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Introduction

Welcome to the Association of Chartered Physiotherapists in Respiratory Care (ACPRC) Journal for 2018. This has been a very exciting year for the journal. It has seen the arrival of two new editors, Amy Bendall and Laura Moth, and special thanks go to the previous editors, Una Jones and Emma Chaplin, for providing such a strong foundation on which to build.

It is with great pride as editors that we are able to bring this journal to you. The quality of the articles is testament to the hard work that you as members have put into your clinical practice and in striving to drive respiratory physiotherapy forward. It has been a phenomenal pleasure to read all your work and gain insight into the diverse areas of clinical practice and projects you are involved with.

Very excitingly this year we have also seen a record number of journal submissions. We have therefore been in the fortunate position to be able to publish the articles in two volumes and hope to continue this moving forward. In addition, we will also be accepting submissions to the journal at any time throughout the year. We hope this provides you with a more flexible approach to publishing your work.

This edition of the journal includes a mix of service evaluations, and original research as well as the new Physiotherapy English National Standards of care for children with Primary Ciliary Dyskinesia and a review article by authors Latchem-Hastings regarding the medico-legal advances in the care of people in a prolonged disorder of consciousness, which we hope you will find thought provoking.

We have tried to reflect the diversity of areas in which respiratory physiotherapists work and hope that as a result there is something of interest to all our members. Respiratory paediatrics is represented in Hepworth and Hopwood's service evaluation of physiotherapy led competencies for nasopharyngeal suction. Two articles address extended hours in Critical Care: An evaluation of a service development initiative of extended hours working by Gustafson and Grant, and Development of an interview tool to qualitatively evaluate the introduction of a limited seven day physiotherapy service by authors Piper et al. Roberts et al. provide a service evaluation of the effectiveness of an inspiratory muscle training group for spinal cord injured patients, and chronic care is represented by Grimsey et al.'s retrospective review of pulmonary rehabilitation in interstitial lung disease. Warrington et al. have provided the results of a national survey assessing training and competence for on-call, which we are confident will be of interest to those leading and contributing to on-call services.

Next year is our biennial ACPRC conference entitled 'Innovate, Influence and Inspire' which is to be held on 26th and 27th April 2019 in Birmingham, so save the date in your diaries now! The call for abstracts for both posters and oral presentations is open now until 31st January 2019, so please do look at the ACPRC website for more details about this which includes the abstract submission guidelines. We are aiming to provide a journal supplement in 2019 of the posters presented at the conference, and we are always keen for authors to develop their poster presentations into an article for submission to the journal.

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We really hope that you enjoy reading this issue of the ACPRC journal and hope that it inspires you to write up your work. Please remember that we provide members with support through the Research Officer and there are also writing guidelines which are all available on the website www.acprc.org.uk.

We would also like to take this opportunity to express our sincere thanks to all the reviewers who have provided excellent feedback.

With our very best wishes,

Laura Moth BSc. MCSP and Amy Bendall MSc. MCSP.

Email: journal@acprc.org.uk.

Pulmonary rehabilitation improves exercise capacity, dyspnoea, and self reported quality of life in individuals with interstitial lung disease: A retrospective review

Laura Grimsey[1], Fiona M Schreuder[2] and Alex Harvey[3]

Abstract

Main themes

- An 8 week pulmonary rehabilitation programme improved exercise capacity in patients with ILD
- This programme also improved health related quality of life in patients with ILD
- This paper adds weight to the growing evidence that PR benefits patients with ILD

Objective

To retrospectively study the effects of an eight week pulmonary rehabilitation programme on the exercise capacity, dyspnoea and health related quality of life of individuals with interstitial lung disease (ILD).

Design

A retrospective review of participants with ILD who attended an outpatient pulmonary rehabilitation programme between 2004 and 2015.

Setting

Pulmonary rehabilitation clinic in a large university teaching hospital.

Participants

59 participants with ILD enrolled onto an eight week outpatient pulmonary rehabilitation programme between 2004 and 2015.

Intervention

Eight week pulmonary rehabilitation programme course.

Authors

[1]Laura Grimsey, BSc (Hons) MSc, Senior Physiotherapist, Norfolk and Norwich University Hospital, UK.

[2]Fiona M Schreuder, MSc, BAppSc (Physiotherapy), PGDipHe.

[3]Alex Harvey (BSc (Hons), MSc, PG Cert, Senior Teaching Fellow at University College London and Lecturer at Brunel University, London.

Keywords

Interstitial lung disease, pulmonary rehabilitation, exercise capacity.

Correspondence author

Laura Grimsey.

Email: laura.grimsey@nnuh.nhs.uk.

Address: Norfolk and Norwich University Hospital, Colney Lane, Norwich, Norfolk, NR4 7UY.

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Main outcome measures

Six minute walk test (6MWT) and Endurance shuttle walk test (ESWT), modified Borg score and Chronic Respiratory Disease Questionnaire (CRQ).

Results

Exercise capacity improved significantly in participants who were assessed using the endurance shuttle walk test (n=48) with a mean difference of 496.14m (95% CI 356.75 to 635.53, p<0.001). Exercise capacity also improved in the participants that were assessed using the 6MWT (n=11) with a mean difference of 68.58m (95% CI 32.78 to 104.37, p=0.002). Health related quality of life as measured with the CRQ improved in all domains (dyspnoea p<0.005, fatigue p=0.004, emotional p=0.015, mastery p=0.005). Baseline walking distance positively correlated with improvement after pulmonary rehabilitation when assessed using the endurance shuttle walk test (r=0.012, p=0.012).No improvement in Borg score was noted.

Conclusions

An eight week pulmonary rehabilitation programme improved exercise capacity and health related quality of life in participants with ILD.

Introduction

Interstitial lung disease (ILD) is the collective term for the group of acute and chronic lung diseases with varying degrees of inflammation and fibrosis (American Thoracic Society (ATS) / European Respiratory Society 2000). There are many classifications of ILD carrying different prognoses (Chapman et al. 2014). The most common is interstitial pulmonary fibrosis (IPF) or usual interstitial pneumonia (UIP) (Chapman et al. 2014). IPF is fatal and the trajectory of the disease is unpredictable; survival is estimated at 3 years on average (Gribbin et al. 2006; Raghu et al. 2011).

People with ILD have a normal response to exercise in the initial phases of the disease (Agusti et al. 1991; Truwit 2003). As the pulmonary vasculature is damaged during the progression of the disease, a ventilation perfusion mismatch occurs, leading to a reduction in diffusion of oxygen and development of hypoxia (Agusti et al. 1991; Blanco et al. 2010). This causes a rapid and shallow breathing pattern with increased respiratory effort (Burdon et al. 1983; O'Donnell et al. 1998; Truwit 2003).

Skeletal muscle dysfunction is well documented in the chronic obstructive pulmonary disease (COPD) population but little is known about this in the ILD population (Mendoza et al. 2014). Quadriceps strength has been shown to be reduced in patients with IPF, and it is suggested that this weakness correlates with exercise limitation (Mendoza et al. 2014; Nishiyama et al. 2005).

Treatment of ILD aims to improve dyspnoea, health related quality of life (HRQoL) and maximise functional capacity (Bajwah et al. 2013). Progressively worsening levels of dyspnoea and fatigue limit a person with ILDs ability to undertake daily activities . A qualitative study found that, because of breathlessness, patients did not do physical activity as frequently or as intensely as they did before their condition developed (Swigris et al. 2005). Pulmonary rehabilitation (PR) might be of benefit to prevent this cycle of inactivity and to help manage symptoms.

Methods

Design

The study was a retrospective case note review. Routine data that were collected for the PR programme between 2004 and 2015 were reviewed. These data were used to review change in primary outcome measures recorded pre and post PR.

Participants

Participants with a diagnosis of ILD who had undergone the PR programme, were included. Additionally, participants who had a diagnosis of ILD in addition to another respiratory disease were also included. Participants with no diagnosis of ILD were excluded. Clinical outcome measures of the Endurance Shuttle Walk Test (ESWT), the 6 Minute Walk Test (6MWT), modified Borg score and Chronic Respiratory Disease Questionnaire (CRQ) were extracted from Excel spreadsheets of routine PR clinical outcome measures from 2004 to 2015 for included participants. Data were examined for completeness and if pre or post data were unavailable then the participant was not included in the final analysis.

Intervention

Participants attended an eight week PR programme once a week with one hour of supervised exercise and one hour of education. The PR programme was run by a physiotherapist, occupational therapist and respiratory nurse. The programme was initially designed for patients with COPD; however patients with other chronic respiratory diseases who were functionally limited by shortness of breath and under the care of a respiratory physician were also accepted onto the programme. The participants were offered an hour of supervised exercise that included aerobic training (walking and cycling), and upper limb and lower limb strengthening exercises. Attendees were advised to exercise to a level of breathlessness on the Borg scale (3-4) and were given breathing strategies to assist with breathlessness while exercising. During the PR programme, participants were encouraged to walk at the speed used for the initial ESWT. The education sessions included coping strategies for managing chronic disease and advice on exercise and relaxation. Participants were advised to complete upper limb and lower limb strengthening exercises a further three times per week and to walk daily at a specified level of breathlessness on the Borg score as practised within the PR supervised sessions.

Outcome measures

Outcome measures were taken routinely at the beginning and end of the PR course. These included the 6MWT or ESWT (with the modified Borg score recorded post-test) and the CRQ.

Within this PR programme, patients who were functionally less able completed the 6MWT and not the ESWT. This was judged by the physiotherapist and specialist nurse running the PR programme. The other participants all completed two incremental shuttle walk tests to calculate which level they should walk on the ESWT. The patients then completed one ESWT and this distance was recorded. ESWT or 6MWT were repeated after eight weeks along with post exercise modified Borg scores and CRQ questionnaires. The same ESWT level was used as on the baseline assessment.

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Data analysis

The paired t-test or Wilcoxon signed rank was used to compare the difference in pre and post rehabilitation data for walking distance (ESWT, 6MWT), dyspnoea (modified Borg) and HRQoL (CRQ). Data were grouped for analysis according to whether exercise capacity was assessed with the ESWT or the 6MWT. Spearman's coefficient correlation was used to look for an association between baseline walking distance and change in 6MWT or ESWT.

Results

A total of 76 participants were identified who had been referred for PR with a diagnosis of ILD over the specified time period. Complete information was unavailable for 17 participants; these participants were excluded from analysis.

Of the remaining 59 participants with complete data, 48 had been assessed using the ESWT and 11 the 6MWT. There were only 30 complete sets of data for pre and post rehabilitation CRQ scores out of the total of 59. Table 1 provides information regarding diagnosis of the 59 reviewed participants.

Table 1: Diagnosis of participants included in the retrospective review where the specific type of ILD was recorded.

Diagnosis	N	Percent %
Interstitial pulmonary fibrosis (IPF)/Usual interstitial pneumonia (UIP)	14	23.7
Sarcoidosis	6	10.2
Non-specific interstitial pneumonia (NSIP)	3	5.1
Non specified ILD	36	61
TOTAL	59	100

Exercise capacity

Groups were analysed separately depending on the walking test completed. Table 2 shows these results. A paired t-test was used to look for statistical significance pre to post rehabilitation as this data was normally distributed.

Table 2: The difference in walking distance pre and post rehabilitation.

Walk Test	N	Pre PR Mean distance (SD) m	Post PR Mean distance (SD) m	Mean difference (95% CI) m	P value
ESWT	48	213.53 (122.5)	709.67 (543.9)	496.14 (356.75 to 635.53)	<0.001*
6MWT	11	180.15 (123.5)	248.72 (134.6)	68.58 (32.78 to 104.37)	0.002*

*Key: CI – Confidence interval, ESWT- Endurance shuttle walk test, m- metres, SD-Standard Deviation, 6MWT-Six minute walk test, *denotes statistical significance p<0.05.*

MCID for change in 6MWT =24-54m (Du Bois et al. 2011; Swigris et al. 2010; Holland et al. 2009).

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A statistically significant difference was demonstrated between pre and post programme exercise tests for both ESWT and 6MWT.

Breathlessness

Breathlessness was measured using the Borg score after completion of the walking tests prior to PR and post PR. The groups were analysed separately depending on the walking test completed. The paired t test for the ESWT group showed a pre-post PR Borg score mean difference of 0.445 (95% CI -0.322 to 1.2, p=0.249). The change in 6MWT pre-post PR Borg score was also not statistically significant (p=0.293).

Quality of life

Pre and post PR CRQ scores for each of the four domains (dyspnoea, fatigue, emotional function and mastery) were compared and the mean score for dyspnoea is shown in table 3. The other three domains of the CRQ scored as follows: fatigue (p=0.004), emotional (p=0.015) and mastery (p=0.005) on the Wilcoxon signed rank for change between pre and post PR. The data for fatigue, emotional and mastery domains were not normally distributed and as such are not presented with mean values.

Table 3: The mean difference for pre and post pulmonary rehabilitation CRDQ score for dyspnoea.

Domain	Mean Pre PR score (SD)	Mean Post PR score (SD)	Mean difference (95% CI)	P-value (Paired t test)
Dyspnoea	2.68 (1.28)	3.77 (1.17)	1.09 (0.69 to 1.49)	<0.005*

*Key: CI- confidence interval, SD- standard deviation, *denotes statistically significant p<0.05.*

MCID for change in CRDQ = 0.5 in all domains (Schünemann et al. 2005).

A statistically significant difference was demonstrated between pre and post-programme HRQoL in all four domains. The dyspnoea domain score had the greatest statistically significant change and this change is of clinical significance as it is greater than the MCID of 0.5 for the CRQ (Chang et al. 1999, Schunnemann et al. 2005).

Correlation

Baseline exercise capacity and change in walking distance

As shown in table 4, for those participants who completed the ESWT, a significant correlation was found between initial walking distance and change in walking distance after eight weeks of PR. In other words, participants who were able to walk further on the baseline shuttle walk showed a greater improvement after completing eight weeks of PR. There was no statistically significant correlation between baseline walking distance and post-PR walking distance for the participants measured using the 6MWT.

Table 4: **Correlation of initial walking test distance and change in walking distance.**

Walking test	N	Spearmans correlation coefficient	P value
ESWT	48	0.361	0.012*
6MWT	11	0.064	0.852

*Key: ESWT- endurance shuttle walk test, 6MWT – six minute walk test, *denotes statistically significant difference p<0.05.*

Discussion

Exercise capacity

Participants completing eight weeks of PR with a diagnosis of ILD have shown a statistically significant increase in exercise capacity which exceeded the MCID for the 6MWT of 24-54m (Du Bois et al. 2011; Swigris et al. 2010; Holland et al. 2009); the mean difference for participants who were measured using the 6MWT was 68.58m. The 48 patients that completed the ESWT showed a mean improvement of 496.14m. There is no established MCID for the ESWT; however it is likely that an improvement of 496.14m will have translated into clinical benefits for the participants.

Comparison of the two walking tests used in clinical practice is difficult and complicates the analysis. The 6MWT has been used in the literature most frequently within the ILD population and there is also an established MCID. This PR programme routinely used the ESWT and therefore there were fewer participants to analyse in the 6MWT group. The 6MWT was only used where it was thought the participant would not be able to complete the warm up required for the ESWT and the 2 preceding ISWTs used to calculate the ESWT level. There is also controversy as to what the two tests are measuring, as some authors suggest the 6MWT is a maximal test whereas others suggest it is submaximal (Eaton et al. 2006; Jenkins & Čečins 2011; Park et al. 2011; Revill et al. 1999). The ESWT is a test of endurance with potentially greater ability to distinguish a difference pre and post rehabilitation (Eaton et al. 2006). Most of the research carried out on the ESWT is from the COPD population and therefore this will need further validation in the ILD population. A submaximal or endurance test is more likely to mimic activities of daily living and therefore has greater translation into patients' day to day functioning (Revill et al. 1999).

There is likely to be some weakness in quadriceps strength in this patient group, and improving this may impact on exercise capacity (Nishiyama et al. 2005). The PR programme included lower limb and upper limb strengthening exercises, in addition to walking and cycling. Improvements in muscle strength may have contributed to increased walking distances although firm conclusions cannot be made as measuring muscle strength was not within the scope of this study.

Most of the PR programmes included in other studies have provided two supervised sessions of exercise per week; however the programme in this retrospective study only had one session per week. Despite this, this programme still demonstrated statistically and clinically significant changes. The PR programmes for ILD that have previously been investigated have varied in length, although all were equal to or greater than eight weeks. A longer programme of twelve weeks appeared to show more improvement in functional capacity (Nici et al. 2006;

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Vainshelboim et al. 2014). There is no definitive guide in the ILD literature as to the optimum duration of a PR programme or the recommended frequency of sessions (Spruit et al. 2013).

Within this retrospective review, a statistically significant improvement in Borg score from pre PR to post PR was not observed for either walking test. However, post-PR, participants were on average able to walk further on both walking tests which could suggest that for the same level of breathlessness their functional capacity had improved.

Quality of life

Post-PR, there was a statistically significant improvement in all four domains of the CRQ. The dyspnoea domain was above the MCID for change suggesting clinical significance (Schünemann et al. 2005). In addition, over 60% of participants scored over the MCID in both the fatigue and emotion domains.

Several outcome measures are used within the literature to examine HRQoL in ILD. A twice weekly eight week programme of strength and endurance training failed to find a statistically significant improvement in the dyspnoea domain of the CRQ as opposed to the present study. In an earlier study assessing the effects of a twice weekly, eight week PR programme for participants with ILD (n-59, including 34 participants with IPF), a statistically significant difference in the dyspnoea and fatigue domains of the CRQ post-PR was found (Holland et al. 2008). The poorer prognosis associated with IPF might have accounted for significant differences in only two of the four domains of the CRQ in that study.

Even though the present study did not show an improvement in Borg score, the HRQoL dyspnoea domain improved substantially. This may be because patients could walk further for the same level of breathlessness, so functionally they could achieve more. Participants completing the ESWT achieved a large change in walking distance, which may have translated into significant functional gains thereby enhancing their HRQoL. It is also important to note that the PR programme included participants without ILD and with other respiratory conditions who had similar limitations. In this way, attendance at PR not only gave the participants access to experienced health professionals, but also to peer-support from other participants with respiratory disease. In addition, the education sessions provided advice about how to manage breathlessness which would have been applicable to this group of participants with ILD, perhaps providing a feeling of self control.

Initial exercise capacity and change in walking distance correlation

In this study, a linear association was seen for initial walking distance and exercise capacity as measured by the ESWT. There was no statistically significant correlation between baseline walking distance and post-PR walking distance for the participants measured using the 6MWT possibly due to the small sample size in the 6MWT group. This suggests that in the ESWT group a participant who walked less on the baseline walking test improved less than participants that could walk further to begin with. The 6MWT has been shown to be a useful indicator in predicting prognosis in ILD, and desaturation and decline in walking distance over time has shown to be a strong predictor of mortality (Lama et al. 2003; Du Bois et al. 2011; Caminati et al. 2009).

A recent study found that ILD patients with a higher Medical Research Council (MRC) breathlessness score showed less improvement in exercise capacity, although these patients only received a home exercise programme and therefore may have missed out on some of the advantages of attending a PR group (Jenkins et al. 2011). This same study also suggested that in a population with IPF, the more breathless a patient, the more limited the improvement that could be made due to the progression of the disease (Jenkins et al. 2011). An initial walking distance of 157m in those with the highest MRC score and did not show any improvement after PR (Jenkins et al. 2011). In comparison the present study recorded an initial pre PR average walking distance of 180.15m with patients improving by a mean distance of 68.52m (95% CI 32.78 to 104.37), suggesting that significant improvements above the MCID can be made despite poor initial exercise capacity. Other authors have reported that individuals with a lower baseline 6MWT show greater increases after PR, which is in contrast to the findings of the present study (Ryerson et al 2014; Ferriera et al. 2009). It has been suggested that maximum exercise capacity is likely to be limited by the disease itself, but peripheral adaptations are likely to occur that could have important implications for increasing exercise capacity (Holland et al. 2009).

Limitations

There are a number of limitations to this study. It was a retrospective study with a limited number of participants. In addition, the data were collected as part of a clinical PR programme and as such it cannot be certain that data collection was accurate and reliable. There was no control group and so therefore there is an inherent risk of bias. After data were collected by clinical staff during the PR assessment weeks, data were routinely inputted onto an Excel spreadsheet by an administrative member of staff, and it is possible that data entry errors could have occurred. When the data were transferred from the PR Excel spreadsheet to the study's data collection sheet, this was not double checked by another person and so transposition errors may also have occurred.

ILD covers a broad spectrum of different disease processes, and it is possible that some of the non-specified ILD patients (n=36) had a diagnosis of IPF but this had not been recorded. This could have affected the results as IPF carries a poorer prognosis than that of NSIP (Chapman et al. 2014). It may have been interesting to examine change in walking distance in relation to lung function, or different comorbidities, however this would have required a larger sample size.

Whilst only including 11 patients, the 6MWT data was likely to have been collected by many different therapists. While attempts have been made to standardise this exercise test (Crapo et al. 2002), evidence has suggested that alteration of the verbal instructions can significantly change the distance walked by the same participant (Weir et al. 2013). The different therapists may not have given standardised instructions to all participants and this could have affected the results. The ESWT eliminates this element as the patient must walk to a preset pace which cannot be influenced by the therapist.

The CRQ results contained only 30 complete sets of data as, during the study period, the PR programme changed the questionnaire to one more specific to the COPD population. The lack of MCID and information on validity and repeatability specifically for the ILD population makes drawing firm conclusions difficult.

Conclusion

This retrospective study demonstrated that people with ILD improved their exercise capacity and HRQoL following a once weekly 8 week PR programme. No improvement was seen in breathlessness as measured by the modified BORG scale, although a significant improvement in dyspnoea was found in the CRQ following PR.

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As the study was retrospective, results should be interpreted with caution. A randomised controlled trial comparing outcomes achieved following PR for people with ILD would be recommended to confirm the results obtained in this single centre retrospective review.

Improvements in exercise capacity and HRQoL for people with ILD following PR support the referral of this population to PR programmes.

Ethical approval: Ethical approval was not required as the study was considered to be a service evaluation. Participants had already enrolled onto the pulmonary rehabilitation (PR) programme as part of routine clinical care. This study used the data that were collected as part of routine PR to assess the effectiveness of the PR service. Approval and registration from the audit department at the hospital was sought and gained.

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Conflict of interest: None.

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Evaluation of a service development initiative of extended hours working for physiotherapy services in critical care

Owen D Gustafson[1] and Jonathan A Grant[2]

Abstract

Aim

To evaluate a service development initiative of extended hours physiotherapy services in critical care in a single university teaching hospital.

Service change

A change in working hours for the critical care team ensuring one member of staff worked until 20:00 Monday to Friday, through the introduction of a Long Day shift

Evaluation

The primary outcomes were feasibility of service delivery measured by the proportion of Long Day shifts covered, and impact on the frequency of overnight respiratory physiotherapy on-call interventions. The secondary outcome was the impact on day time rehabilitation provision measured by the number of missed rehabilitation interventions.

Results

At 12 months following the service change 88% of available Long Day shifts were covered with 233 on-call interventions prevented resulting in an approximate cost saving of £11, 650. There were 120 missed rehabilitation interventions compared to 144 over the previous 12 months.

Conclusion

This service realignment model was feasible to deliver, decreasing the burden on the on-call service at no extra cost. It provides a potential model for decreasing the cost of a respiratory physiotherapy on-call service.

Authors
[1]Critical Care and Research Physiotherapist Adult Intensive Care Unit, Oxford University Hospitals NHS Foundation Trust.
[2]Critical Care Physiotherapist Adult Intensive Care Unit, Oxford University Hospitals NHS Foundation Trust.

Keywords
Physiotherapy, extended hours, on-call, critical care.

Correspondence author
Owen Gustafson.
Tel: 01865 221499.
Email: owen.gustafson@ndcn.ox.ac.uk.

Introduction

Overnight on-call physiotherapy services for respiratory interventions have been established practice in the UK for many years. The requirement for access to physiotherapy services 24/7 for critical care is also included in the core standards for intensive care units (ICU) in both the

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UK (FICM 2013) and Australia and New Zealand (CICM 2016). Despite these recommendations, the current financial climate within the NHS has resulted in increasing scrutiny on services such as overnight on-call physiotherapy, leading to a position statement from the ACPRC (2017). Within this they set out a vision for all Trusts providing acute medical and surgical services to have access to respiratory physiotherapy services 24/7.

In order to ensure access to respiratory physiotherapy services is provided in an efficient manner that minimises impact on staff, alternative methods of service delivery need to be explored. Extended working patterns in critical care with significant additional investment have been demonstrated to be successful (NHS Improvement 2012). The implementation of a “Twilight” service for the provision of respiratory physiotherapy services without additional investment has been demonstrated to decrease the frequency of on-call physiotherapy use (Douglas et al. 2006). However the impact of such service realignment on day time physiotherapy provision has not been evaluated. It remains unclear if extending the working day and subsequently having less staff working during “core hours” negatively impacts on the number of rehabilitation interventions delivered in the day. This may, in part, be why despite these examples of extended hours working and service realignment, physiotherapy services continue to be predominantly provided during standard day time hours.

The Oxford University Hospitals NHS Foundation Trust (OUH NHSFT) has an overnight on-call physiotherapy service that covers a number of tertiary acute services including four separate ICUs, respiratory and neurosurgical high care beds and acute medical and surgical wards across two sites. Referrals to this service can be made by a doctor or critical care nurse, or as a pre-arranged call by the day time physiotherapy team. The total number of overnight on-call referrals for the Trust escalated over 5 years from 446 in 2009 to 829 in 2014, with each call costing the Trust approximately £50 (excluding travel costs and the impact of compensatory rest). This increase in on-call activity necessitated a change in service delivery in order to decrease the burden on the on-call service. In July 2016 the Adult Intensive Care Unit (AICU) team instigated a change in working patterns with a view to providing a sustainable solution to increasing daytime cover for critical care patients, therefore decreasing the burden on the on-call physiotherapy service. The aims of the service realignment were to:

1. Evaluate the feasibility of delivering an extended hours critical care physiotherapy service without additional financial investment.
2. Assess the impact of an extended hours service on the frequency of interventions provided by the on-call physiotherapy service.
3. Evaluate the impact of the service realignment on the frequency of physiotherapy rehabilitative interventions delivered in critical care.

Methods

Setting

The service realignment took place for 12 months from July 2016 up to and including June 2017. The AICU physiotherapy team was increased to four physiotherapy staff in November 2015 to cover 16 ICU beds. The staff traditionally worked 08:00 – 16:00, Monday-Friday which equated to 40 hours of cover for the ICU over five days. The AICU was historically the highest user of the physiotherapy on-call service accounting for approximately 30% of activity across the trust.

Intervention

The team changed their working hours to facilitate one person working from 08:00 – 20:00 each day, Monday to Friday. This shift was termed a long day (LD). Each physio that worked a LD then worked 8-12 the following day. Each staff member worked one LD between Monday and Thursday each week. The Friday LD was rotated amongst the team, with staff working an 8-12 shift in place of one of their 8-4 shifts the following week. This change in working patterns resulted in a potential increase in hours covered to 60. As this increase in hours covered was achieved with no additional investment, LD shifts that would be vacant due to staff sickness, vacancy or annual leave would not be expected to be covered by staff taking on additional extended hours shifts. The weekend service provision was unaffected by the service change.

The areas covered by the extended hours service were: AICU, Cardiothoracic Critical Care Unit (CTCCU), Neurosurgical Intensive Care Unit (NICU), the Emergency Department (ED) and theatre recovery. These areas combined make up approximately 40% of the on-call activity of the Trust. The overnight on-call did not change, continuing to provide cover from 16:30 – 08:30, however the physiotherapists covering the overnight on-call shift had access to the AICU team rota and information on the areas covered during the extended hours period (16:00 – 20:00). On-call staff would pass on any on-call referrals for areas covered to the AICU physiotherapist working the LD.

The AICU team member working the LD shift recorded and categorised all patient interventions between 16:00 and 20:00 according to Table 1.

Table 1: Categorisation of intervention seen in the extended hours period.

Categorisation	Description
1	Emergency – referred via critical care staff or on-call physiotherapist
2	Pre-arranged on-call
3	At risk patient – but not meeting criteria for overnight on-call intervention
4	Usual case load

Outcomes

There were 2 primary outcomes of the service evaluation. Feasibility of the service realignment was evaluated through the proportion of available extended hours shifts that were covered. The impact on the frequency of on-call physiotherapy interventions was established via the number of Category 1 and 2 interventions undertaken between 16:00 and 20:00, as these patients met the local criteria required for an overnight physiotherapy on-call intervention. The secondary outcome was the impact on day time services in AICU as measured by the number of missed physiotherapy rehabilitation interventions compared to the previous 12 months. These were defined as any mobilisation activity or active bed/chair based exercise therapy.

Results

There were 249 available LD shifts, of which 88% (n= 219) were covered. Of the 30 uncovered shifts, 28 were due to annual leave and 2 due to sickness. Overall sickness rates within the team were unchanged from the previous 12 months. A mean of four (SD±2) patient interventions were completed per extended hours period.

The interventions undertaken between 16:00 and 20:00 are presented in table 2. The total number of on-calls prevented were 233 resulting in an approximate cost saving of £11,650. Figure 1 demonstrates the on-call activity for the 12 month period, and the on-call activity that would have occurred without the service realignment.

Table 2: Number of interventions seen in the extended hours period.

Categorisation	Number of interventions
1	51
2	182
3	301
4	403

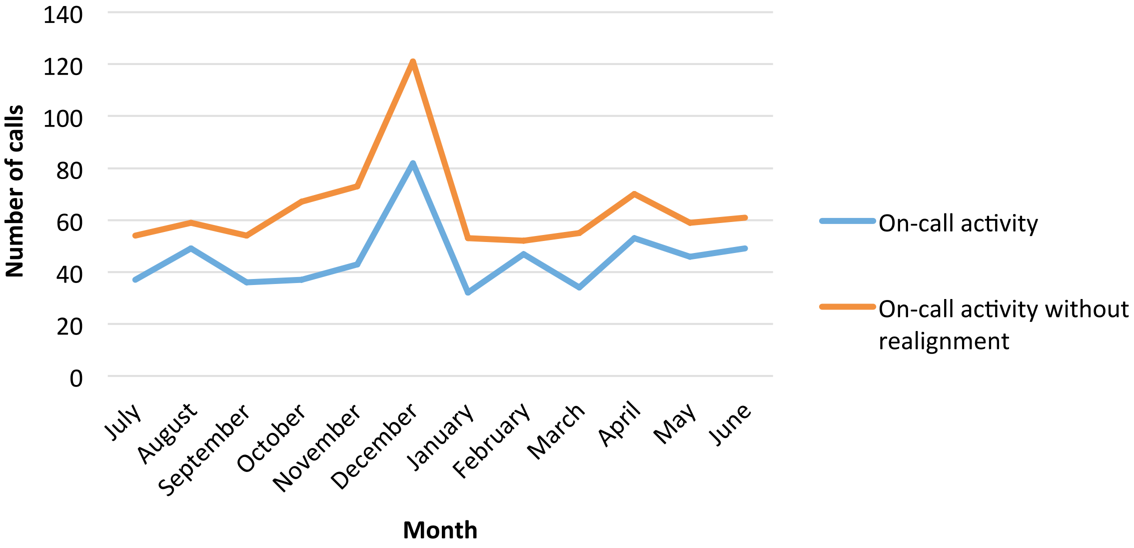

Figure 1: On-call activity with and without the service realignment.

The number of interventions delivered by the on-call physiotherapist to the clinical areas covered by the extended hours service was 37% (n=204) of the total 545 interventions delivered by the on-call service to adult patients. This is a similar number of calls to these areas compared to the previous three years which ranged between 197 and 240 calls. Of these on-call interventions 69% (n= 141) occurred when there was no LD shift cover.

There were 120 missed rehabilitation interventions during this period, compared to the 144 missed rehabilitation interventions over the previous 12months.

Discussion

This service evaluation demonstrates that providing extended hours working for physiotherapy services in critical care was achievable without additional investment, with 88% of the available shifts covered and a mean of four interventions per extended hours period. There were 233 interventions undertaken that would otherwise have been referred to the on-call physiotherapist, translating to an approximate cost saving of £11,650 over the 12 months. There was no increase in the number of missed physiotherapy rehabilitation interventions on AICU compared to the previous 12 months.

The significant financial benefit demonstrated through this service alignment has increased the sustainability of the on-call service. The reduction in on-call physiotherapy activity demonstrated is consistent with previously published evaluation of the introduction of evening respiratory physiotherapy services (Douglas et al. 2006). Additionally, our service evaluation also demonstrated that providing an extended hours service did not negatively affect the number of rehabilitation interventions delivered by the AICU physiotherapy team. The fundamental differences in our service realignment was that it was delivered by a single team within the critical care physiotherapy service, and the shift model more closely resembled that of the ICU nursing staff. Empirically, these differences assisted in the success of the service realignment by causing minimal disruption across the wider respiratory service, facilitating shift changes and further embedding physiotherapy within the AICU MDT.

The service realignment resulted in critical care patients receiving the majority of their out of hours respiratory interventions from a critical care physiotherapist, as opposed to physiotherapists with varying degrees of critical care or respiratory experience. It is unclear how effective on-call physiotherapy services within the UK are (Shannon et al. 2013), with significant disparities demonstrated in paediatric physiotherapy interventions delivered by non-respiratory compared to respiratory physiotherapists (Shannon et al. 2015). The service realignment increased access to critical care physiotherapists from 40 hours to 60 hours per week, increasing specialist care delivery.

Maintaining on-call competency for non-respiratory staff to cover critical care areas poses a challenge for many physiotherapy services (ACPRC 2017), and is likely to increase with the expanding role of physiotherapy within critical care. The extended hours covered in this service provided increased access to specialist advice for on-call physiotherapists, in addition to training opportunities for non-respiratory and student physiotherapists. Student physiotherapists on placement with the AICU physiotherapy team would undertake LD shifts with their supervisor, therefore gaining exposure to on-call situations and interventions which students find beneficial (Bendall and Watt 2015).

There were 204 interventions delivered by the on-call physiotherapist to the areas covered by the LD shift. Even though this number is similar to the previous three years, this is in the context of a service that that has increased its activity by 86% since 2009. However, 69% (n=141) of these occurred when there was no LD shift in place. If there had been a physiotherapist working a LD shift seven days per week throughout the year, there would have been only 63 calls for the 12 month period. Therefore, future plans for service development include extending the service realignment across seven days.

There are potential limitations to this service realignment. There was no formal feedback gathered from the AICU physiotherapy staff partaking in the service realignment or from other members of the MDT. Regular team meetings were held to review the progress of the service realignment, with staff wishing to continue with the shift pattern at the end of the 12 month period. A further limitation is the potential reduction in skill of non-respiratory physiotherapists on the on-call rota as a result of decreased exposure to critical care patients. With the reduction in on-call activity, the potential for the on-call service to move entirely within the respiratory service is being evaluated.

In conclusion, this service realignment model was feasible to deliver, providing increased access to critical care physiotherapists and decreasing the burden on the on-call physiotherapy service at no additional cost. Where physiotherapy services are under financial scrutiny, this model provides an option for decreasing the cost of their on-call respiratory physiotherapy service.

Key Points

- Extended hours working in critical care is feasible to deliver without additional investment
- Critical care services that extend into the evening can significantly decrease the burden on overnight on-call staff
- Service realignment to provide extended hours service in critical care does not negatively impact the provision of physiotherapy rehabilitation

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Development of an interview tool to qualitatively evaluate the introduction of a limited seven day physiotherapy service in critical care

Philippa A Piper[1], Owen D Gustafson[2], Jody E Ede[2] and Sarah A Vollam[2]

Abstract

The aim of the paper was to describe and evaluate the development of a replicable interview tool to qualitatively appraise the introduction of a limited seven day physiotherapy service to critical care. An interview topic guide was developed using a structured five stage framework to evaluate critical care staff perception of the service change. Content was developed by synthesising current literature and empirical knowledge from experienced researchers and clinicians. The interview tool developed provides a rigorous, replicable method of exploring the effects of increasing physiotherapy provision in critical care. It is intended that the themes identified by the tool will inform future expansions of physiotherapy services.

Authors
[1]Adult Intensive Care Unit, Oxford University Hospitals NHS Foundation Trust.
[2] Kadoorie Centre for Critical Care Research, Nuffield Department of Clinical Neuroscience, University of Oxford.

Keywords
Physiotherapy, critical care, qualitative research, semi-structured interview, interview topic guide.

Correspondence author
Philippa Piper.
Tel: 01865 221499.
Email: philippa.jones@ouh.nhs.uk.

Introduction

Qualitative methods can examine aspects of organizational change and offer unique opportunities to contribute to empirical literature (McCuster and Gunaydin 2014). Mixed methods research provides pragmatic advantages; the qualitative data provides a deep understanding of survey responses and statistical analysis can provide detailed assessment of patterns of responses (Creswell and Plano Clark 2011). The use of mixed methods in health services research is becoming increasingly common (O'Cathain et al. 2007), however many intensive care unit (ICU) rehabilitation studies do not review the qualitative impact of their interventions on other staff groups. Physiotherapy in ICU is a complex intervention and therefore in addition to outcome evaluation, studies evaluating this intervention should include a process evaluation (Craig et al. 2008). Qualitative methods, such as interviews, may provide a more in depth understanding of social phenomena than obtained from purely quantitative methods (Gill et al. 2008).

Physiotherapy is an integrated and fundamental service for critically ill patients in the United Kingdom (UK), evidenced by the requirements for both rehabilitation and acute respiratory interventions set out in the Guidelines for the Provision of Intensive Care Services (FICM 2016). ICU rehabilitation interventions are predominantly provided during Monday to Friday day time working hours (Duncan et al. 2015). Early rehabilitation and mobilisation in ICU has been shown to be safe and feasible (Berney et al. 2012), and may have a benefit in improving health related

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quality of life (HRQOL), physical function, muscle strength, hospital length of stay (LOS) and duration of mechanical ventilation (Connolly et al. 2016). Increasing physiotherapy service provision to enable rehabilitation seven days a week may have positive effects on patient outcomes. However, the related cost implications of an increase to service provision must be justified.

Whilst quantitative data would explain patient outcomes of the service change; for example show the number of rehabilitation interventions delivered, it is limited in expanding on how this was achieved. Qualitative evaluation of the service change enables the understanding of what form an intervention takes in practice, as well as providing data about why and how the planned activities succeed or not (Portela et al. 2015).

In July 2017 the physiotherapy service for the Adult Intensive Care Unit (AICU) at the Oxford University Hospitals NHS Foundation Trust (OUH NHSFT) initiated a limited seven day service. Physiotherapy hours were extended to 8am until 8pm Monday-Sunday and the staffing rota pattern was changed to enable full physiotherapy cover Monday – Friday with reduced cover (two physiotherapists) at weekends. Respiratory and rehabilitation interventions were provided seven days a week and were available to all patients in AICU. A mixed-methods review of the service change was conducted. Quantitative measures included the number of physiotherapy interventions and rehabilitation sessions over the total course of their ICU admission, level of mobility at ICU discharge, hospital length of stay post ICU and hospital discharge destination. Qualitative analysis was undertaken to understand the impact of the service change on multidisciplinary team (MDT) working in the form of semi-structured interviews. The intended benefit of embedding a qualitative component to the service evaluation is to enable exploration of core themes and better understand end user impact for staff. The paper describes and evaluates the development of a replicable interview tool which has been used to gather this data.

Methods

This evaluation used a framework proposed by Kallio et al. (2016) to design the embedded qualitative component of the mixed methods service evaluation and inform data collection methods.

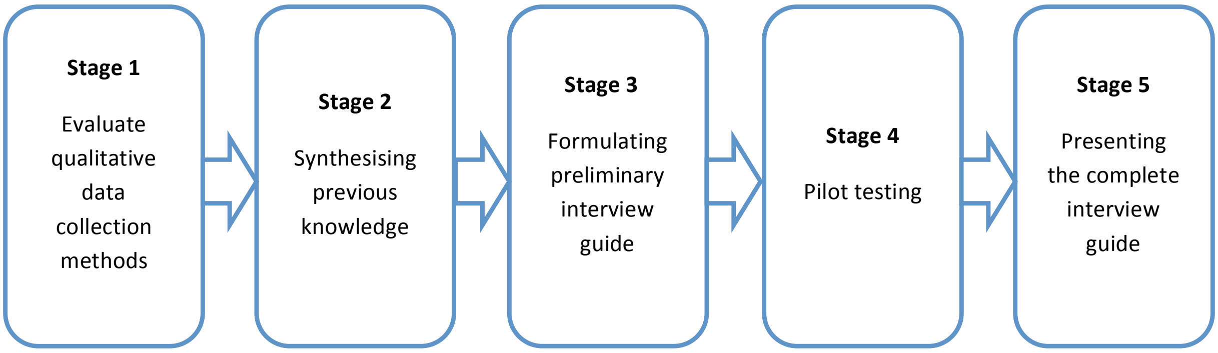

Figure 1: 5 step framework for semi-structured interviews.

Stage 1. Evaluate qualitative data collection methods

As qualitative methods are an emerging way of evaluating physiotherapy services we wanted to encourage themes which were not anticipated by the researchers. Structured interviews do not enable the interviewer to explore beyond the set of pre-determined questions; this method would likely provide a more limited dataset as themes not covered by the set questions devised by the researchers would be missed. Focus groups may not encourage an entirely unbiased

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opinion of the service change (Brinkman and Kvale 2015) and were therefore not selected. Ethnographic observations were not possible as the service change had already occurred and cannot be completed in retrospect.

Interviews are the most commonly used data collection method in qualitative research, with a semi-structured format the most frequently used technique in healthcare (DiCicco-Bloom and Crabtree 2006; Gill et al. 2008). Semi-structured interviews consist of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to diverge (Gill et al. 2008). The semi-structured approach enables discovery or elaboration of information that is important to interviewees but may not have previously been thought of as pertinent by the research team (Gill et al. 2008). Methodological research on the development of semi-structured interview topic guides is sparse (Kallio et al. 2016).

Topic guides are a requirement of the COREQ 32 point checklist for qualitative research (Tong et al. 2007). Interview topic guides have been defined as a list of questions which directs conversation toward the research topic during the interview (Crindland et al. 2015). Semi-structured interviews are strongly guided by the interviewee's perceptions, opinions and experience and allow diverse perceptions to be expressed (Crindland et al. 2015).

Stage 2. Synthesising previous knowledge

Turner (2010) states researchers should determine research phenomenon based on previous knowledge before the interview. The semi-structured interview methods were developed from synthesising current literature and empirical knowledge from experienced researchers and clinicians. Consulting subject matter experts (SME) ensures that the interview structure complements and deepens theoretical background (Ribonet 2011). SME included in the preliminary phase were: two research nurses with ICU experience, local qualitative methods experts from the Kadoorie Centre for Critical Care Research, and three clinical and research physiotherapists providing the increased service. The critical care experience of the SME ranged between 10 and 15 years.

Stage 3. Formulating preliminary interview guide

We chose to explore staff perceptions of the service change to allow for a rich in-depth insight into the before and after effects, and how this may have impacted the wider organisation, outside of the patient domain. The preliminary interview guide was rigorously developed. Initially broad questions were developed by the main author and then discussed with a focus group of SME. The original draft of the interview topic guide was then developed and shown to critical care physiotherapists working in ICU. Anticipated themes were developed which informed the design of the interview questions and subsequent probing questions (Kallio et al. 2016). Questions were developed to give broad scope to answer and ensure relatedness. The core themes identified to be explored were:

1. the MDT understanding of the physiotherapy role in AICU;
2. MDT perspective of the changes to physiotherapy services;
3. MDT perception of patient outcomes due to physiotherapy service and
4. MDT perspective of patient and relatives experience of physiotherapy during their AICU stay.

The interview topic guide was made up of six questions which is consistent with Creswell (2013) who states guides should consist of five to seven open-ended questions. Questions were carefully worded to be impartial so as not to lead interviewees to anticipated answers. Prompts were discussed and developed at this time to assist the interviewer in maintaining flow.

The last question "*How could rehabilitation be further improved for ICU patients?*", whilst not evaluating the service change, was included in the interview tool as there is a long term goal for the physiotherapy service to become a full seven day service, and insight into the gaps identified by the MDT would be useful in developing this.

Stage 4. Pilot interview.

A pilot interview was conducted with an interviewee who fulfilled the service evaluation's inclusion criteria (Table 1).

Table 1: Inclusion criteria for interview subjects.

Pilot and Main Interviewee Inclusion Criteria
• Worked in AICU during both time periods of September – December 2016 and September – December 2017
• Were members of the MDT working clinically

This interviewee was chosen as having extensive experience in the clinical area. The interview was recorded on two dictaphones then transcribed to NVivo where thematic analysis was completed by two researchers (PP, JE). The interview topic guide was reviewed to ensure questions were clear and well phrased to address the core themes. Feedback of interview technique and preliminary results was given by local expert qualitative methods researchers.

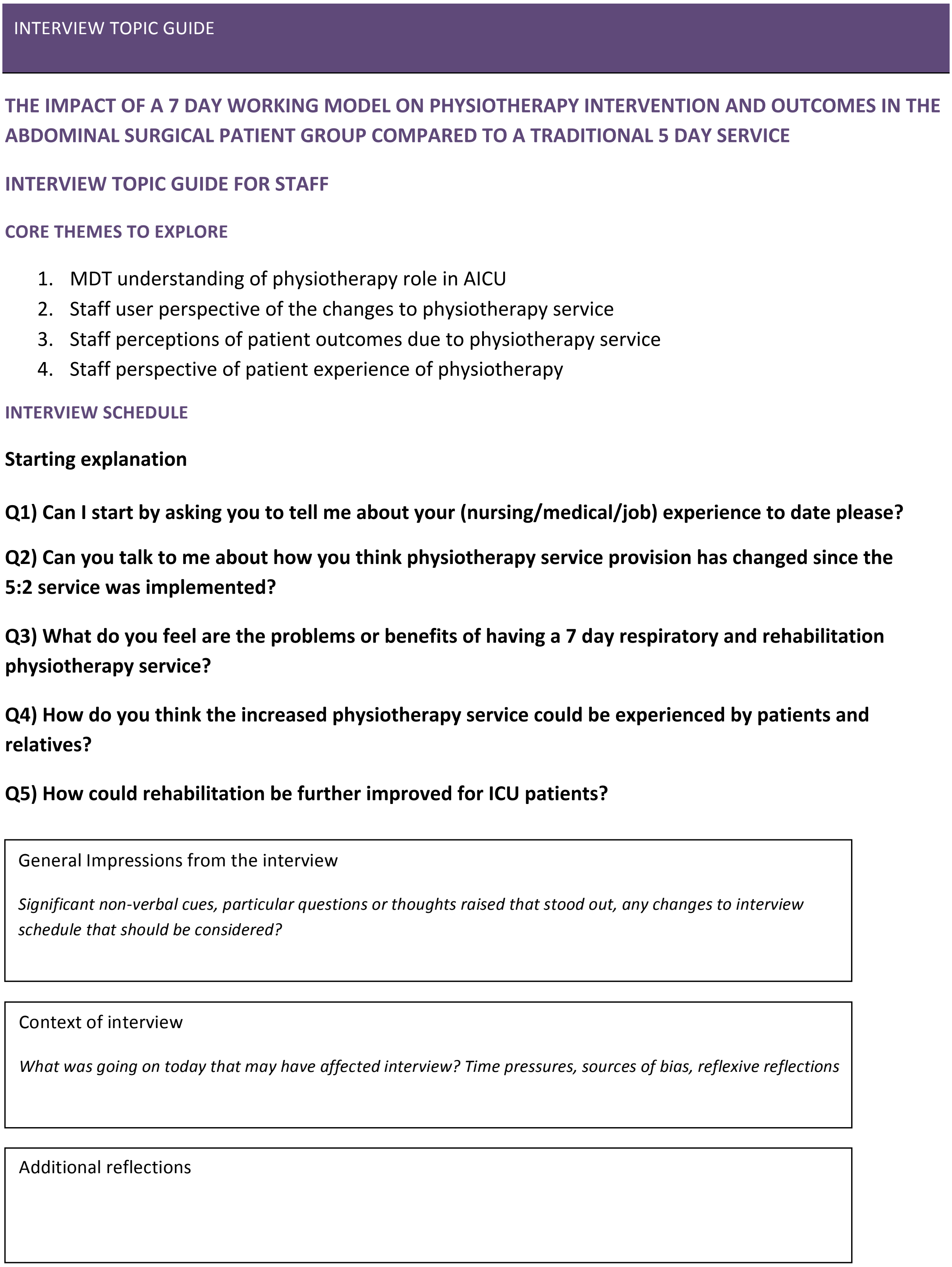
Stage 5. Presenting the complete interview guide

Following the pilot test the interview topic guide was reviewed and adjusted to ensure sufficient depth of information was gathered from the participant and allowed researcher reflexivity (Creswell 2013).

The most prominent themes drawn were around continuity of care, team trust and efficiency and effectiveness. Question 5 "*Have you noticed any changes to the rehabilitation of the abdominal surgical patient group specifically as a result of the service change?*" was found to be confusing and difficult to answer in the pilot interview. This was thought to be due to the difficulty in isolating specific patient groups from overall experience and was answered more generally in response to other questions. It was therefore removed.

Results

The aim of the final interview topic guide is to closely illustrate the 5-steps in development, to be user friendly and to focus on areas of exploration which the MDT perceive as a priority. This guide has been designed to be impartial, timely, replicable and reflexive.



INTERVIEW TOPIC GUIDE

THE IMPACT OF A 7 DAY WORKING MODEL ON PHYSIOTHERAPY INTERVENTION AND OUTCOMES IN THE ABDOMINAL SURGICAL PATIENT GROUP COMPARED TO A TRADITIONAL 5 DAY SERVICE

INTERVIEW TOPIC GUIDE FOR STAFF

CORE THEMES TO EXPLORE

1. MDT understanding of physiotherapy role in AICU
2. Staff user perspective of the changes to physiotherapy service
3. Staff perceptions of patient outcomes due to physiotherapy service
4. Staff perspective of patient experience of physiotherapy

INTERVIEW SCHEDULE

Starting explanation

Q1) Can I start by asking you to tell me about your (nursing/medical/job) experience to date please?

Q2) Can you talk to me about how you think physiotherapy service provision has changed since the 5:2 service was implemented?

Q3) What do you feel are the problems or benefits of having a 7 day respiratory and rehabilitation physiotherapy service?

Q4) How do you think the increased physiotherapy service could be experienced by patients and relatives?

Q5) How could rehabilitation be further improved for ICU patients?

General Impressions from the interview

Significant non-verbal cues, particular questions or thoughts raised that stood out, any changes to interview schedule that should be considered?

Context of interview

What was going on today that may have affected interview? Time pressures, sources of bias, reflexive reflections

Additional reflections

Figure 2: **Developed interview topic guide.**

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Discussion

It is intended that our results will inform future expansions of physiotherapy services within critical care, highlighting potential positive and negative components of the current process. The results are also likely to provide a base for the development of future interview tools that can be used to qualitatively analyse the effect of physiotherapy service change in critical care. Conclusions from this embedded qualitative arm of the service evaluation will highlight the effect of the increased physiotherapy provision, if any, on patients and the MDT as perceived by the MDT.

The tool was developed using the framework for semi-structured interviews developed by Kallio et al. (2016); however there are potential limitations in this development. Due to time constraints, a pilot interview was undertaken on only one participant. There is limited literature identifying core themes for the inclusion of an interview tool evaluating physiotherapy service provision, therefore the questions were developed using empirical knowledge. However, this was obtained from a variety of expert sources.

Increasingly it is reported that mixed methods research is needed to contribute to a rich and comprehensive study (DiCicco-Bloom and Crabtree 2006). The interview tool developed (Figure 2) provides a rigorous, replicable method of exploring the effects of increasing physiotherapy provision in critical care on the wider MDT. The tool enables multiple interviewers of different backgrounds to ask and format the interview in the same way, and gives researchers the flexibility to pursue individual lines of inquiry depending on participant contributions (Miles et al. 2014).

Planned future work

Main interviews will be conducted by two researchers from different health professions. This will reduce interviewer and participant bias and ensure that MDT staff feel able and willing to discuss negatives issues regarding the physiotherapy service delivery. Guides will be cross-referenced for relevance, appropriateness and flow. The interviews are to be conducted in a private room away from the AICU and will last no longer than 30 minutes duration. It is planned that 15 interviews will be conducted but themes will be frequently analysed during this time and interviews will stop once saturation is reached.

Conclusion

The interview tool developed is intended to provide an evaluation of MDT perspectives of increased physiotherapy service provision in critical care, in addition to providing a framework for the qualitative evaluation of physiotherapy interventions in critical care.

Key Points

- The tool developed provides a rigorous, replicable method of exploring the effects of increasing physiotherapy provision in critical care
- Semi-structured interview tools are powerful and contribute to the depth and richness of studies further then measurable outcomes alone
- Qualitative and mixed method designs should be incorporated by physiotherapists in research when evaluating services and interventions in critical care to better capture service user opinion and experience

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Ethics

This project has been reviewed and approved locally as a service evaluation: Datix Audit Number: 4832.

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A service evaluation of the effectiveness of an inspiratory muscle training group for spinal cord injured patients, assessing the change in maximal inspiratory pressure and maximum phonation time

Kate A Roberts[1], Sarah E Morgan[2], Hannah L Chalke[3] and Anthony W Gilbert[4]

Abstract

Objective

An inspiratory muscle training (IMT) group was introduced for inpatients at the London Spinal Cord Injury Centre (LSCIC) with a view to improving their respiratory function and improving their understanding of and compliance with long-term IMT. The target was for individuals to achieve 115% of their lesion-specific reference value (LSRV) maximal inspiratory pressure (MIP) to reduce the likelihood of future respiratory complications. A change in maximum phonation time (MPT) during speech was also assessed.

Method

Patients attended a twice-weekly IMT group and performed eight sets of ten repetitions at 80% of their MIP using an inspiratory muscle trainer, either a Powerbreathe or Threshold. They were encouraged to practice independently every day between sessions and were provided with a diary to log this. They were also provided with written and verbal information on IMT.

MIP, maximal expiratory pressure (MEP), forced vital capacity (FVC) and maximum phonation time (MPT) were assessed at the start and end of a seven to eight week training programme.

Results

Data was obtained for eight patients. Overall there was a statistically significant improvement in MIP. All patients improved their MIP, three of the eight to 115% of their LSRV. Data on MPT was collected for four patients, all of whom improved their MPT.

Authors

[1]Kate A Roberts, Senior Specialist Physiotherapist, London Spinal Cord Injury Centre, Royal National Orthopaedic Hospital, Stanmore.

[2]Sarah E Morgan, Speech and Language Therapist, Royal National Orthopaedic Hospital, Stanmore.

[3]Hannah L Chalke, Speech and Language Therapist, Royal National Orthopaedic Hospital, Stanmore.

[4]Anthony W Gilbert, Research Physiotherapist, Royal National Orthopaedic Hospital, Stanmore.

Keywords

Inspiratory muscle, training, spinal cord injury, pneumonia-risk, motivation.

Correspondence author

Kate Roberts.

Tel: 0208 909 5500.

Email: kate.roberts@rnoh.nhs.uk.

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Conclusion

Improvements in MIP and MPT were seen as a result of patients attending an IMT group. However, the effect on patient motivation and long-term continuation of IMT following discharge from hospital is still to be investigated.

Introduction

Complications associated with respiration are one of the leading causes of morbidity and mortality in those with spinal cord injury (SCI) (Mullen et al. 2015). Tetraplegia causes significant reduction in lung function due to paralysis of the respiratory muscles (Berlowitz et al. 2016). The level of reduction is dependent on injury level, with those with a higher level of injury being more significantly affected (Winslow and Rozovsky 1997).

A study by Raab et al. (2016) found that maximal inspiratory pressure (MIP) is the most accurate indicator of the risk of pneumonia in SCI patients. In a single-centre, retrospective cohort study of 307 SCI patients they found that a MIP <115% of the lesion-specific reference value (LSRV) leads to a 4.6 fold increase in the likelihood of getting pneumonia. LSRV is determined by entering patient data including SCI level, age, gender, height, weight and time post-injury into an online, open-access tool created by Mueller et al. (2012) following their study into prediction models for patients with complete SCI. This tool is available at www.scionn.nl/RefCalc.xls. Raab et al. (2016) identified limitations to their study including the need for a multi-centre follow-up study and a more specific definition of the type of pneumonia.

Three other studies have been performed to assess the predictors of pneumonia in SCI, of which two assessed only non-modifiable factors such as age, level and completeness of injury. Postma et al. (2009) assessed FVC (forced vital capacity), FEV1 (force expiratory volume in one second) and PEF (peak expiratory flow) but not respiratory strength. They found these respiratory function parameters to be “moderately accurate” predictors of pneumonia and all of equal accuracy.

Inspiratory muscle training (IMT) has been shown to lead to a statistically significant improvement in respiratory function, including MIP (Mueller et al 2013; Postma et al 2014). The Cochrane review on IMT in SCI (Berlowitz and Tamplin 2013) identified that IMT leads to an improvement in FVC, MIP and maximal expiratory pressure (MEP) but further research is required to establish the required intensity of training and its long-term effectiveness. McDonald and Stiller (2018) investigated the use of IMT with patients with acute SCI and began training at 50% MIP, progressively increasing the load to a maximum of 90% MIP. This training intensity was based on a case series report by Bissett et al. (2012) into the safety of IMT in the intensive care setting. Improvements in MIP and FVC were seen in approximately half of their participants.

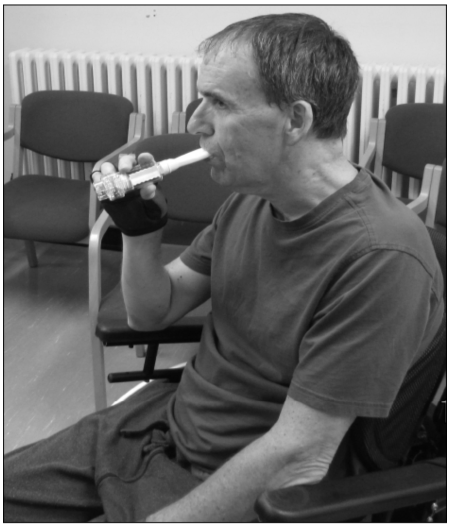
An intensity of 80% MIP was chosen in the randomised controlled trial by Mueller et al (2013) which compared three IMT methods in a group of 24 SCI patients. The results of this study indicated a significant increase in inspiratory muscle strength from IMT at high training intensity (80% of MIP) and low training volume. The authors hypothesised that high-intensity training would be important in maintaining patients’ motivation and compliance during the trial and in the long-term.

At the London Spinal Cord Injury Centre (LSCIC) our standard practice was to provide individuals with an inspiratory muscle training device, teach them how to use it, then leave them to continue independently with occasional verbal reminders. Patients' MIP and MEP were not assessed to inform the intensity level of training; this was judged by the physiotherapist on an individual basis. In order to promote increased use of the IMT devices and reinforce the importance of this as a vital, routine part of daily life we set up an IMT group. This is the first IMT group to be run in the UK for SCI patients, with individual IMT performed at approximately 50% of SCI centres.

We also wanted to assess outcome measures which would have a noticeable effect on the patients' quality of life. Respiratory dysfunction seen in SCI has been shown to decrease phonation length and perceptual voice quality (Tamplin et al. 2014) therefore we assessed phonation length alongside respiratory function testing.

Method

A twice-weekly IMT group was introduced in May 2017 for adult inpatients at the LSCIC undertaking their first rehabilitation admission following SCI (Picture 1). Patients with an FVC of less than 2 litres were invited to participate. A total of 16 patients attended the group during the first six months of its introduction and data was analysed for those patients who attended the group for a minimum of seven weeks.



Picture 1.

The group was run by physiotherapy technicians with input from physiotherapists and speech and language therapists (SLT) as part of the standard weekly rehabilitation programme (two 30-minute sessions per week in a designated room).

Respiratory function tests (FVC, MIP and MEP) and maximum phonation time (MPT) for a sustained vowel (aaah) were recorded at baseline. Patients then completed eight sets of ten repetitions at 80% MIP using an inspiratory muscle trainer, either a Powerbreathe Medic Classic (Picture 2) or Threshold IMT (Picture 3) determined by their initial MIP. This intensity was chosen as the population characteristics and intentions for the group were similar to that of Mueller et al. (2013).

Picture 2: **Powerbreathe.**

Picture 3: **Threshold.**

The individual's target was to achieve a MIP of 115% of their LSRV (i.e. 115% of their expected MIP for their lesion level). MIP was reviewed at 3-5 weeks and the resistance on their IMT device was adjusted to 80% of their new MIP, or as high a pressure as possible whilst still moving the device valve.

Patients were provided with written information about the group alongside a verbal explanation of the reasoning behind IMT and the practicalities of the group. They were encouraged to practice independently every day between sessions and were provided with a diary to log this.

Respiratory function tests and MPT were then repeated at seven to eight weeks (T2). Patients were encouraged to continue attending the group until discharge and to continue with IMT once discharged home.

Data was analysed using IBM SPSS v16 and assessed for distribution. The paired t-test was used if data was normally distributed and the Wilcoxon signed rank test used if it was not.

The cost of setting up this service was in the purchase of a MicroRPM spirometer for assessment. Staffing for the service was met within the current complement.

Results

Eight patients attended the group for at least seven weeks; five male, three female (Table 1). The age range was 35-71 years (mean 44.5 years). Their ISNCSCI (International Standards for Neurological Classification of Spinal Cord Injury) score ranged from C4-T4, A to C. Further details of the ISNCSCI can be found at: http://asia-spinalinjury.org/wp-content/uploads/2016/02/International_Stds_Diagram_Worksheet.pdf.

Table 1: **Patient demographics.**

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8
Age	36	39	71	62	38	35	39	36
Gender	M	M	M	M	F	M	F	F
ISNCSCI	C4 B	T4 A	C4 B	C4 A	T3 A	T3 A	C4 B	T3 C

All patients demonstrated improvements in MIP, with three of the eight patients achieving a MIP of ≥115% of that expected (according to their LSRV). Seven of the eight patients achieved a MIP of ≥85% of that expected (Figure 1).

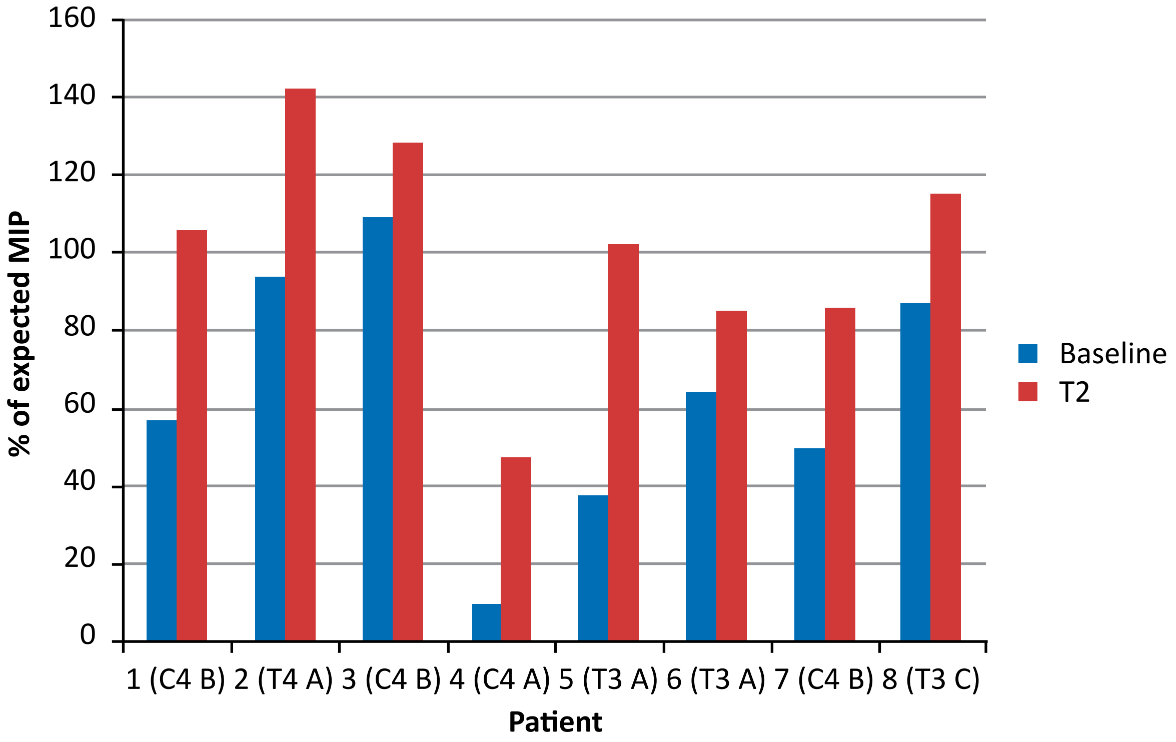


Figure 1: **Percentage of expected MIP per patient at baseline (T1) and end of training programme (T2).**

Data was assessed for distribution and met parametric assumptions. The paired t-test was therefore used to compare differences between values at time point one (T1, baseline) and time point two (T2, follow up). Although the decision was made to focus on the change in MIP (Maximal Inspiratory Pressure), improvements were seen across all components of respiratory testing.

At baseline (represented as Baseline in Figure 2) the MIP was lower (mean value = 63.62, SD = 32.27) than the MIP at follow up (represented as T2 in Figure 2) (mean value = 101.5, SD = 29.08). The mean difference (-37.9) between T1 and T2 was statistically significant (t= 6.976 (7); p = <0.001); 95% CI [25.04-50.71].

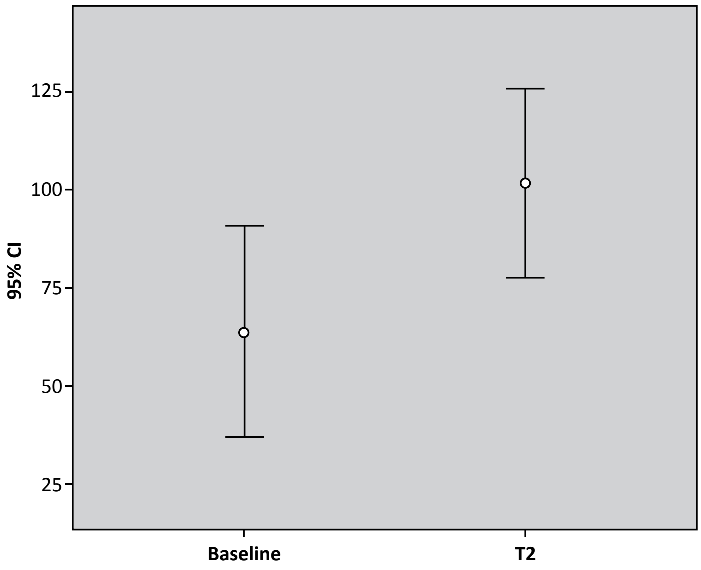


Figure 2: **Mean difference and 95% confidence intervals (CI) for MIP at baseline (T1) and end of training programme (T2).**

MPT was collected for four patients as the data was incomplete for the remaining patients. All patients had an increase in MPT with one patient more than doubling their MPT (in Figure 3).

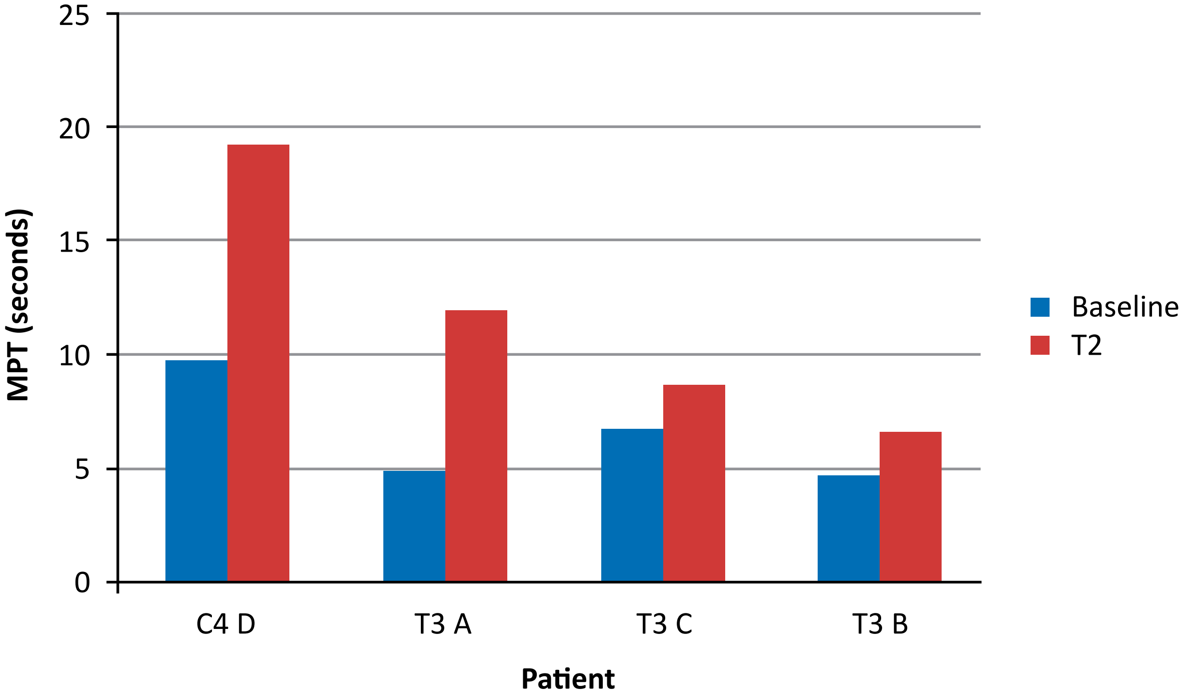


Figure 3: Change in MPT per patient at baseline (T1) and end of training programme (T2).

Discussion and Conclusion

This IMT programme led to a statistically significant improvement in MIP in SCI patients. Evidence suggests this will decrease the risk of these individuals developing pneumonia (Raab et al. 2016). Some patients did not achieve 115% of their LSFV in the time frame they attended the IMT group but may do so with continued IMT. It would be useful to gain data on this in the future.

The improvement seen in MIP in this evaluation echoes the findings of a number of other studies into IMT which have reported improvements in lung function in a number of patient groups: COPD, asthma, heart failure associated with inspiratory muscle weakness, and spinal cord injury (Lötters et al. 2002; Dall'Ago et al. 2006; Berlowitz and Tamplin 2013; Mueller et al. 2013; Silva et al. 2013).

This service evaluation found that IMT led to an increased phonation time in the small number of patients with sufficient data for analysis. Improvements in this parameter was associated with increased words per breath and perceived loudness. This in turn is likely to have a positive influence on their quality of life as they will be able to communicate more easily on a day-to-day basis and will feel more confident that they have sufficient voice capacity to call for help if required.

There are other factors which may have influenced the change in MIP seen during this evaluation including natural resolution of respiratory depression. Postma et al. (2013) state "Pulmonary function is substantially reduced immediately after the onset of SCI but (partly) restores in the months thereafter" (p1540). There may also have been an improvement in the technique of patients performing their respiratory function tests due to practice, however no literature could be found to support this theory. In the future we would follow internationally-recognised advice for three readings to be taken for each parameter, of which two are within 5% of each other (Moore 2012).

Analysing the reasons for the improvements in MIP was not the sole intention of the group: one of the key aims of the change in service provision was to improve the patients' understanding of the benefits of IMT, to boost their motivation and to inspire them to continue with independent training. It is known that, as with all muscle training, the effect on inspiratory muscle strength appears to reduce or be lost with the cessation of training (Berlowitz et al. 2016) therefore it is necessary to encourage life-long continuation of IMT in our patients if the benefits of IMT are to be maintained.

Subjectively, patients reported being more motivated to complete IMT in a group setting, however, a patient focus group or satisfaction questionnaire needs to be undertaken to obtain qualitative feedback on this.

There was also incomplete use of the IMT logs by patients therefore we were unable to gain accurate data on patient compliance with independent IMT. The amount of independent training performed may well have influenced the results and we expect may reflect the patient's inclination to continue with IMT long-term.

Investigating the long-term continuation of IMT in this patient group, the effect on their lung functions and their incidence of chest infections and pneumonia will inform us about the clinical significance of IMT on both patient quality of life and potential cost-saving, seen in the reduced incidence of chest infections and in turn the costs associated with antibiotic prescription and, in more serious cases, hospital admission.

The improvements seen in this patient group have informed our decision to continue running the IMT group at the LSCIC and to continue ongoing data collection. In the future it would be beneficial for multi-centre research to be performed into the short and long-term compliance with and effects of IMT on respiratory health in SCI.

Key Points

1. Spinal cord injured patients attending a twice-weekly inspiratory muscle training group for a minimum of seven weeks all improved their maximal inspiratory pressure.
2. Improvements in maximum phonation time were also observed following IMT.
3. Further analysis is needed into patient motivation and the long-term continuation of IMT.

Acknowledgements

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Ethical and R&D approval

Written patient consent gained for use of picture 1 on websites and in publications. The RNOH Research and Development team were informed of this service evaluation and informed us it did not require approval from the Research Ethics Committee (REC) or R&D Office.

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Training and education for respiratory on-call physiotherapists in the UK: a national survey

James Warrington[1], Ema Swingwood[2], Harriet Shannon[1]

Abstract

Background

Physiotherapists frequently provide emergency on-call respiratory services outside of normal working hours. The Association of Chartered Physiotherapists in Respiratory Care (ACPRC) has raised concerns regarding the heterogeneity of training and education across the United Kingdom, particularly given that non-respiratory physiotherapists participate in on-call respiratory treatments. The aim of this study was to explore current provision of on-call respiratory physiotherapy in the United Kingdom (UK).

Methods

This study employed a survey-based approach. An online survey was developed and piloted to meet the aims of the study. Physiotherapists were recruited proactively via professional on-line noticeboards, the Council for Allied Health Professionals' Research, other special interest groups and using social media. The survey was open to responses for 3 weeks.

Results

A total of 120 responses were received, of which 13 were excluded as they did not meet the inclusion criteria. Responses indicated good representation nationally, from those who run on-call services and deliver training at their respective hospitals. There was wide variation in the processes that physiotherapists must complete prior to undertaking on-call duties. Competence was assessed via a number of means, with wide variation between the assessment methods. There was a lack of consensus regarding the purpose of on-call respiratory physiotherapy.

Conclusion

The results highlight the varied nature of on-call service provision and training in the UK. Training methods have shifted from supervised sessions to more practical-based work utilising the skills and knowledge of colleagues.

Authors

[1]1 UCL GOS Institute of Child Health, 30 Guilford Street London WC1N 1EH.

[2]University Hospitals Bristol NHS Foundation Trust.

Keywords

On-Call, Competence, Education.

Correspondence author

Dr Harriet Shannon, Senior teaching fellow. Email: h.shannon@ucl.ac.uk. Address: UCL, GOS, Institute of Child Health.

Introduction

The aim of respiratory physiotherapy is to promote secretion clearance, maintain or recruit lung volume, optimise oxygenation, and prevent respiratory complications in both intubated and

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spontaneously breathing patients (Fink 2007; Berney et al. 2012; Morrison and Agnew 2014; McIlwaine et al. 2015). Respiratory physiotherapy treatments have been shown to reduce the incidence of atelectasis, prevent pneumonia, and reduce tracheostomy placement and associated prolonged mechanical ventilation (Berney et al. 2002).

Traditionally, core physiotherapy working hours are (approximately) 08:30 – 16:30, Monday to Friday (Millett 2011). Outside of those hours, on-call and weekend services are provided. The on-call service provides emergency respiratory input to those patients who are acutely deteriorating and who might otherwise require an increase in ventilatory support or intubation (Babu et al. 2010). On-call physiotherapy can be provided to patients in intensive care, as well as those on respiratory and other wards, providing a respiratory service across the entire hospital site.

As far back as 2002, the Association of Chartered Physiotherapists in Respiratory Care (ACPRC) raised concerns regarding the lack of an on-call competence framework (Cross et al. 2003). Later, Gough and Doherty (2007) reported a lack of national guidelines to set competency standards, stating that competency assessment is often ad hoc. Locally devised frameworks were used in 88% of trusts (Gough and Doherty 2007). 10 years later, there remains no accepted/measured minimum standard of competence for on-call participation.

Harden (2005) reported concerns around training/education for competency attainment and maintenance. In her survey of on-call provision, respondents reported that 11% of newly-qualified physiotherapists were on the on-call rota within 1 month of commencing their professional careers, increasing to 49% within the first 3 months. 67% of physiotherapists believed resources and time for appropriate training were inadequate (Harden 2005). There is nothing to suggest that this picture has changed substantially since then. However, over a decade on, the nature of physiotherapy services are changing. Some hospitals have introduced seven day working and there is greater emphasis on round-the-clock care (CSP 2015). Simultaneously, the NHS is under financial strain and these, plus other unknown factors, may impact on both training and service provision. Disparities in training, competence or service delivery may potentially impact (positively or negatively) on patient outcomes and result in regional differences regarding the quality of care that patients receive.

The aim of the study was to capture a national snapshot of on-call service provision and training.

Methods

Ethical approval for the study was granted via Chair's Action from the joint UCL and UCLH research ethics committee (R&D number 834/001).

A semi-structured focus group was held to gain insight into common themes and patterns arising during on-call working. Focus groups allow for thoughts to be triggered between individuals and from there ideas to be exchanged and experiences to be shared (Krueger and Casey 2015). The participants were UK physiotherapists undertaking an MSc in advanced cardiorespiratory physiotherapy. They were of experienced Band 6 level or above, with a special interest in cardiorespiratory care.

The key themes that emerged were the nature of training undertaken prior to on-call practice, and the attainment and maintenance of competence once participating on the on-call rota, particularly regarding non-respiratory physiotherapists whose usual area of practice was substantially different from the requirements of on-call work (such as musculoskeletal physiotherapy).

Themes from the focus group, together with findings from previously published literature and discussions with academic staff, formed the foundation of the survey.

The survey was piloted by five specialist respiratory physiotherapists, which led to minor adjustments to the structure, format and choice of responses for some questions. Most significantly, an 'other' option was made available to the drop-down lists of possible responses to most questions, followed by a free text box to allow physiotherapists to offer alternative responses. Views and opinions regarding on-call service delivery were generally removed in favour of questions regarding the operational aspects of the on-call service and training, which better reflected the aims of the study. The final questionnaire was created using Opinio web-based survey software version 7.7.2 (ObjectPlanet Inc.). See Appendix for an abridged version of the survey.

Inclusion criteria included those individuals responsible for the organisation of the on-call respiratory rota or associated training, and who worked within the NHS in the UK. Focussing on these individuals ensured data collected was accurate and service-specific, with limited opportunity for duplication within one hospital site. Physiotherapists were excluded if they did not have management or training responsibilities within the on-call service.

Physiotherapists were recruited proactively via the Chartered Society of Physiotherapy (CSP) and ACPRC noticeboards, the Council for Allied Health Professionals' Research (CAHPR), other special interest groups and via social media including Twitter and Facebook. A snowball effect was encouraged. Responses were downloaded into Excel for further analysis. Inputted data were reviewed by an independent academic to ensure accurate replication from the online software. Descriptive statistics were used to summarise demographic details, and data were presented as proportions of the total number of responses.

Results

In total, 120 questionnaires were completed. Of the excluded respondents (n=13), 10 were Band 5 physiotherapists who had no input in the on-call management or training. Two respondents were not from UK hospitals, and 1 worked in a private hospital. The following analyses are based on 107 responses, unless otherwise stated.

Demographic information

Respondents were of seniority levels Band 6 (31%, n= 36), Band 7 (48%, n= 55) and Band 8a (15%, n= 17) (missing data for 6%, n=7) (see question 2, appendix). Forty six (43%) respondents worked in teaching hospitals, Forty one (38%) were from district general hospitals, with a further 18 (17%) working in specialist centres (question 3). There was good representation from all regions of England, with small contributions from the other countries (Scotland, Wales and Northern Ireland, see Figure 1) (question 4).

On-call service delivery

Fifty-six (52%) respondents used a 'traditional' model of respiratory cover, comprising a full complement of respiratory physiotherapists during 'core' office hours, with a reduced on-call service in the evenings and at weekends. Remaining respondents utilised either a seven-day service (19%, n=20), twilight service (18%, n=19) or a 12-hour shift pattern (7%, n=8) (question 6).

All respondents reported that the on-call service was populated by respiratory and non-respiratory specialist physiotherapists (question 8). Non-respiratory physiotherapists included those holding static posts in non-respiratory specialties, as outlined in Table 1 (question 9). Band 6 physiotherapists were included in all hospitals (100%, n=107), Band 5's and 7's in 86% and 77% of hospitals respectively (n= 92 and 82), and Band 8a's represented on 27% (n=29) of on-call rotas (question 10).

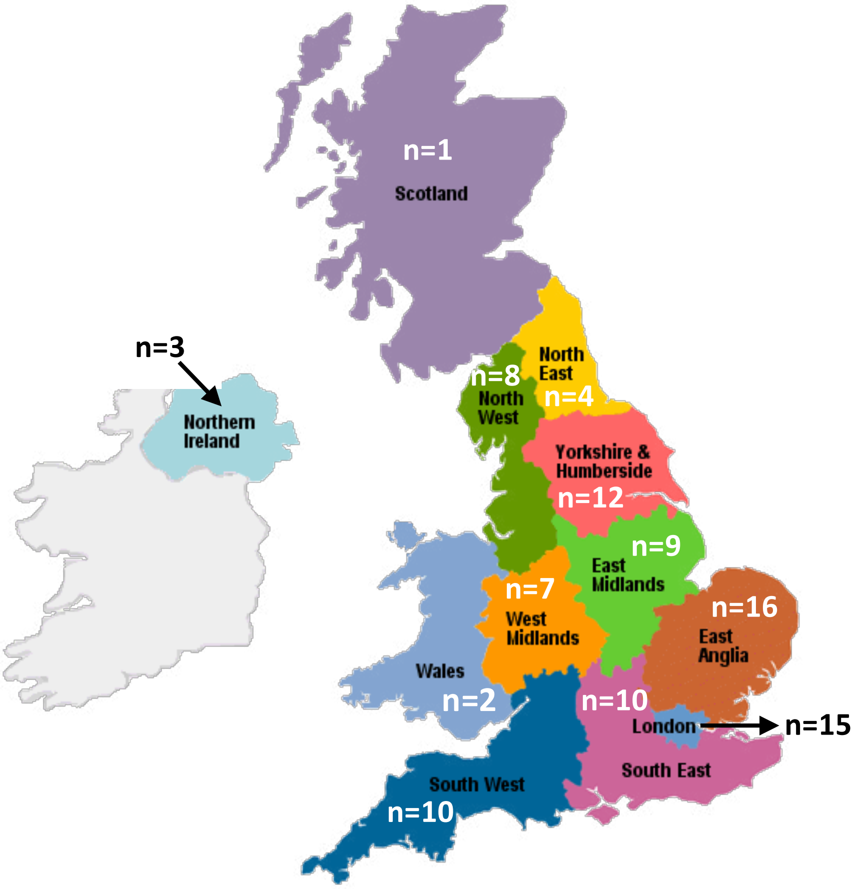

Figure 1: The number of respondents from each region throughout the UK (there were missing data from 10 respondents).

Table 1: Physiotherapists who hold static posts in non-respiratory areas, and participate in the respiratory on-call rota.

Specialty	% of respondents
General Medical	72%
General Surgery	67%
Neurology	66%
Care of the Elderly	63%
Musculoskeletal	37%
Orthopaedics	36%
Paediatrics	31%
Community	11%
Other (not specified)	7%
Women's Health	1%

On-call training and competence

Prior to commencing on-call work, all respondents stated that some form of training was required (question 11). 86% (n=92) of respondents were required to complete competencies set out by their Trust. 85% (n=91) of respondents stated that some form of formal training was required, such as a programme of in-service training (multiple responses were accepted). 76% (n=81) undertook work shadowing with a senior respiratory colleague, whilst 51% (n=55) completed all or part of a respiratory rotation. Other training methods included directed reading (52%, n=56), on-line learning (14%, n=15) and simulation (1%, n=1) (question 12).

The curriculum of on-call training included interpretation of respiratory data, such as arterial blood gases (79% of responses, n=85), respiratory assessment of the acutely unwell patient (73%, n=78), and rationale and practicalities of various airway clearance techniques (79%, n=81) (question 13). Less clinically-focused topics such as anatomy, physiology and pathophysiology received slightly less attention (being covered by 48%, n=51 and 38%, n=41 respectively), with one respondent stating in free text that ‘prior knowledge regarding anatomy and physiology is assumed.’ Curriculum tended to be delivered within the context of practical scenarios and case studies (83%, n=89 and 65%, n=70 respectively), as well as lectures (57%, n=61).

Competency was formally assessed by a senior colleague in 63% (n=67) of responses, and through completion of Trust competencies (n=61, 57%). Self-assessment occurred in 39% (n=42) of cases, and through participation in simulation (n=26, 24%). Twenty one (20%) respondents stated that competence was not assessed prior to therapists participating in on-call duties (question 14).

Once on the on-call rota, 41% (n=44) of respondents stated that competence was reassessed at intervals ranging from 6 monthly (n=2), annually (n=33) and every 1-2 years (n=9) (question 16). Meanwhile, 55% (n=59) stated that it was not reassessed (4% of respondents didn’t complete this question) (question 15).

Philosophy of practice

Finally, respondents were asked about their views on on-call service provision (question 17). 50% of respondents felt that on-call services should provide ‘maintenance’ services, whereby physiotherapists are expected to deliver a safe assessment and treatment, stabilise the patient and protect them overnight, until a respiratory physiotherapist is available. Meanwhile, 49% of respondents stated that on-call physiotherapists should have the required skills to make clinically important changes to the patient’s respiratory status that are as effective as those delivered by respiratory physiotherapists during the normal working day. The remaining respondent stated ‘although not ideal, a maintenance service is acceptable but we should strive to ensure all physiotherapists who are part of the on-call rota have the same skill-set.’

Summary of results

- Although the ‘traditional’ method of delivering a respiratory service still dominates, alternative models were adopted by 44% of respondents.
- Non-respiratory physiotherapists who hold static posts in other specialties are generally required to participate in respiratory on-call duties.

- There is wide variation in the processes that physiotherapists must complete prior to undertaking on-call duties. Only 55% of respondents had a requirement for therapists to have completed all/part of a respiratory rotation prior to commencing on-call.
- Competence was assessed via a number of means, with wide variation between the assessment methods. Competence re-assessment is not commonplace.
- There is no current consensus as to the ‘aim’ or purpose of an on-call service.

Discussion

This study aimed to capture a national snapshot of respiratory physiotherapy on-call service provision and training through an online survey.

There is significant diversity in the way that respiratory services are organised, a finding that was not evident when Harden (2005) investigated on-call provision. Our results demonstrate that some hospitals now work 7 day, twilight and 12 hour shifts, whilst others maintain the traditional ’office hours’ model. Further, robust research is required to ascertain whether such models are sustainable, financially viable and impact positively on a patient’s hospital stay.

No recent study has sought to ascertain whether and which non-respiratory physiotherapists participate in respiratory on-call services. This study found a significant number of outpatient musculoskeletal staff participating on the on-call rota, as well as those from other non-respiratory specialty areas. The implications of non-respiratory physiotherapists participating in the on-call rota is out of the scope of this study, although it does raise questions as to how non-respiratory staff can best be supported to maintain their competence and confidence when their normal caseload is so different.

No previous work has comprehensively sought to collect data regarding training methods for on-call staff prior to working on-call. Results from the current study demonstrated no consensus on current methods of training. 51% of respondents reported that physiotherapists were required to complete all or part of a respiratory rotation. This is greater than previously reported by Gough and Doherty (2007) and Harden (2005) who found this in only 36% and 31% of services respectively. These results highlight an improvement in the exposure that physiotherapists have to respiratory patients prior to joining the on-call rota. This is likely to be beneficial, given that domain-specific knowledge is learned through experience within a work environment (Thomas et al. 2008). Joint treatment sessions were the most popular training method (91%), followed by practical scenarios (83%).

Eighty-six (86%) respondents reported local trust competencies as a way of assessing competence. This corresponds with Gough and Doherty (2007) who reported an 88% usage. These figures represent a vast improvement since Harden (2005) reported formal competencies were only used by 32% of respondents (and informal assessments by a further 49% of respondents).

Competence was not routinely assessed in 20% of hospitals, which is similar to the 16% reported by Harden (2005). Dixon and Reeve (2003) reported that 33% of respondents did not have any formal standards for assessing competence. These figures are noteworthy because they highlight the potential for under-confident or less competent physiotherapists to deliver treatments, negatively affecting patient outcomes. However, it is not known whether competency assessments are effective at assessing clinical ability. This study did not ascertain reasons for non-assessment of competence.

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Self-assessment of competence proved to be popular amongst respondents as 39% reported its usage. Self-assessment is an important competence marker but in isolation, may be unreliable (Thomas et al 2008). An over-confident physiotherapist may overestimate competence, while another therapist who no longer wishes to participate in the on-call rota may rate her/himself as 'incompetent' to add weight to a request to be removed from on-call duties.

Prior to the current study, no research had ascertained whether competency was re-assessed. Results suggest that competence was re-assessed in only 41% of responding hospitals. This raises concerns about maintenance of skills, particularly for those working in non-respiratory clinical specialities.

Improvements over the past 10 years regarding on-call requirements and the necessity to complete a respiratory rotation are positive; however, there is still substantial variation nationally. The aim of on-call service provision proved to be divisive. This suggests that a more cohesive approach is required to avoid a 'postcode lottery' regarding levels of training and competence of on-call staff.

Limitations

The limitations of this survey include the fact that it is difficult to know how many hospitals within the UK utilise an on-call service, in order to estimate the percentage response rate to the survey. Given the timeframe of the project, there was limited scope for in-depth question development in collaboration with a pool of senior clinicians. This means that some important questions may have been missed, or were open to misinterpretation. Despite this, the results still provide valuable data pointing towards areas for future study. There is inevitably a risk of response bias, since those particularly engaged with the issues surrounding on-call provision are more likely to wish to participate in a survey of this nature. Finally, the survey relied heavily on closed questions with drop-down responses. While this meant that the survey could be completed fairly quickly (thus improving the number of responses), we may have lost some of the richness of data that open questioning would have elicited.

Conclusion

Compared with 10 years ago, this study has shown that more physiotherapists are now required to complete a respiratory rotation (at least in part) before joining the on-call rota. Training methods have shifted from supervised sessions to more practical-based work utilising the skills and knowledge of colleagues. Once physiotherapists have joined the on-call rota, the majority will not have their competence re-assessed. In addition, the on-call rota is populated by physiotherapists from specialities other than respiratory, which presents a unique challenge in terms of training and maintenance of skills. Further research is required into the impact of such approaches on the quality of the service that is provided.

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Appendix: On-call training and service provision within the NHS: an on-line survey (abridged version)

Please note that these questions have been transcribed from the on-line survey, however some of the formatting in the responses column has been lost (many were interactive drop-down options in the on-line survey).

This survey is intended to be completed by physiotherapists who **manage** the on-call respiratory service or training within their hospital.

The purpose of this survey is to explore the current on-call service provision with the NHS, and record current training strategies. We would like to gather some information about your on-call service and explore current procedures regarding on-call training. No personal information will be collected as part of this questionnaire.

General information

1	Does your hospital provide an on-call physiotherapy service for patients with emergency respiratory needs?	YES/NO – if NO, could you describe the main reasons for this (reasons could include funding, staffing, patient population, no local need etc.) If NO, thank you for your time, and please 'submit' your survey as it is, using the function at the bottom of the page.
2	What is your current AfC banding?	
3	Please indicate which ONE of the following terms best describes your hospital	District general, teaching hospital, specialist/tertiary centre, charity funded centre, other (please state)
4	In which region of the UK is your hospital situated?	East Midlands, West Midlands, East Anglia, Greater London, North East, North West, South East, South West, Yorkshire and the Humber, Northern Ireland, Scotland, Wales, other (please specify)
5	How would you describe your current role/s within the on-call respiratory rota (please tick all that apply)	a) I organise the on-call rota b) I deliver or organise on-call training c) I assess physiotherapists' competence to practice on-call d) I review any adverse events or near misses associated with on-call e) I manage staff appraisals, of which on-call competence is a part f) Other (please state)

Information about your on-call service

6	What is the usual shift pattern of those individuals who work on the respiratory wards, including intensive care (this does NOT include the on-call service)	a) 'Office' hours only (such as 8:30am to 5:30pm), 5 days per week (separate weekend rota) b) 'Office' hours only (such as 8:30am to 5:30pm), 7 days per week c) 'Long days' (such as 12-hour shifts) over 5 days per week (separate weekend rota) d) 'Long days' (such as 12-hour shifts) over 7 days per week e) Variable hours to cover a twilight or evening service, 5 days per week f) Variable hours to cover a twilight or evening service, 7 days per week g) Other (please state)
7	What hours does your on-call service provide?	
8	Do both respiratory AND non-respiratory staff contribute to the on-call respiratory rota? (This includes both rotational and static staff)	a) Both respiratory and non-respiratory on-call staff b) Respiratory only c) Non-respiratory only d) Unsure e) Other (please add clarification if this question doesn't fit with your hospital's way of working)
9	Is your on-call respiratory rota populated by physiotherapists who hold static posts in any of the following areas? (Tick all that apply)	a) Musculoskeletal b) Neurology c) Care of the elderly d) Community e) Paediatrics f) Orthopaedics g) General medical h) General surgery i) Other (please state)
10	Which AfC bandings of physiotherapists participates on the respiratory on-call rota? (please tick all that apply)	a) Band 5 b) Band 6 c) Band 7 d) Band 8a e) Band 8b f) Other (please state)

On-call education and training

11	What requirements must new staff complete before joining the respiratory on-call rota (please select all that apply)	a) Undertake all or part of a respiratory rotation b) Shadow a senior colleague c) Formal training (such as in-service training) d) Complete on-line learning e) Pass Trust competencies f) Directed pre-reading g) None of the above h) Other (please state)
12	How is current on-call training delivered? (please select all that apply)	a) Lectures b) Practical workshops c) Simulation d) Joint sessions with a senior colleague e) Other (please state)
13	If you run formal on-call in-service training, which topics do you cover? (please select all that apply)	a) Respiratory anatomy and physiology b) Overview of the pathophysiology of common cardiorespiratory diseases c) How to undertake a respiratory assessment of an acutely unwell patient d) Interpretation of data (for example, chest x-ray interpretation, arterial blood gas analysis, ventilator setting etc) e) An overview of the rationale and practicalities of administering airway clearance techniques f) Practical sessions where physiotherapists can familiarise themselves with adjuncts and equipment g) Case studies, with accompanying questions h) Problem-solving exercises i) None of the above j) Other (please state)

Assessment of competence

14	How is initial on-call respiratory competence assessed? (please select all that apply)	a) Competence is not assessed b) Formal assessment from a senior colleague (such as an observed assessment/treatment) c) Simulation training d) Self-assessment such as the ACPRC on-call competence questionnaire e) Trust competencies f) Other (please state)
15	Is competence routinely re-assessed?	YES / NO / OTHER (please state)

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16	How often are on-call competencies re-assessed?	a) Every 4 months b) Every 6 months c) Annually d) Every 1 to 2 years e) Competence is not re-assessed f) Other (please state)

Philosophy of practice

17 Please select which statement you feel is most appropriate when describing the 'philosophy' of practice for on-call physiotherapists at your hospital, and the aim of the on-call respiratory rota.

a) On-call should be seen as a maintenance' service whereby, as a minimum, physiotherapists are expected to deliver a safe treatment, stabilise the patient and protect them through the night, until a respiratory physiotherapy is available to deliver a more effective treatment the following day
b) On-call physiotherapists should have the necessary respiratory skills to make clinically important changes to the patient that are as effective as those delivered by respiratory physiotherapists during the normal working day
c) Other (please provide details in the space below)

A service evaluation of a physiotherapy led, competency based training session for nursing staff on nasopharyngeal suctioning in a tertiary care children's hospital

Claire Hepworth[1] and Laura Hopwood[2]

Abstract

Aim

To assess the effects of a nasopharyngeal suction (NPS) training package on the competence, knowledge and confidence of qualified nursing staff.

Method

A monthly 2 hour physiotherapy led training package incorporating theory, practical and Objective Structured Clinical Examination (OSCE) elements was delivered at Alder Hey Children's Hospital (AHCH). Competence levels were assessed using Trust guidelines and OSCE assessments with a 50% pass rate. Self-rated knowledge and confidence questionnaires were completed before and after the training.

Results

67 nursing staff completed the training and 67/67 (100%) trainees were competent to perform NPS after the training. Additionally there was a substantial increase in trainee's self-rated confidence and knowledge.

Conclusion

The physiotherapy-led training package was effective at ensuring participants competence, confidence and knowledge in performing NPS. Future recommendations are to make the training compulsory for all appropriate staff, helping ensure a standardised, safe and effective NPS technique for patients.

Authors

[1]Clinical Specialist Paediatric Respiratory Physiotherapist, Alder Hey Children's NHS Foundation Trust.

[2]Highly Specialised Respiratory Paediatric Physiotherapist, Alder Hey Children's NHS Foundation Trust.

Keywords

Nasopharyngeal suction, Training, Physiotherapy, Nursing staff, Paediatrics.

Correspondence author

Claire.hepworth@alderhey.nhs.uk.

Tel: 01512525862.

Laura.hopwood@alderhey.nhs.uk.

Tel: 01512525862.

Introduction

NPS is a common clinical technique utilised in the treatment of children within the UK (APCP 2015), and is typically performed by physiotherapists, nursing staff, and trained parents and carers (Trigg and Mohammed 2010). NPS involves passing a suction catheter into the nasopharyngeal space, aiming to elicit a cough and clear upper respiratory tract secretions (Moore 2003). It is indicated when secretions cause respiratory deterioration or impact on effective

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ventilation (Hough 2001). NPS should only be used when secretions cannot be cleared effectively by other less invasive techniques (Moore 2003), for example: re-positioning, nebulisers and forced expiratory technique.

Children who require NPS are usually unable to cough and clear secretions effectively for themselves (Harden et al. 2009). This includes children with neuromuscular conditions, complex needs, or children with excessive secretions due to respiratory tract infections (Trigg and Mohammed 2010). NPS can be used in the acute setting and also in a patient's home and social environment for children with long term needs (Trigg and Mohammed 2010). When safely and appropriately delivered, this technique can reduce airway obstruction caused by secretions and promote effective ventilation (Moore 2003). If performed incorrectly or ineffectively, NPS can have adverse physiological effects. These include infection, hypoxia, atelectasis, and cardiac arrhythmia (APCP 2015), potentially impacting on length of hospital stay. It should therefore only be performed by trained professionals, ensuring appropriate, safe and effective use whilst minimising potential side effects.

NPS is recognised as a vital skill for professionals that work with acutely ill children and children with complex needs (Trigg and Mohammed 2010). Despite NPS being common practice in many hospitals, there are wide variations in the procedure (Moore 2003). These variations include: indications for suction, depth of suction and the level of negative pressure used. Additionally, these variations are reflected across the United Kingdom (UK) with different universities teaching different techniques. There is also controversy over the term 'NPS' and the anatomical specifics of whether the catheter reaches the pharynx or trachea, termed nasopharyngeal or nasotracheal suction. The lack of national multidisciplinary guidelines and a consistent approach can lead to low confidence and poor knowledge surrounding NPS.

The Association of Paediatric Chartered Physiotherapists (APCP) have developed NPS guidelines (APCP 2015) however their utilisation across different disciplines is unknown. Nevertheless, adhering to a safe and effective clinical practice guideline can improve the consistency of patient care (Woolf et al. 1999). Furthermore, professionals' have a duty to ensure they deliver safe, appropriate and effective care to patients and to develop their clinical competence in accordance with their code of practice (NMC 2015; CSP 2011). Clinical competence has been described as a mix of skills, knowledge, attitudes and ability to perform a technique (Notarnicola et al. 2016). Clinical competence according to AHCH is the ability to perform a technique safely and independently without the need for supervision or assistance (Appendix 1). To assess competence, Objective-Structured-Clinical-Examinations (OSCE) can effectively be used (Oranye et al. 2012) and are a well recognised, standardised evaluation method in both medical and allied health professionals.

There are limited numbers of studies on the benefits of an interprofessional training approach in the Cochrane review (Reeves et al. 2013) however improved patient satisfaction (Campbell 2001); reduced clinical error rates (Morey 2002) and improved collaborative team behaviour (Weaver 2010) have been demonstrated. It is also acknowledged within the literature that the most successful training is delivered though active learning combining observation, action and reflection (Wrenn and Wrenn 2009). Moreover, using a variety of teaching styles is likely to suit a wide range of trainees learning styles and foster an effective learning environment (Frankel 2009). Therefore our interprofessional NPS training utilised a variety of teaching approaches: observation, theory and practical to help consolidate learning.

Senior respiratory physiotherapists at AHCH are responsible for ensuring fellow physiotherapists, nursing staff, parents and carers are trained to competently deliver NPS. Trainees were assessed at different competency levels dependant on their background. To ensure a standardised approach to NPS, a competency based training package was developed for qualified nursing staff to attend. The goal was to ensure staff had the knowledge, confidence and competence to deliver NPS; promoting good patient care. This service review was completed to assess the impact of this training on the knowledge, confidence and effectiveness of trainees. To the author's knowledge, there is no published research that has assessed the effectiveness of a physiotherapy led competency based NPS training package for nursing staff.

Aims

Primary aim: To assess the effectiveness of the training package on the number of trainees deemed competent in performing NPS.

Secondary aim: To establish the value of the training package on trainees' knowledge and confidence in performing NPS independently.

Method

The NPS technique used in this training adheres to Trust policy which includes a maximum depth measurement taken from the nostril, to the tragus of the ear, and then to the base of the neck (Appendix 1). There is no research to support that this NPS technique is superior to other techniques in the literature, however this has been implemented safely and effectively for many years at AHCH. Furthermore this technique is advocated in the APCP guidelines (APCP 2015).

Co-authors (CH and LH) developed a voluntary monthly competency based NPS training package for nursing staff to attend from May 2017. The package was 2 hours in duration and involved a theoretical presentation, interactive demonstration, practical session, and OSCE on an infant or paediatric manikin. The training was directed at qualified nursing staff working with self-ventilated patients (without an artificial airway) and was delivered by the acute respiratory physiotherapy team. Additional training sessions were provided for newly qualified nurses within the Trust. If the trainee failed the OSCE, they were allowed to retake once. Competency was assessed according to Trust guidelines at a level where trainees could provide NPS independently without assistance and a 50% pass rate was required on the OSCE. Trainees automatically failed the OSCE if they did not adhere to a clean technique or measure the suction size or depth correctly (Appendix 2).Trainees completed an anonymous self-evaluation questionnaire rating their knowledge and confidence of NPS before and after their training. The pre-training evaluation form consisted of 10 questions (Table 1). Pre and post training evaluation questions were the same, with the addition of two questions on the post training evaluation questionnaire (Table 2). Data was analysed from May 2017 – December 2017.

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Table 1: Summary of the self-evaluation questionnaire completed by trainees both before and after nasopharyngeal suction training.

Question number	Pre evaluation Question on nasopharyngeal suction	Answers	Classification of question
1	General knowledge on nasopharyngeal suction	5 point scale from excellent – very poor	Knowledge
2	Confidence to assess indications for procedure	4 point scale from confident to not at all confident	Confidence
3	Confidence to perform nasopharyngeal suction on a known patient	4 point scale from confident to not at all confident	Confidence
4	Confidence to perform nasopharyngeal suction on a new patient	4 point scale from confident to not at all confident	Confidence
5	Confidence to problem solve during the procedure	4 point scale from confident to not at all confident	Confidence
6	Knowledge of potential hazards and contraindications	5 point scale from excellent – very poor	Knowledge
7	Knowledge of how to minimise these potential hazards	5 point scale from excellent – very poor	Knowledge
8	Knowledge on measuring correct size of suction catheter and suction depth	5 point scale from excellent – very poor	Knowledge
9	Self rate your technique when performing nasopharyngeal suction	5 point scale from excellent – very poor	Knowledge
10	Confidence in caring for a child who requires nasopharyngeal suction	4 point scale from confident to not at all confident	Confidence

Table 2: Summary of the additional questions on the post training self-evaluation form completed by trainees.

Question number	Post evaluation Question on nasopharyngeal suction	Scale of ranking
11	Did the study day and OSCEs enhance your leaning	Yes or No and details
12	Were there any areas not covered in the training?	Yes or No and details

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Ethics

Local ethics approval was not required because this service review collected non-sensitive, anonymous information from participants using evaluation questionnaires.

Data analysis

1) The number of trainees that completed the training successfully was presented as a proportion (%) of the total number of trainees participating.
2) Self-evaluation forms were completed pre and post training. To analyse the data, each question was sub-classified relating to either confidence or knowledge. Answers relating to confidence were ranked on a 4 point scale from confident to not at all confident. Answers related to knowledge were ranked on a 5 point scale from excellent to very poor. Pre and Post evaluation form answers were compared.

Analysis of the results was undertaken by a blinded physiotherapist and evaluation questionnaires were only undertaken if both the pre and post training evaluation forms were completed.

Participants

26 established qualified nurses and 41 newly qualified nurses completed the training, totalling 67 trainees.

Results

Self-evaluation forms pre and post training were completed in at least 61/67 (91%) participants for each question, demonstrating a high completion rate (Table 3). 64/67 (96%) trainees passed their OSCE on their first attempt, and 3/3 (100%) passed on their second attempt. These individuals are now able to competently perform NPS for patients in AHCH. One trainee on request was trained to a higher competency level, to lead and supervise others in competently performing this technique. This individual is now able to cascade training to other qualified nursing staff within the area they work.

Participants' self rating of their knowledge pre and post training and the changes between these, are summarised in Figure 1 and Table 3. The overall mean improvement in participants' knowledge across all questions was 94%. There was no deterioration in knowledge scores from pre to post training. Participants' self-rating of their confidence pre and post training and the changes between these, are summarised in figure 2 & table 3. The overall mean improvement in participants' confidence was 86%. There was no deterioration in confidence scores from pre to post training. 63/63 (100%) of participants completing questions 11 and 12 felt that the training session had enhanced their learning and there were no suggestions for improvement or areas that were not discussed.

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Table 3: The numbers of participants change of knowledge scores after nasopharyngeal suction training.

Question number	Knowledge or Confidence	Number of completed pre and post evaluation forms (out of 67)	Stayed same level of knowledge or confidence n (%)	Improvement in knowledge or confidence n (%)
1	Knowledge	63	3 (5%)	60 (95%)
2	Confidence	63	11 (17%)	52 (82%)
3	Confidence	64	7 (11%)	57 (89%)
4	Confidence	64	13 (20%)	51 (80%)
5	Confidence	63	7 (11%)	56 (89%)
6	Knowledge	64	5 (8%)	59 (92%)
7	Knowledge	64	1 (2%)	63 (98%)
8	Knowledge	64	6 (9%)	58 (90%)
9	Knowledge	62	4 (6%)	58 (93%)
10	Confidence	61	10 (16%)	51 (84%)

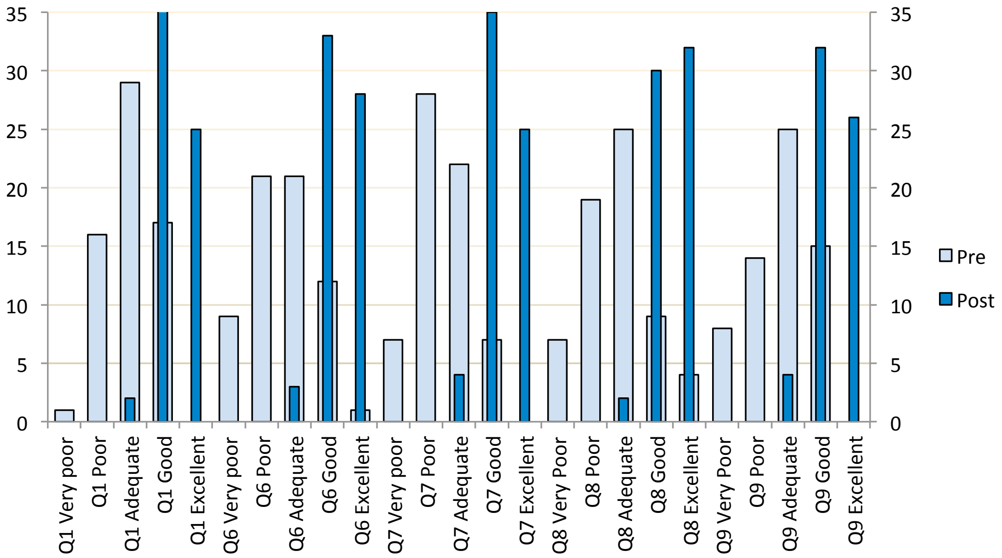

Figure 1: Participants self-rating of their knowledge in nasopharyngeal suction pre and post training. (y axis represents count).

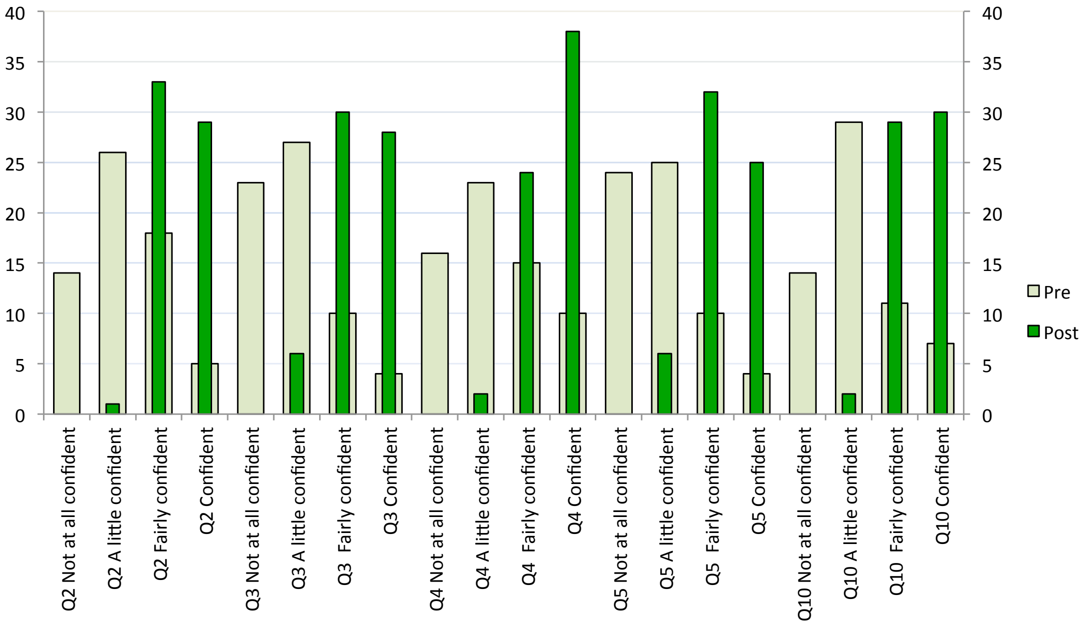

Figure 2: **Participants self-rating of their confidence in nasopharyngeal suction pre and post training. (y axis represents count).**

Discussion and conclusion

The training had a 67/67 (100%) success rate in training participants as competent in NPS without the need for supervision or assistance. This demonstrates the effectiveness of the physiotherapy led training package. There was an improvement in both trainee knowledge and confidence established through the self-evaluation questionnaires, demonstrating the perceived value of the training. It is known that developing confidence in newly qualified staff can enhance their competence in clinical skills (Bandura 2001). These findings suggest the different styles of training used within this package; theory, practical and OSCE, were acceptable to trainees. This supports literature from a Cochrane review demonstrating the use of combined training approaches, resulting in significant changes in professional practice (Thomson et al. 2001).

For the trainees whose knowledge or confidence remained the same from pre to post training evaluation, their pre-perceived knowledge or confidence was always high; scoring fairly confident, confident, good knowledge or excellent knowledge. The main areas that trainees felt least confident in prior to training was performing NPS on a new patient and problem solving. The main area trainees felt least confident in following their training was problem solving, however 90% of participants still self-rated themselves as fairly confident or confident. This was not surprising to the authors as trouble shooting potential problems that may arise during NPS on a manikin, is not a true representation of what may happen to a patient within a clinical environment. In practice, a patient may be agitated, moving, clinically deteriorating or have anatomical anomalies making safe and effective performance of NPS more difficult. This supports the reason for offering this competency training to qualified nursing staff, who are likely to have higher levels of confidence and background knowledge when dealing with more complex situations. Further support was additionally offered to trainees on a one-to-one basis following the training; however there have been no requests for this. This may be due to the high levels of confidence and knowledge achieved from the competency based training.

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There are some limitations within this service review and the findings discussed may not be generalised to other tertiary paediatric hospitals. The results demonstrate the effectiveness of the training programme; however as we did not assess the trainees NP Suction competency level prior to the training, we cannot declare that the success rate was due to the training package alone. There was a risk of bias as the OSCE was not consistently performed by an independent assessor due to staffing levels however this reflects true clinical practice. Additionally the use of self-evaluation forms could present a risk of bias, however the OSCE based competencies used in conjunction, would help to minimise this. Due to the success of the training package, it is now available to physiotherapists and other suitably qualified staff at AHCH.

The application of this training into clinical practice is unknown and a future consideration is to conduct concealed audits into clinical nasopharyngeal practice; identifying areas that require further work. The impact of this training on patients and their families is unknown and could be explored in the future. The impact of time on knowledge and confidence will be reviewed by the authors sending out a 9 month post evaluation form to all trainees. Interestingly, the majority of trainees were newly qualified staff and a future focus would be to expand the uptake of training in established staff. The training was not mandatory therefore trainees may have been subjected to higher levels of motivation and not truly reflective of the professional population. In the future the authors will focus on establishing this training package as mandatory for all relevant clinical staff, including regular updates and re-assessment of competencies. The findings of this service evaluation could have implications beyond this Trust, providing a baseline for a standardised training package for competency based NPS.

In conclusion, the physiotherapy led training package had a 67/67 (100%) success rate when training participants to perform NPS competently and independently. It also had a positive impact on self perceived rating of knowledge and confidence levels when performing the technique.

Key points

1) Following a theoretical and practical based training package, 67/67 (100%) participants passed an OSCE and competently suctioned a mannequin.
2) Following a theoretical and practical based training package, a large majority of participants reported an increase in knowledge and confidence.

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Appendix 1

Name:
Clinical Assessment Area (s):
Name of Assessor:

Competency criteria	**Competency level**						**Comments/ recommendations**
	1	2	3	4	5	6	
1. Can locate and demonstrate awareness of the Trust policies relevant to nasopharyngeal suction. *See appendix 1.*							
2. Can determine the need for suction using assessment of the child's respiratory system. *See appendix 2.*							
3. Can demonstrate an understanding of why increased pulmonary secretions adversely affect the patient. *See appendix 3.*							
4. Can demonstrate an understanding of the hazards of nasopharyngeal suction. *See appendix 4.*							
5. Can demonstrate the correct procedure for carrying out nasopharyngeal suction. Can give evidence based rationale to support all stages of the procedure. *See appendix 5.*							
6. Can demonstrate understanding of the role of the multi-disciplinary team with regard to nasopharyngeal suction. *See appendix 6.*							

Competency Assessment – Nasopharyngeal Suction

Competence Level – Key

- **Competence Level 1** – Has observed this activity.
- **Competence Level 2** – Has been involved in this activity with the support and assistance of experience colleagues (*Maximum level of competence for 3rd yr student nurse until assessed as competent*).
- **Competence Level 3** – Can perform this activity satisfactorily without the need for supervision or assistance.
- **Competence Level 4** – Can perform this activity satisfactorily in a timely manner.
- **Competence Level 5** – Can perform this activity, safely, in a timely manner while showing initiative and flexibility in response to the child and family's needs.
- **Competence Level 6** – Can perform this activity safely, in a timely manner, whilst responding to the needs of the child and family. Can lead and supervise others in performing this activity. (*Minimum level of competence for all assessors*).

Guidance notes

- This competency assessment tool is to be used in conjunction with the Nursing and Midwifery Council Code of Conduct.
- Competency Levels are indicated for both qualified and unqualified staff.
- For the practitioner / learner to be deemed competent – the indicated level must have been consistently achieved.
- Once competence has been achieved – the assessor must forward the name of the practitioner to the Competency Development Nurse for entry onto the Trust Training Database.
- Assessors must ensure that periodical review of any learning objective takes place and indicate assessment periods on the competency template.
- Practitioners are reminded that they should not attempt to carry out tasks which they are not competent or confident to do.

Verification of Competence

Signed by Practitioner / Learner: Date:

Signed by Assessor: Date:

- I confirm that the individual has been assessed as competent in nasopharyngeal suction.

Guidance notes

Appendix 1.

The Practitioner should know the location of Trust Policy documents in particular the Nursing and Infection Control folders.

The Practitioner should discuss policies relevant to nasopharyngeal suction including, consent to examination or treatment (C7), hand decontamination (C14), administration and prescribing of oxygen (C38), patient observation and monitoring on ward areas (C40) and resuscitation (C23).

Appendix 2.

The Practitioner should assess the following with reference to the Trust policy "Patient Observation and Monitoring on Ward Areas" (C40).

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- Colour.
- Respiratory rate and pattern.
- Signs of respiratory distress.
- Heart rate.
- Auscultation.
- Chest expansion.
- Palpation.
- SpO2.
- Effectiveness of cough.
- Need for sputum specimen.

Appendix 3.

The Practitioner should discuss the following indications for suction:

- Bradycardia secondary to hypoxia.
- Decreased SpO2 due to secretions.
- Increased work of breathing due to secretions.
- Inability to generate an effective/spontaneous cough.
- Aspiration.
- Visible secretions in airway causing distress.

Appendix 4.

Hazards of Naso-pharyngeal suction:

- Infection.
- Pain / discomfort.
- Trauma.
- Bradycardia.
- Desaturation.
- Pneumothorax.
- Atelectasis.
- Cardiac arrhythmias.
- Hypo/hypertension.
- Laryngospasm.

Appendix 5.

Equipment.

1. Suction source.
2. Oxygen.
3. Correct size suction catheters.
4. Bowl.
5. Sterile distilled water.
6. Vinyl gloves.
7. Oxygen saturation monitor.
8. Disposable apron.
9. Sterile gel for lubrication if required.

Procedure.

1. Action.

Check all equipment is available and in working order.

Rationale.

To maintain patient safety.

2. Action.

Explain and discuss the procedure with the child and their carer.

Rationale.

To ensure the child and their career understands the procedure and that the carer and child (dependent on age and developmental stage) gives valid consent in accordance to the trust policy “Consent to Examination or Treatment” (C7).

3. Action.

Prepare the child for the procedure. Position for safety and effectiveness; lying on their side; supine with head turned to side; supported in wheelchair.

Rationale.

To reduce the risk of aspiration.

4. Action.

Wash hands using antibacterial soap and water in accordance with the Trust policy “Hand De-contamination” (C8) and put on disposable apron.

Rationale.

To avoid cross-infection.

5. Action.

Choose an appropriately sized, graduated suction catheter, with a side port for suction control.

- Size of suction catheter should be half the diameter of the smallest nostril.
- Depth of suction should be measured from the nostril to ear lobe and then to the base of the neck. Record this depth of suction.

Rationale.

Suction can cause mucosal trauma and arrhythmias. Measured suction depth with multi-eyes catheters causes less trauma and arrhythmias (Odell et al. 1993).

6. Action.

Test suction pressure by placing thumb over end of suction tubing for 5 to 10 seconds.

Rationale.

There is a risk of atelectasis if the suction pressure is too high (Glass and Grapp 1995; Caroll, 1994).

7. Action.

Watch the maximum pressure on manometer and adjust if required:

- 20 kPa maximum for all children

Rationale.

To minimize the risk of atelectasis and hypoxia.

8. Action.

Attach the suction catheter to the suction tubing:

- Peel back catheter to expose hard plastic connector.
- Leave rest of catheter in protective cover.

Rationale.

To ensure sterility of catheter.

9. Action.

Put glove on dominant hand.

Rationale.

This gloved hand will be used to insert sterile catheter into airway.

10. Action.

Do not touch anything with the gloved hand *EXCEPT* the sterile part of the catheter.

Rationale.

To maintain a clean technique.

11. Action.

Remove catheter with gloved hand.

Rationale.

To maintain a clean technique.

12. Action.

Hold end of catheter with gloved hand and plastic connector with the un-gloved hand.

Rationale.

To maintain clean technique.

13. Action.

Check patient's baseline observations and breathing pattern immediately prior to inserting suction catheter with reference to the Trust policy "Patient Observation and Monitoring on Ward Areas" (C40).

Rationale.

Enable early recognition of any potential complications (refer to action point 1 of procedure).

14. Action.

If patient on oxygen increase oxygen flow rate for 1 minute. If patient not on oxygen consider giving oxygen prior to procedure. Refer to the Trust policy “Administration and Prescribing of Oxygen” (C38).

Rationale.

To prevent hypoxia.

15. Action.

With suction off, insert catheter diagonally backwards into the nostril until desired depth is reached.

Rationale.

To avoid hitting the top of the nasal passage with catheter and causing trauma.

16. Action.

If resistance is felt, pull back catheter and gently re-insert catheter at a slightly different angle.

Rationale.

To avoid trauma.

17. Action.

At desired depth, apply suction. After a count of 2 seconds, withdraw catheter slowly. Do not rotate, stir or trombone the catheter.

Rationale.

To maximize secretion removal whilst minimizing trauma.

18. Action.

Monitor the patient during and after the procedure using pre-suction baseline observations as a guideline in accordance with the Trust policy “Patient Observation and Monitoring on Ward Areas” (C40).

Rationale.

Early recognition of adverse effects is essential. Evaluation of effectiveness of procedure and reassessment of the patient.

19. Action.

If the child deteriorates during the procedure stop suction and initiate adequate measures as indicated by the Trust policy “Resuscitation” (C23) until the patient’s observations return to normal.

Rationale.

To resuscitate the patient so preventing further deterioration and promoting full recovery.

20. Action.

Re-attach the oxygen delivery equipment and wean oxygen to maintain SpO2 within normal limits for patient in accordance with the Trust policy “Administration and Prescribing of Oxygen” (C38).

Rationale.

To minimize hypoxia and to maintain patient safety and comfort.

21. Action.

Reassess the need for suction with reference to appendices 3 and 4.

Rationale.

Evaluation of effectiveness of suction and to determine if the procedure needs repeating.

22. Action.

Catheters should not be used more than twice or be flushed with saline or water prior to commencement of suction.

Rationale.

To maintain cleanliness of the procedure and equipment, therefore, minimising the risk of infection to the patient and person performing the procedure.

23. Action.

Once procedure is completed wind catheter around the gloved hand, disconnect from suction tubing and pull glove off, inside out.

Rationale.

Safe disposal of equipment and prevention of cross infection.

24. Action.

Flush tubing with sterile water.

Rationale.

Refer to the Trust policy “Cleaning and Decontamination of Medical Devices and Hospital Equipment” (C8).

Appendix 6.

The Practitioner should understand when further interventions may be necessary and should refer the child to medical staff or the physiotherapy team as appropriate.

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Appendix 2: The nasopharyngeal OSCE for nasopharyngeal suction.

NP suction OSCE for staff at Alder Hey Hospital

Please assess the trainee doing NP suction. The areas in red indicate a fail. The trainee is able to have 2 attempts for the OSCE, and if the trainee fails both attempts they will need to rebook onto the next nasopharyngeal suction training session.

The OSCES are to assess if the trainee is able to perform this activity satisfactorily without the need for supervision or assistance.

Name of trainee__________________________ Assessor_______________________

Area of work_____________________________ Date__________________________

No	OSCE assessment descriptor	Performed satisfactory	Performed but needed prompts	Performed but needed prompts
1	Question: What are the indications for NP suction?	2	1	0
2	Question: What are the contraindications for suction?	2	1	0
3	States wash/gel hands	2	Fail	Fail
4	Introduced themselves and explains procedure to patient	2	1	0
5	Checks has all the relevant equipment	2	1	0
6	Checks suction pressure is 20kps/150mmhg (hold for 5 seconds)	2	1	0
7	Selects appropriate catheter size and explains how this is measured	2	Fail	Fail
8	Correctly measures depth of suction	2	Fail	Fail
9	Positions patients appropriately	2	1	0
10	Checks baseline observations & breathing pattern	2	1	0
11	Pre oxygenate	2	1	0
12	Opens catheter and attaches to suction tubing (clean technique)	2	1	0

13	Puts glove on dominant hand (clean technique)	2	Fail	Fail
14	Removes catheter with dominant hand (clean technique)	2	Fail	Fail
15	Insert clean catheter into nasopharynx timely with suction not applied to pre measured depth	2	1	0
16	Withdraws clean catheter with suction on	2	1	0
17	Question: What would you do if you hit resistance?	2	1	0
18	Question: How many times can you use the catheter if kept clean?	2	1	0
19	Appropriately disposes of catheter and gloves	2	1	0
20	Question: What would you assess during and after NP suction?	2	1	0
21	Question: What would you do with the oxygen after NP suction?	2	1	0
22	Question: How do you know when to discontinue np suction?	2	1	0
23	Flush the suction tubing with water	2	1	0
24	States wash/gel hands	2	Fail	Fail
25	Question: What would you do if the patient significantly deteriorates during suction?	2	1	0
26	Question: What are the hazards of suction and how do you reduce this?	2	1	0

Score____/52

(Score 26 and over = pass)

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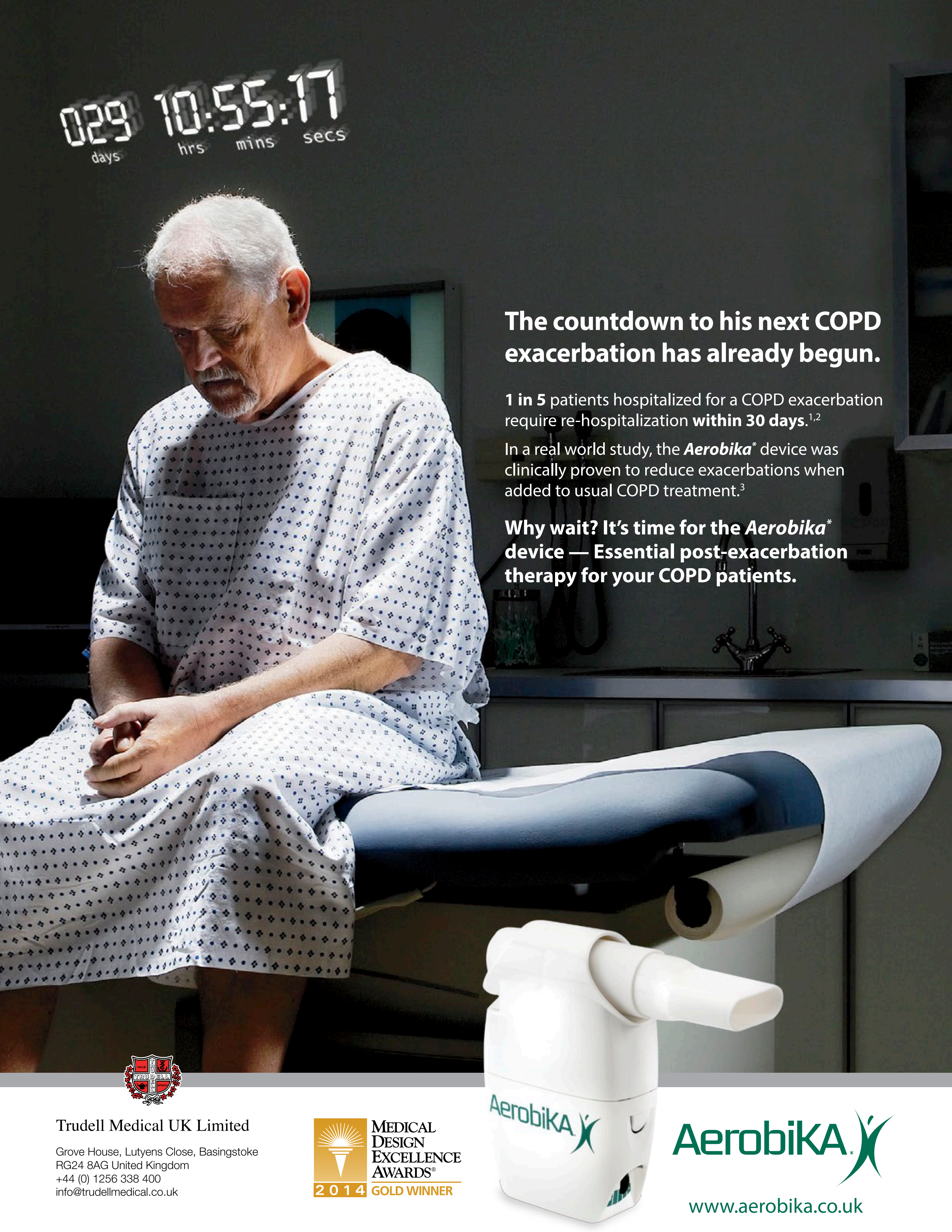

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Review clinical evidence here

Physiotherapy English National Standards of care for children with Primary Ciliary Dyskinesia (2018)

Schofield, L.M.[1] Lloyd, N.[2] Kang, R.[3] Marsh, G.[4] Keenan, V.[5] and Wilkins, H.M.[5]

Introduction

Primary Ciliary Dyskinesia (PCD) is a relatively rare hereditary disorder characterised by chronic infection of the upper and lower airway. In addition, approximately half of the patients have situs inversus and fertility issues are common. The multi-system problems related to PCD are highly disease-specific and therefore children and young people with PCD require access to a multi-disciplinary team (MDT) uniquely specialised in these systems to optimise care.

Since 2013 all children in England with PCD receive their care from one of the four specialist PCD management centres. Although the centres are located around England – Leeds/Bradford in the North, Leicester/Birmingham in the Midlands, The Royal Brompton in London and Southampton in the South West - many individual's live long distances from one of the centres. As such, network care arrangements have been developed between each specialist centre and their local centres to ensure that all patients, wherever they live, have access to specialist services and are managed according to current PCD standards of care.

Development of the document

The standards have been developed in association with the following documents, which should be consulted as required:

- 2013/2014 NHS Standard contract for Primary Ciliary Dyskinesia (PCD) diagnosis and management service (children) (NS England 2013)
- Primary ciliary dyskinesia: diagnosis and standards of care (Bush et al. 1998)
- Diagnosis, Monitoring and treatment of primary ciliary dyskinesia: PCD foundation consensus recommendations based on state of the art review (Shapiro et al. 2016)
- Primary Ciliary Dyskinesia: a consensus statement on diagnostic and treatment approaches in children (Barbato et al. 2009)

Produced by the English Paediatric PCD National Management Service Physiotherapists.

Authors

[1]Leeds General Infirmary, Leeds, LS1 3EX.

[2]Birmingham Children's Hospital, Birmingham B4 6NH.

[3]University Hospitals of Leicester, Leicester LE1 5WW.

[4]Royal Brompton Hospital, London SW3 6NP.

[5]Southampton General Hospital, Southampton SO16 6YD.

Keywords

Physiotherapy, PCD, standard of care.

Correspondence author

Lynne Schofield.

Email: lynneschofield@nhs.net

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- European Respiratory Society Guidelines for the management of adult bronchiectasis (Polverino et al. 2017)
- Guideline for Non-CF bronchiectasis, British Thoracic Society (Pasteur et al. 2010)
- BTS and ACPRC joint guidelines for the physiotherapy management of the adult, medical, spontaneously breathing patient (Bott et al. 2009)
- Standards of Care and Good Clinical Practice for the Physiotherapy Management of Cystic Fibrosis (CF Trust 2017)

Evidence based recommendations

In this document, the evidence used to support the recommendations has been graded using the Oxford Centre for Evidence-based Medicine - Levels of Evidence (Philips et al. 1998). The authors of these recommendations are committed to evidence-based practice. However, with a paucity of PCD specific research, current practice is predominantly based on evidence extrapolated from research in cystic fibrosis (CF) and non-CF bronchiectasis. Where there is an absence of PCD specific and age relevant evidence, evidence from other diseases (with consideration of the differences in pathophysiology) and anecdotal evidence have been used to form the expert opinion-based recommendations in this document.

Future aspirations

Looking into the future, PCD specific research is very much needed to guide and support the physiotherapy management of young people with PCD. Until a strong body of evidence is available, work on a broader European consensus document is planned. The authors welcome interest for collaboration on this future work.

1. Service standards

- All individuals with PCD, living in England and cared for by a paediatric service will have access to a specialist PCD physiotherapist through one of the four specialist PCD management services.
- If the individual with PCD lives a long distance from the specialist centre, the specialist PCD physiotherapist will work alongside local respiratory physiotherapists to provide ongoing monitoring and care throughout the year.

Clinics

- The individual with PCD should be seen at least once a year by the PCD specialist physiotherapist as an outpatient for their annual review.
- The individual with PCD should be seen by either the specialist PCD physiotherapist or a specialist respiratory physiotherapist at least three monthly at either their local hospital or specialist centre depending on where they live. If seen by a local respiratory physiotherapist, the specialist PCD physiotherapist should be available to support PCD care delivered by the local physiotherapy team.

In-patient care

- If/when admitted to their local hospital, the local hospital physiotherapy team will be responsible for the individual's physiotherapy care whilst an in-patient. This should include provision for weekend treatments and 24-hour physiotherapy on-call service. During normal working

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hours, the specialist PCD physiotherapist will be available to provide peer specialist advice and support via a direct telephone line, mobile and email.

School and home visits

- The specialist PCD physiotherapist should offer the opportunity for the individual with PCD to receive a home visit (this is generally offered to newly diagnosed patients and those patients undergoing a period of clinical instability).
- The specialist PCD physiotherapist should offer the opportunity for the individual with PCD to have a school visit from the specialist PCD physiotherapist when they start a new school or when commencing physiotherapy treatment at school.

Transition

- At the time of transition, the specialist PCD physiotherapist should liaise with the adult team and provide information regarding the individual's current physiotherapy needs and management.

Advice and education

- The specialist PCD physiotherapist should be responsible for providing individuals with PCD and their parents/carers with appropriate information and leaflets to help them do their physiotherapy treatment at home.
- During normal working hours, an advice service should be available to individuals with PCD, their parents/carers and other professionals involved in the life of the individual via a direct telephone line, mobile and email.

Equipment

- The specialist PCD physiotherapist will provide adjuncts for physiotherapy along with the individual's local physiotherapy service.

Clinical standards

- The specialist PCD physiotherapist is responsible for providing local hospitals and physiotherapists with paper-based and/or internet-based guidelines (such as PCD specific physiotherapy guidelines).
- The specialist PCD physiotherapists should be committed to undertaking regular audit and strategies to develop and improve the specialist PCD service.

2. Airway clearance techniques

General principles:

Recommendations:

- All individuals with PCD should be advised on an effective airway clearance regime by an appropriately experienced physiotherapist, ideally from diagnosis. (C)
- Airway clearance regimens should be individualised and age appropriate. (D)
- Physiotherapists should provide clear guidance on frequency and/or duration of airway clearance regimens including advice for during exacerbations. (D)

The ciliary function, which is essential to clear the respiratory tract from particles and organisms is impaired from birth in people with PCD. Although people with PCD have an intact and effective cough (Green et al. 2011), the mechanisms which mobilise and centralise secretions are reduced.

Airway clearance techniques are a range of interventions used to augment mucociliary clearance by manipulating the distribution of ventilation, optimising and biasing airflow, splinting open small airways and providing airflow turbulence. Airway clearance techniques are widely recommended in the management of PCD (Barbato et al. 2009). There is no evidence to guide the frequency of airway clearance interventions, as most individuals with PCD report a daily productive cough, thus once or twice daily effective airway clearance is recommended in clinical practice. Coughing can be a stigma in PCD (Whalley and McManus 2006) and in individuals not reporting a daily cough, it is important to ensure the patient is not under-reporting symptoms or cough supressing. An increased frequency of airway clearance may be needed to prevent secretion retention during periods of exacerbation if secretions are greater in volume or more difficult to clear. Airway clearance techniques are time consuming and are a burden of care for patients and families undertaking them. Clinicians should work alongside patients and families to balance the challenges of care with the benefits of treatments when agreeing an airway clearance regimen (McManus et al. 2003).

Regimen content:

Recommendations:

- The technique used during airway clearance should be chosen on an individual basis. Consideration should be given to both objective findings and patient engagement aspects including their level of independence and technique preference. If a technique does not appear to be currently effective for an individual, alternatives should be considered. (C)
- Breathing techniques including breathing control and forced expiratory techniques (huff) should be introduced as a component of airway clearance to all individuals as age appropriate. Breathing techniques including the Active Cycle of Breathing Technique (ACBT) and Autogenic Drainage (AD) should be considered for all patients, as age appropriate. (D)
- Advice on positioning during airway clearance should be individualised based on assessment findings and knowledge of the underlying condition. (D)
- The use of manual techniques (percussion, vibrations) may be indicated on a regular basis or during periods of exacerbation. Manual techniques method should be taught to any individuals required to perform them by a qualified physiotherapist. (D)
- When devising a regimen consideration should be given to the inclusion of a Positive Expiratory Pressure (PEP) device (simple or oscillatory). (D)
- When providing airway clearance devices, instructions on device cleaning and replacement should be given in line with local or regional infection prevention recommendations and manufacturers guidance. (D)
- It may be appropriate to consider high-frequency chest wall oscillation (HFCWO) in individuals who are unable to undertake any other form of airway clearance effectively. (C)

A range of airway clearance techniques are available and there is currently no evidence to support superiority of one technique. Research using multiple breath washout in PCD has indicated lung abnormalities may arise first in the peripheral airways (Green et al. 2011). Breathing techniques such as the forced expiratory technique, ACBT and AD, use airflow to mobilise secretions from peripheral to central airways (Miler et al. 1999). Breathing techniques can be introduced into airway clearance regimen as age appropriate and may require time and guidance to be optimised. Positioning can be used to influence regional ventilation and lung volumes during airway clearance (Pryor 1999). In PCD whilst mucociliary clearance is impaired throughout the lungs, bronchiectatic changes are more commonly found within the middle and lower lobes (Jain et al. 2007; Kennedy et al. 2007; Cohen-Cymberknoh et al. 2014). The risk of gastro oesophageal reflux during head down positioning for airway clearance should also be considered.

PEP devices can facilitate the splinting and ventilation of obstructed smaller airways (Gremmo and Guenza 1999). A range of PEP devices are available delivering either simple or oscillatory PEP with mask or mouthpiece interfaces. No one device appears superior and in current clinical practice different devices are used with different patients and in different centres. Oscillatory PEP devices may oscillate at frequencies similar to healthy ciliary beat frequency (McCarren and Alison 2006). The efficacy of these oscillatory PEP devices in PCD, where the cilia are often static or have an abnormal beat frequency, is unknown.

HFCWO has been shown to be as effective as physiotherapist administered postural drainage, percussion and vibrations (PDPV) in young people with PCD, with significant increases in lung function following both interventions (Gokdemir et al. 2014). Participants preferred HFCWO although this finding may be biased by the in-patient hospital stay required during the PDPV period but not the HFCWO period.

3. Mucolytic and muco-active agents

Hypertonic Saline:

Recommendations:

- Consider the use of inhaled hypertonic saline (3-7%) in individuals with PCD, to promote cough clearance and alter mucus consistency, to enhance the effectiveness of airway clearance techniques. The introduction of inhaled hypertonic saline should be timely and based on the clinical symptoms of the individual. (D)
- Inhaled hypertonic saline should be used as an additional tool and in conjunction with their physiotherapy treatment. Correct timing and application of the nebuliser within the individual's current airway clearance routine should be made apparent to the individual and their family by the clinician. (D)
- Use a face mask to target upper airways where sinus rinse is not tolerated or mouth piece to target lower airways. Alternatively use sinus nebuliser to target nasal clearance. (D)
- Ensure a clinical trial is carried out for the initial 'test dose' of hypertonic saline to confirm safety and suitability for the individual (see Appendix A). (D)
- A bronchodilator should be given, at the prescribed dose, immediately prior to the test dose of hypertonic saline *if* this is part of the individual's normal airway clearance routine. Consider introducing bronchodilator if FEV1 drops (as per Flow chart in Appendix A) on initial test and re-assess test dose. (D)
- Instruction about appropriate cleaning, sterilisation and maintenance of the nebuliser equipment is essential and should be given at the time of issuing the equipment. (D)

Inhaled hypertonic saline (3% to 7%) is used to promote cough clearance and alter mucus consistency to aid in secretion clearance. It is thought that hypertonic saline induces a change in the liquid within the airways, drawing it from the epithelium into the mucus. This alters the mucus' rheology by reducing its viscosity and elasticity, allowing the cilia to move and clear it more easily.

Inhaled hypertonic saline is recommended in consensus guidelines and is commonly used in the management of individuals with PCD (Shapiro et al. 2016). Research on its use in cystic fibrosis has been shown it to be an effective and safe adjunct to physiotherapy. Short-term benefits from hypertonic saline have been demonstrated in adults with non-CF bronchiectasis including improved quality of life, lung function and increased ease and amount of sputum expectorated. One randomised controlled trial, which compared hypertonic 7% saline with isotonic (0.9%) saline in adults with PCD found little evidence of the impact of hypertonic saline on a measure of quality of life (Paff et al. 2017). Despite the inconclusive findings of this trial, further evidence from larger, disease-specific and multisystem research in children is needed to come to a definitive conclusion (Kuehni et al. 2017). The long-term effects of hypertonic saline in comparison to isotonic (0.9%) saline remain comparable.

Using hypertonic saline via a sinus nebuliser may also be of benefit to individuals with chronic rhinosinusitis, although this is based on clinical expert knowledge as there is currently no relevant research in this field (see section 4).

RhDNase:

Recommendations:

- The use of RhDnase is not routinely used in individuals with PCD, however, it can be considered for enhancing airway clearance on an individual basis. (D)
- A clinical trial should be carried out for the initial ‘test dose’ of RhDNase to confirm safety and suitability for the individual (see Appendix A). (D)

RhDnase is not routinely commissioned by NHS England for the use in individuals with PCD (all ages) due to the absence of evidence supporting its use (NHS England 2018). A collection of case reports where RhDNase was used in the treatment of individuals with PCD have been identified, but collectively they do not substantiate sufficient enough evidence to support recommendation for general use in PCD (Desai et al., 1995; de Jongste 1999; El-Abiad et al. 2007). RhDNase is not recommended in individuals with Non-CF bronchiectasis due to possible clinical detrimental effects.

Mannitol:

Recommendations:

- The use of Mannitol is not routinely used in individuals with PCD, however, it can be considered for enhancing airway clearance on an individual basis. (D)
- A clinical trial should be carried out for the initial ‘test dose’ of Mannitol to confirm safety and suitability for the individual (see Appendix A). (D)

Inhaled dry powder Mannitol has not been studied in PCD. Benefits seen with use in the Non-CF bronchiectatic population include improved quality of life and facilitation of mucociliary clearance. Mannitol is not widely used in clinical practice in UK PCD management. Further research in this area is required.

4. Exercise

Recommendations:

- Daily cardiovascular exercise should be strongly encouraged in patients with PCD as poor exercise capacity is linked to reduced pulmonary function in PCD. (C)

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- Exercise may improve mucus clearance and can be used in conjunction with airway clearance techniques (C) but should not be considered a substitute for airway clearance.
- Physical activity advice should be individually tailored considering their health status. (D)
- Exercise testing should be considered in patients with PCD. (C)
- Urinary Incontinence screening/assessment should be considered in patients with PCD. (D)
- Postural/musculoskeletal assessment should be considered in patients with PCD. (D)

It is widely accepted that exercise has many health benefits in both health and disease. There is some evidence to show that patients with PCD have reduced exercise capacity compared to subjects without PCD (Valerio et al. 2012; Madsen et al. 2013,). The consensus amongst experts in the field is that people with PCD should strive to achieve equitable activity levels to those without disease, therefore current physical activity guidelines for healthy children are applicable to children with PCD (Bull et al. 2010).

In physiotherapy, exercise is used to enhance the clearance of bronchial secretions to maximise airway clearance. Within PCD specifically, there is some evidence to suggest that exercise may improve airway clearance (Philips et al. 1998). The authors of this study describe ten out of twelve children with PCD had a better bronchodilator response to exercise than a β2-agonist as measured by changes is peak expiratory flow rate (PEFR) and FEV1. However, the effect of sputum clearance resulting from multiple spirometry/PEFR manoeuvres and the exercise itself were not considered but may have played a significant role in the findings. Clearance of airway secretions is likely to be facilitated by bronchodilation, however more research is needed to support this finding.

Regular assessment of exercise habits, education on the importance of exercise in PCD and advice on how to exercise should be included in physiotherapy consultations. Formal exercise testing may help the identification of patients with reduced exercise capacity and assist the development of exercise programs.

Urinary incontinence:

Little is known about urinary incontinence (UI) within the PCD population. A higher incidence of UI is seen in other respiratory conditions characterised by chronic cough, partly due to the repeated coughing causing increased pressure on the pelvic floor (Dodd and Langman 2005; Massery 2005). As such consideration should be given to UI assessments in children with PCD.

Musculoskeletal:

Little is known about postural/musculoskeletal issues in children with PCD, these may need to be considered, as in other chronic respiratory conditions (Massery 2005).

5. Sinonasal management

Recommendations:

- As with effective FET and cough for the lower airway, the importance of nasal clearance/effective nose blowing should be taught as this will underpin any additional therapies introduced. (D).
- Advice on the use of sinonasal clearance devices including method (gravity assisted /positive pressure) and frequency should be individualised based on assessment findings, equipment availability and clinician decision. (D).

- Consideration should be given to assess for any co-existing conditions, which may exacerbate sinonasal symptoms (for example: asthma/allergy/hayfever) which may entail additional/separate treatment strategies. (D).

Nasal symptoms of a persistent nature are characteristic of PCD (Barbato et al. 2009). The management of sinonasal symptoms should be considered part of routine physiotherapy/ multidisciplinary PCD care.

General guidance for recognising sinonasal symptoms have been summarised in the *European Position Paper on Rhinosinusitis and Nasal Polyps* (Fokkens et al. 2012), with chronic rhinosinusitis (CRS) defined as:

- Inflammation of the nose and paranasal sinuses characterised by two or more symptoms, one of which must be nasal blockage/obstruction/congestion or nasal discharge (anterior/posterior nasal drip).
- Other possible symptoms include facial pain/pressure, reduction or loss of sense of smell (in adults) or cough (in children).
- Symptoms must have continued for at least 12 weeks

There is no clear consensus on the best treatment option for chronic rhinosinusitis in PCD (Barbato et al. 2009; Rubbo and Lucas 2017). Sinonasal irrigation is a safe, cheap and usually a well-tolerated treatment option (Chong et al. 2016), but further studies are needed to assess its effectiveness in PCD. Like Cystic Fibrosis, the sinuses may act as a bacterial reservoir in PCD (Alanin et al. 2015; Alanin et al. 2017). As the paranasal sinuses develop in varying stages up until full maturation in teenage years, ongoing and timely re-assessment of appropriate treatment options should be considered.

Considerations for treatment may be stratified by age as follows:

Up to 5 years:

- Nebulised medications to aid decongestion should be administered via a face mask to help alleviate both upper airway and lower airway symptoms (Kuehni et al. 2017).
- Focus on education/games for nose blowing when age appropriate to aid nasal cavity clearance.

5 years and over:

- Focus education on nose blowing to aid nasal clearance
- Nasal rinsing may be introduced from ages 6 and upwards to aid more effective sinonasal clearance, however, this should be individualised based on assessment findings
- Face masks may still be used for nebulised therapies and encouraging intermittent nasal inhalation for more targeted deposition in the upper airway.
- Consider switching to nebuliser mouthpiece administration to bias the lower airway, if targeted therapy sinonasal management is well established.

Teenage-adulthood:

- Regular nose blowing.
- Regular saline sinonasal rinsing, if clinically appropriate.
- Regular medical and ENT reviews should be undertaken for presence of polyps/obstructive tissue.

- Sinonasal nebulisation may be considered as targeted therapy, should sinonasal rinsing not be tolerated.

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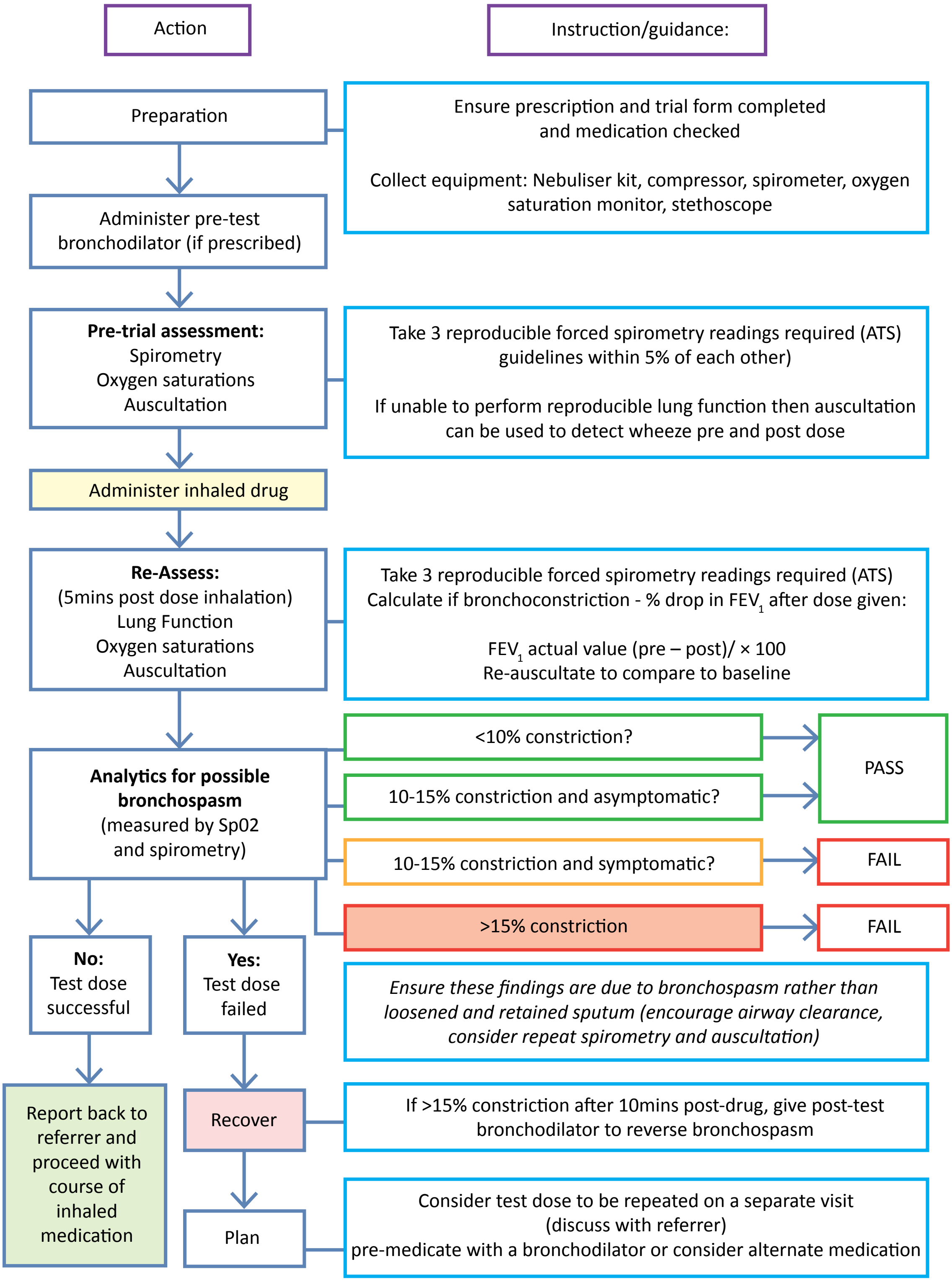
Appendix 1: Test dose procedure flow chart



Action

Instruction/guidance:

Preparation

Ensure prescription and trial form completed and medication checked

Collect equipment: Nebuliser kit, compressor, spirometer, oxygen saturation monitor, stethoscope

Administer pre-test bronchodilator (if prescribed)

Pre-trial assessment:
Spirometry
Oxygen saturations
Auscultation

Take 3 reproducible forced spirometry readings required (ATS) guidelines within 5% of each other)

If unable to perform reproducible lung function then auscultation can be used to detect wheeze pre and post dose

Administer inhaled drug

Re-Assess:
(5mins post dose inhalation)
Lung Function
Oxygen saturations
Auscultation

Take 3 reproducible forced spirometry readings required (ATS)
Calculate if bronchoconstriction - % drop in FEV_1 after dose given:

FEV_1 actual value (pre – post)/ × 100
Re-auscultate to compare to baseline

Analytics for possible bronchospasm
(measured by Sp02 and spirometry)

<10% constriction? → PASS

10-15% constriction and asymptomatic? → PASS

10-15% constriction and symptomatic? → FAIL

>15% constriction → FAIL

Ensure these findings are due to bronchospasm rather than loosened and retained sputum (encourage airway clearance, consider repeat spirometry and auscultation)

No:
Test dose successful

Report back to referrer and proceed with course of inhaled medication

Yes:
Test dose failed

Recover

If >15% constriction after 10mins post-drug, give post-test bronchodilator to reverse bronchospasm

Plan

Consider test dose to be repeated on a separate visit
(discuss with referrer)
pre-medicate with a bronchodilator or consider alternate medication

Figure 1. Reproduced with permission from G Marsh from the Royal Brompton Hospital's Drug response testing proforma 2016 version 2.

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Review Article

Medico-legal advances in the care of people in a prolonged disorder of consciousness: updating practice

Julie Latchem-Hastings[1] and Geraldine Latchem-Hastings[2]

Introduction/overview

Focussing on applications to the court of protection for withholding/withdrawing clinically assisted artificial nutrition and hydration (CANH), in this review article we chart the extraordinary recent legal and medical practice changes in the care of people with a prolonged disorder of consciousness. In doing so we highlight key ethical questions arising from these cases to be used for your own reflective practice and discuss how these changes and new forthcoming guidelines by the British Medical Association are important for physiotherapists working in respiratory care.

Authors
[1]Dr Julie Latchem-Hastings, School of Medicine, Cardiff University, UK.
[2]Dr Geraldine Latchem-Hastings, School of Healthcare Sciences, Cardiff University, UK.

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Correspondence author
Dr Julie Latchem-Hastings.
Tel: 02920 687951.
Email: LatchemJM@cardiff.ac.uk.

Background

Disorders of consciousness (DoC) refer to a collection of disorders: coma, the minimally conscious and vegetative state[1] (Owen 2008; Bernat 2009; Demertzi et al. 2011). Briefly, 'coma' although a term in common parlance to cover a range of disorders of consciousness specifically refers to the state of unconsciousness which rarely lasts for more than a few weeks. Most people who remain unconscious (rather than dying or recovering consciousness) after a few weeks enter either a vegetative or minimally conscious state.

The vegetative state (VS) is a state in which people:

> *never regain recognisable mental function but recover from sleep-like coma in that they have periods of wakefulness when their eyes are open and move; their responsiveness is limited to primitive postural and reflex movements of the limbs* (Jennett and Plum 1972, p. 734).

If a patient is in a VS it is deemed 'permanent' (with recovery of consciousness highly unlikely) after six months or a year, depending on the nature of the original injury (and considering

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[1] DoC are distinct from 'locked-in' (people who are conscious but totally paralysed following brain damage) and brain death' (where there is a complete loss of all brainstem function and these people are considered legally dead).

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issues such as infections, medical stability, any trajectory of change) (see Royal College of Physicians guidelines 2003; 2013 and Multi-Society Task Force 1994).

The *minimally conscious state* (MCS), a diagnostic category defined in 2002, is a condition in which the person shows limited and inconsistent, but clear evidence of awareness (Giacino et al. 2014; Estraneo et al. 2015). Unlike VS patients, people in MCS can sometimes, but not consistently follow simple commands, make verbal or gestural yes/no responses, have some intelligible speech or make purposeful movements. The line between vegetative and minimally consciousness, can often be very small, so much so, that diagnoses of VS or MCS are often contentious (Nettleton et al. 2014; Latchem 2017).

For those who remain in any of the DoC for more than 4 weeks following sudden onset acquired brain injury, they are considered to be in a *Prolonged* Disorder of consciousness (PDoC) (RCP 2013).

Nobody knows exactly how many PDoC patients there are being maintained long-term in UK communities and care homes, but estimates suggest there are somewhere upwards of 4,000 VS patients and 12,000 MCS patients. Historically most people would have died of severe brain injury through apnoea (Demertzi et al. 2011), however due to advancements in medical technologies (such as resuscitation, surgical procedures, innovations in intensive care (Demertzi et al. 2011), and the delivery of food and fluids artificially) more people are not only surviving severe brain injury but can be sustained in a PDoC for many years (Kaufman 1993; 2000; Kitzinger and Kitzinger 2012). Although the treatments provided to this patient group are often (although not always) 'futile' in that, they do not restore these patients' consciousness or function, most of these patients are being given treatment indefinitely.

Life-prolonging treatments and the burden of 'futile' treatment

For other patient groups, life-prolonging treatments (including CANH) are withdrawn in intensive care, care homes and hospices across the country when such treatments are futile, burdensome, unwanted or not in the patient's best interests (Kitzinger 2017). This is most often *not* the case for people in a PDoC. Why is this the case for this patient group? The answer is a complex and multifaceted one, but it is largely due to four main areas:

1) uncertainty about the extent of brain damage and prognosis of the patient (their likelihood of recovery) in intensive care.
2) The reducing 'window of opportunity' for death once these patients are medically stable (see Kitzinger and Kitzinger 2012).
3) Clinicians with conscientious objection or ethical concerns about withholding treatment and not including CANH withdrawal within routine best interest decision meetings and
4) judicial involvement in decisions about the withdrawal of feeding tubes from this patent group.

This article focusses on the fourth of these factors – judicial involvement both past and present, in decisions about the withdrawal of clinically assisted artificial nutrition and hydration (CANH) from a person in a vegetative or minimally conscious state.

The history of judicial involvement in CANH withdrawal from patients in a permanent vegetative or minimally conscious state

The withdrawal of a feeding tube from a person in VS was first brought to the attention of an English court in the early 1990s in the aftermath of the Hillsborough disaster. In 1989 Tony Bland, a Liverpool football supporter was crushed in the stadium. His broken ribs punctured his lungs, leading to hypoxic brain injury and a subsequent diagnosis of Permanent VS (PVS). Convinced that their son would not want to be maintained in this condition, in 1993 his parents and the treating doctor decided it would be best to withdraw his feeding tube and allow him to die. However, when the medical team consulted the coroner, he said doing so would be 'murder' and the case was subsequently taken to court.[2]

Seeking to allow doctors to withdraw CANH without fear of prosecution, the case went as far as the Supreme Court. Here, the judges decided that withdrawal was lawful, but it was also agreed that '*until a body of experience and practice has been built up*', future cases should be heard by the courts (*Lord Keith, Airedale NHS Trust v Bland [1993] AC 789*). Until recently it has therefore been widely believed that this part of the ruling still applies to withdrawal of feeding tubes from patients in a vegetative – and to those in a minimally conscious state.

Since the case of Bland, approximately 120 cases have come to court. Cases which involve the sanctity of life are ruled on by weighing up a person's 'critical' versus 'experiential' interests (see Table 1). Early PVS cases focussed on establishing that these people have no experiential interests. In all cases where the court felt all appropriate measures had been taken and were confident in the PVS diagnosis, approval to withhold CANH and allow the person to die have been granted. However, these cases have mostly come to court when all parties (treating team and family) have agreed that CANH should be withheld.

Table 1: Experiential v critical interests explained.

Experiential Interests	Critical Interests
The things that people do just because they like the experience of doing them e.g. eating, going out with friends, doing sport etc. The value of such things depends on the fact that people find them pleasurable or exciting as experiences. These preferences might be viewed as frivolous rather than profound like critical interests.	These are the things that people would think that their life had been wasted or they were worse off in some way without. These are convictions about what helps to make a good life. They represent critical judgments rather than experiential preferences. They are the kind of things that make a person think, had it not been so, their life would have been worse or wasted e.g. having a close relationship, or fulfilling a duty.

The first case in the UK where a request to the court was made for the withholding of CANH from a patient in MCS came in 2011[3]. The initial application however was made thinking that 'M' was in PVS but assessments made for the case concluded that she was in fact in a MCS.

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[2] Airedale NHS Trust v Bland [1993] AC 789.

[3] W-v-M [2011] EWHC 2443.

M suffered extensive and irreparable brain damage at the age of 43 following viral encephalitis in 2003. She was entirely dependent on others for her care, including being fed artificially. With respect to M's critical interests, her family provided clear evidence that M would not wish to have her life maintained in such circumstances. M's sister gave evidence saying

> *"She can't even enjoy a cup of tea. She's got no pleasure in life. Her daily routine is just being taken out of bed, put in a chair, showered, then put back to bed. There's no dignity in it. It's not a life, it's an existence, and I know she wouldn't want it. She would be horrified by her existence. Horrified. I don't want her to suffer any longer. There is no light at the end of the tunnel. There is nothing. We have gone down every avenue. We have tried everything and there is no rehabilitation. I'm just looking for a peaceful end for my sister. I know she would not want to carry on living like this. I cannot bear the thought she is going to live X amount of years in this state. It is cruel."*

Unfortunately, M did not have an advance decision (see Table 2) but she had expressed a view that she would rather not be kept alive in a similar scenario.

Table 2: Learning Activity 1.

What is an advance decision? What is a lasting power of attorney for health and welfare?

(To check your understanding and the answers to these questions go to our PDoC training resource for Allied Health Professionals www.cdoctraining.cdoc.org.uk)

Opposing the application, the Official Solicitor argued that withdrawal of life-sustaining treatment would amount to murder, as well as a breach of the European Convention on Human Rights and if a balance sheet exercise was deemed applicable, this should result in favour of maintaining M's life. The court rejected the application and it was agreed that the balancing exercise weighed in favour of maintaining life. For Mr Justice Baker, the crucial distinction between a patient in PVS and one such as M—in MCS was that she could experience some pleasure from her existence. With conflicting evidence and consequential uncertainty over quite how much pleasure in comparison to suffering M had actually experienced, Mr Justice Baker chose to disregard the evidence regarding what M would have wanted had she been able to contribute to the decision. Here sanctity of life and the potentiality of being able to experience some quality of life, however small won over the previously expressed values and beliefs of M as a prior competent self-determining adult.

This concept/value of 'prior expressed values and beliefs' of a competent person having weight in and for decision-making for their future incompetent self (a future self who lacks capacity to make decisions for themselves) is one core premise of the Mental Capacity Act (MCA), introduced in 2005. Slowly, following the bedding in of the MCA, core values from the act have begun to influence PDoC cases. Over time arguments have focussed less on sanctity of life, potential for improvement and experiential interests and more on individual autonomy and patient's prior express values and beliefs. For example, the case of Paul Briggs in 2016[4] was highly significant, in that Paul was considered to have rehabilitative potential and his treating team did not think that CANH withdrawal was in his best interests. Paul's wife however, told the court of the strength of Paul's prior expressed values and beliefs. For Paul, even with the fulfilment of the prognosed

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[4] Briggs -v- Briggs & Ors [2016] EWCOP 53

improvement, that life would still not be one he would have considered to be of any quality. Due to the evidence for and the strength of Paul's prior expressed values, the court judged that his feeding tube could lawfully be removed.

Table 3: Learning Activity 2.

What do you understand by best interest decision making?
What do you understand your own role to be in this process?
(To check your understanding of best interests go to the law and ethics section in our PDoC training resource for Allied Health Professionals www.cdoctraining@cdoc.org.uk)

Despite the establishment of this body of practice, the consistency of judgments for VS cases and the developments in MCS cases, both PVS and MCS cases were still being referred to the court, causing enormous expense and those involved often experiencing long delays. Such delays then meant that individuals were being treated longer than necessary, causing great distress for their family and for the clinicians treating them (see Kitzinger and Kitzinger, 2017). Such experiences of the process of getting to and going through court cases contributed to a growing agreement amongst many medics, academics and lawyers that in the main these cases should be managed through best interest decision making by the treating team rather than being referred to court. In 2018, the legal position on such cases was finally clarified; initiated by the case of 'Mr Y'.

Recent legal challenges and case law – the case of Mr Y

A man anonymously known as 'Mr Y' was in a vegetative state following resuscitation after cardiac arrest. Both his doctors and his family believed that it was not in his best interests to continue with CANH because he would not have wanted to live in a vegetative state or with catastrophic brain injuries.

Instead of making an application to the Court of Protection as is usual in such cases, the Trust issued an application in the Queen's Bench Division of the High Court for a declaration that it was not mandatory to seek the court's approval for the withdrawal of CANH from a patient with PDOC in a situation such as Mr Y's. The case was heard in December 2017[5]. In this pivotal case it was not mandatory to bring before the court the withdrawal of CANH from Mr Y since the clinical team and Mr Y's family were agreed that continued treatment was not in his best interests. In making the judgment, Mr Justice Jackson based his decision on the MCA 2005. He pointed out that if clinicians make decisions, including treatment withdrawal decisions, "in the best interests" of incapacitated patients they are protected against liability by section 5 of the Act, so do not require the additional security of a declaration from the court. However, he also highlighted that the court still has a role in some of these cases – to be available in situations where there is disagreement or where it is felt that, for some other reason, an application should be made.

The Official Solicitor appealed against this decision and the appeal was heard in the Supreme Court[6]. The question for the Supreme Court was: if doctors and families follow a robust best

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[5] NHS Trust v Y [2017] EWHC 2866 (QB), [2017] MHLO 37.

[6] An NHS Trust and others (Respondents) v Y (by his litigation friend, the Official Solicitor) and another (Appellants) [2018] UKSC 46

interest decision making process and both agree that continuing CANH would not be in the best interests of the patient, then is judicial involvement required?

It is important to keep in mind that:

1) As highlighted earlier, CANH had been established in law as a medical treatment in the case of Tony Bland in 1993 (Airedale NHS Trust v Bland [1993]).
2) That it can, and should be withdrawn when it is no longer in a person's best interests.
3) Medical practitioners withdrawing CANH are not guilty of murder nor is this 'euthanasia' or 'assisted dying' under the law.

In the case of Y, the Supreme Court ruled that judicial approval is not mandatory before withdrawing CANH from people in a PDoC, upholding the decision of Mr Justice Jackson in 2017. The Supreme Court judgment brings the treatment of patients in prolonged disorders of consciousness in line with decision-making about other patients (e.g. with dementia or advanced neurological illnesses) for whom best interests decisions concerning withdrawal of medical treatments (including CANH) can already be enacted without having to seeking court approval (unless there is disagreement).

Impact on practice and new clinical guidelines in 2018.

New guidelines around providing or withholding CANH for adults who lack the capacity to consent are currently being prepared by The British Medical Association (BMA), the Royal College of Physicians (RCP) and the General Medical Council (GMA), in consultation with a wide range of stakeholders. These new guidelines are due to be published in the autumn of 2018. In the meantime, interim guidelines from the BMA, RCP and GMC have been written and made available via the BMA website: https://www.bma.org.uk/advice/employment/ethics/mental-capacity/clinically-assisted-nutrition-and-hydration.

What does it mean for physiotherapists working in cardio-respiratory care? Opportunities and challenges

While this article focuses on the new changes in relation to the withdrawal of CANH, questions are being and need to be asked of decision-making processes earlier on the pathway of this patient group. The MCA (2005) S, 4(6)(a) focus on a person's prior expressed values and beliefs and his/her ability to have decision-making power over his/her own future incapacitated self is the key to the shift in legal decision making in these cases.

The recent case of Paul Briggs which focussed not on Paul's potential for rehabilitative improvement but on the strength of his prior expressed values and beliefs that no matter how much he may improve, this improvement would not, for him, be a life he considered acceptable – was pivotal in the decision to withhold his CANH and allow him to die.

Care and treatment early in the acute pathway must be driven more equally between finding out about the patients prior expressed values and beliefs, any lasting power of attorney (LPA) for health and welfare or advance decision as it is by medical information and prognostic expectations. This is critical for physiotherapists working in respiratory care as they contribute to decision making processes and provide life-sustaining interventions such as tracheostomy and chest care. While the provision of high quality medical intervention is critical to patient care, so is the avoidance of providing unwanted, burdensome or futile interventions.

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The essence of this is beginning to be also expressed in clinical literature. For example, the new 'consensus statement' on managing devastating brain injury (Harvey et al. 2018) - endorsed by the Intensive Care Society and many other bodies, states:

> *"In the situation where patient-centred outcomes are recognized to be unacceptable, regardless of the extent of neurological improvement, then early transition to palliative care is appropriate."* (Harvey et al. 2018, p.138)

In conclusion, in the 21st century it takes a good understanding of the law and moral courage to get best interest decision making right for individuals in a PDoC. However, through research, legal cases, public debate, practitioner and organisational learning, better care for these patients is being established.

Where to get guidance and support?

Alongside the consensus statement above and the interim and forthcoming BMA guidelines, online learning about PDoC specifically for AHPs have been produced by the Coma and Disorders of Consciousness Research Centre and can be accessed freely online here at www.cdoctraining@cdoc.org.uk. A section of this learning resource focusses on the current law and practice around the providing, withholding or withdrawing of treatment and will be updated in line with the new BMA guidelines once published. Further freely accessible resources, including a dedicated resource about life sustaining treatment decision making for people who lack capacity to consent will also be made available via the CDoC website in the autumn of 2018.

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W -v- M [2011] EWHC 2443.

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Textbook of Pulmonary Rehabilitation

Editors: Clini, E., Holland, A.E., Pitta, F., Troosters, T. (Eds.)

This is without doubt a comprehensive textbook of pulmonary rehabilitation that has been written by authors with an authority in respiratory disease and expertise in pulmonary rehabilitation.

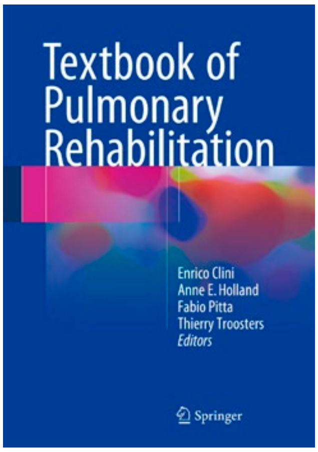
The foreword provides an overview of the book's intentions and useful summary of the current issues and rationale behind pulmonary rehabilitation which the book sets to address. The book proceeds to provide well-structured and well-evidenced chapters with a range of relevant elements of pulmonary rehabilitation including some practical aspects such as identifying participants, assessment, components of and organisation of pulmonary rehabilitation services.

This textbook actually often goes beyond pulmonary rehabilitation and could be viewed as an extensive resource regarding respiratory disease as it includes some physiological aspects in detail and therefore has a potentially wider appeal to health care professionals working in a range of respiratory medicine. At times it may feel as though there is a lot of scientific detail and less practical 'how-to' information or specific case examples for those delivering pulmonary rehabilitation, but this textbook does present an up to date extensive evidence base of the literature for all aspects of respiratory disease and achieves its aims of reviewing this with a focus on pulmonary rehabilitation.

There is an emphasis on the multi-disciplinary team and well as new concepts in pulmonary rehabilitation including telehealth, contemporary alternative settings and specific patient populations such as interstitial lung disease which are all extremely useful and interesting chapters.

Overall this textbook would be a welcome addition to any pulmonary rehabilitation service as a point of reference on a wide range of subjects and patient scenarios and an essential text for respiratory physiotherapists working in this clinical area.

Cath Edwards, Clinical Lead Physiotherapist, Lancashire Teaching Hospitals NHS Foundation Trust.



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