 5$ /Jadad  $\geq 3$  or EPHPP  $\geq$  moderate were reviewed: 10 RCT; 1 cohort study; 1 qualitative study and 1 service report. No significant differences were

identified for exercise capacity, dyspnoea levels or AO utilisation between portable oxygen conserving, pulsed oxygen device or traditional cylinders.

## Conclusion

Light weight (LW), conserving oxygen devices perform as well as traditional heavier cylinders. A trend towards higher physical activity levels for LW conserving devices was noted. Patients preferred these to traditional systems. There is some evidence that patients have a poor understanding of how/when to use their AO which may impact on utilisation and activity levels. The implications for practice are that patients should be able ‘road test’ equipment with on-going support to overcome barriers to use; pulmonary rehabilitation may be a useful setting for this.



## Book Review – Harriet Shannon

### Cardiorespiratory Assessment of the Adult Patient, a Clinician's Guide, 2012

*Authors:*

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*Published by Churchill Livingstone*

*ISBN 978-0702043451*

*Price £25.99, Hard back spiral bound.*

A competent assessment is probably the most important aspect of any physiotherapy intervention, and in respiratory care the complexity of this component cannot be underestimated. A systematic approach to assessment saves time, ensures that no system is missed and provides a logical framework for generating a sensible problem list. This is exactly what the 'Cardiorespiratory Assessment of the Adult Patient' aims to provide. It is intended for the undergraduate physiotherapy student or somebody new or returning to respiratory care and is pitched at exactly the right level for this audience. The attractive A5 spiral-bound book is divided into four chapters.

Chapter one offers the reader justification for the cardiorespiratory assessment, the scope of physiotherapy in this area and describes a number of assessment methods. The methods involve system-based, functional and goal-oriented assessment approaches. It is the system-based method that receives the most comprehensive attention in the later chapters and it would perhaps have been helpful to clarify this stance at an early stage. A particularly useful component of chapter 1 is the section on 'assessment in the community.' This is all too frequently an under-represented area in the literature so it is fantastic that it receives specific recognition here. The 'acute patients in the community decision-making

flowchart' would be hugely beneficial to those physiotherapists in the community who do not receive many referrals for patients with acute respiratory conditions but who may be involved in making decisions about whether these patients should be admitted to hospital. One can imagine the chart being adapted and pinned up on community office noticeboards to aid such decisions

Chapter two contains assessment checklists for a number of settings, beginning with a general respiratory assessment and then becoming more specific to cover general surgery, critical care and medical patients. A checklist for the community setting is also included. Each checklist follows a similar pattern but is adapted to the specific considerations of the particular setting. For example, most include a 'database' section but emphasis is given to the extent and nature of surgery in the surgical checklist while the medical patient's database section suggests establishing a 'baseline' for the patient's norm and the degree of any subsequent deterioration. Such an approach would encourage a student on rotation in one of these areas to focus on the most pertinent information in the medical notes without becoming distracted by more interesting but less relevant aspects. Interspersed throughout this and the following chapter are 'top tips' in eye-catching red boxes. They appear to be written in the tone of a slightly formidable clinical educator, with appropriately placed upper cased words for emphasis. For example, 'If any alarms go off when you are at the bedside on ITU, alert nursing or medical staff immediately. NEVER touch any buttons!' Sound advice for a novice physiotherapist entering the ITU for the first time.

The most substantial chapter, chapter three, is devoted to 'assessment tools.' This is organised into alphabetical order from Arterial Blood Gases to Work of Breathing and, again, it is the systematic nature with which each tool is summarised that makes this a particularly useful point of reference. Each tool is divided into subheadings which offer a brief definition, a description of the purpose of the

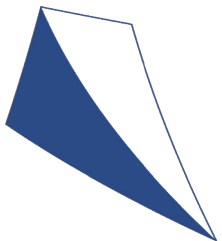


tool, the procedure, how to interpret results and document findings. Some tools are also followed by clinical examples. The level of detail is perfect for use as a quick reference whilst on clinical placement, although the student may well wish to refer to more in-depth textbooks for further information if he/she wished to specialise in a particular area. Further reading is suggested for some of the tools that are necessarily dealt with in a fairly superficial manner, notably exercise testing which could be an entire book in itself.

Finally, chapter four contains some case scenarios to aid the reader in putting the assessment processes into practice. The level of complexity would be suitable for a fairly junior physiotherapist or student, and each scenario is accompanied by some questions to aid the reader in his/her systematic assessment. These are followed by suggested answers. Also included in the book is a perforated pull-out page of 'normal values' for heart rate, blood pressure, temperature, respiratory rate, SpO<sub>2</sub> and blood gases, and a list of commonly used abbreviations. However if I were on a new respiratory rotation, I would also be extremely tempted to tear out the relevant assessment checklist and keep this in my pocket as an aid-memoire and I think this is really the purpose of the book. Whereas a student's objectives are often to develop a systematic approach to the assessment of a particular patient group, with this book the student can have such an approach from the beginning of his/her placement and then develop his problem list and treatment skills with confidence in the knowledge that the underpinning assessment has been undertaken in a thorough manner.



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