Volume 56 Issue 3 November 2024
ISSN 2059-0199 (Online)

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Contents

Editorial

Editorial

Owen Gustafson, Elizabeth King

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

We are delighted to bring you the third and final issue of the *Journal of the Association of Chartered Physiotherapists* in Respiratory Care for 2024.

As 2024 draws to a close, we are excited for the future of the ACPRC Journal in 2025. At the start of the year, we will be advertising for a member to join the Journal on an internship for six months. This internship will be suited for a member with very little experience of publishing in peer review journals but would like to gain experience of the process. During the six months the intern will gain experience of reviewing manuscripts, the peer review process, liaising with authors, and compiling and publishing an edition of the Journal. Please look out for the advertisement in the new year and do contact us to discuss the opportunity further.

This issue has nine articles that encompasses a variety of manuscript styles and topics that highlight the breadth of work that is undertaken in respiratory physiotherapy. It opens with a thought-provoking commentary by Janice Harvey which discusses the role of physiotherapy in organ donation, and is followed by a service evaluation of physiotherapy in the management of non-tuberculous mycobacterial infection and pulmonary disease by Morrison et al. We have a variety of surgical articles in this issue by Finze et al., Pond et al. and Clarke et al. on the topics of head and neck surgery, prehabilitation and paediatric cardiac surgery respectively. This is followed by two articles on critical care which include a case study of personalised care by Jones et al. and a survey on inspiratory muscle training by Davis et al. Finally, the issue concludes with an ACPRC position statement on Simulation Based Education in respiratory physiotherapy and an accompanying commentary by the ACPRC Editorial board.

The ACPRC Journal is supported by many peer reviewers who volunteer their time and expertise, and without them the Journal would not be able to function. At the end of this issue, we have thanked our colleagues who have taken the time to peer review for the Journal in 2024.

We are keen to support members in developing both their projects for publication and their academic writing. We would like to encourage members to contact us to discuss at journal@acprc.org.uk if they would like support or guidance in developing your manuscript or potential ideas for publication. Additionally, if members would like the experience of peer reviewing articles, please get in touch and we will be able to support and guide you through that process.

Dr Owen Gustafson and Miss Elizabeth King
Co-Editors

Commentary

Physiotherapy for the Potential Organ Donor- are we maximising our role?

Janis Harvey, BSc, MSc[1]

[1] Major Trauma Service, Royal Infirmary of Edinburgh

Keywords: Organ donation, respiratory, physiotherapy

https://doi.org/10.56792/UGFI9899

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

Is there a greater gift than that of an organ for transplant? Optimising the potential organ donor, with the aim of increasing the number of organs available for transplant, has started to receive a lot more attention in the critical care field. This discussion has included how we as physiotherapists could work to maximise our contribution. However, before exploring this further, we need to consider consistency and equity of our practice. Is there discord between *knowing* we as physiotherapists have a role to play in increasing the number of organs available for transplant and translating that to being *actively involved* in optimising the potential organ donor? There is a need for us to understand why and how physiotherapists can contribute while exploring and addressing clinicians perspectives about their role for this patient group.

THE RECIPIENT AND DONOR IMBALANCE

For many living in the UK with organ failure, solid organ transplant remains the only means to restore essential functions and lengthen life. The number of people in need of a transplant in the UK is the highest in the last decade.[1] Unfortunately, the demand for organs continues to exceed supply, and many patients will have a long wait, or die, before suitable organs can be identified for transplant. Opt-in legislation across the UK has seen a steady increase in the number of people on the NHS Organ Donation Register, but only a small number of people die in the right circumstances to be eligible to donate organs.

In the UK there are two deceased organ donation pathways. Donation after circulatory death (DCD) follows confirmation of death using cardiorespiratory criteria. Time to asystole will impact the suitability of a DCD donor. Organ donation after brain stem death (DBD) follows diagnosis of death using neurological criteria. For the DBD donor, once consent/authorisation for organ donation has been established, critical care should transition seamlessly from treatment for recovery, to delivering evidence-based donor management to reduce organ injury. Unlike DCD, the progressive brainstem compression that occurs following neurological death means DBD donors are at significant risk from the adverse haemodynamic, metabolic, and hormonal effects which ensue and threaten organ viability for transplant.

OPTIMISING THE POTENTIAL DONOR

Although referral rate of potential donors to the Organ Donation Services Team remains high, conversion of potential donors to successful donors remains challenging.[1] To maximise the quality and quantity of organs to be donated and thus successful transplantation of the available organs, management of the potential organ donor must be optimised, particularly respiratory function which will enhance donor cardiopulmonary status.[2] Healthcare staff, especially those within critical care, have a key role in achieving potential donor optimisation, physiotherapists included. Our role as physiotherapists within critical care is well established, particularly in providing respiratory assessment and a range of interventions to prevent, support and resolve respiratory failure,[3] optimising respiratory function. This role of the physiotherapist is acknowledged in the NHS Blood and Transplant (NHSBT) DBD donor optimisation care bundles which are in use to promote consistency in clinical practice in adult[4] and paediatric patients.[5] Such bundles have also been shown to improve the rate of organs retrieved and function in those transplanted.[6] The bundle indicates that in addition to delivering lung protective ventilation strategies (which have been shown to double the number of lungs transplanted compared to conventional strategies[7]), head up positioning and airway suctioning, the patient should continue to have physiotherapy input.

A ROLE FOR PHYSIOTHERAPY?

It stands to reason that physiotherapists are well placed to contribute to optimisation of the potential donor- compromised gas exchange and chest x-ray changes are the most common reasons for donor lungs failing to meet transplant suitability criteria[8] and both can be improved through respiratory physiotherapy interventions. But despite this, best practice in this area of physiotherapy remains unknown[9-11] and physiotherapy practices for the potential organ donor are variable and inconsistent.[11] Thus, how can we as a community of respiratory physiotherapists maximise our role in the optimisation of potential organ donors and so contribute to the expansion of suitable organs for transplant?

IS THERE A KNOWLEDGE GAP?

Physiotherapy for the potential organ donor is a limited field of practice within critical care and so can be difficult to amass clinical experience. Utilisation of physiotherapy networks and social media can prove fruitful in sharing resources and has provided connections between clinicians with more (and less) exposure in the field.

In my experience building relationships with local Specialist Nurses in Organ Donation (SN-ODs) has created valuable links between services, enhanced our knowledge, and supported clinical decision making. Having recently been involved in developing an education resource on the role of physiotherapists for potential organ donors for the SN-OD optimisation course, there is raised awareness of the physiotherapist's role and advocacy in the wider multidisciplinary team. Therefore, it is important that all physiotherapists are aware of our potential involvement with such patients.

Donor management protocols often include strategies to optimise oxygenation which overlap with physiotherapy interventions but fall short of specifying continuation of physiotherapy. It is possible that this may impact engagement of physiotherapists with such patients,[9] but there is clear recognition of role contribution in the NHSBT donor optimisation bundle, which should be harnessed as an invitation for physiotherapists in the UK to advocate for their involvement with this patient group.

I have seen firsthand that delivering physiotherapy to potential organ donors is not a consistent priority, likely being compromised by competing clinical demands.[11] It is widely recognised that many acute physiotherapy teams are under pressure to efficiently utilise an already limited resource. Is prioritising out the potential organ donor simply due to this? Or does a lack of knowledge about the physiotherapist's role/physiotherapists perspective of their role in this circumstance play a factor? This remains largely unexplored for UK physiotherapists in the available literature.

The introduction of protocols to guide physiotherapy for potential organ donors could aid in achieving consistency of input. A 2021 Australian survey[10] showed such protocols to be preferred in lower donation rate hospitals, but clinical reasoning preferred in higher donation rate hospitals. This may reflect organ donation being a small field of practice, so protocols are welcome in supporting less experienced teams/staff members. It seems logical for such guidance to be established by higher donation hospitals who have more exposure to this patient group. This is why in Edinburgh, where we have the highest number of organ donors in Scotland,[1] a collaboration between physiotherapy and SN-ODs led to the development of local guidance for physiotherapy management during donor optimisation, which has since been adopted in other hospitals across Scotland and adapted for use in other UK hospitals (Image 1).

Ultimately, a consensus statement on the role of the physiotherapist for the potential organ donor would be a positive start towards improving consistency of input, as would UK based research to explore current usual care. In the meantime, this is a call to all physiotherapists who may be involved with this patient group to be curious- consider current practice, openly discuss the potential impact of respiratory physiotherapy for this patient group, connect and collaborate with local SN-ODs and most importantly, advocate for our role in donor optimisation.

Key points

- The number of people in need of a transplant in the UK continues to exceed supply.
- To maximise the quality and quantity of organs to be donated, it is crucial that potential organ donors are optimised, particularly respiratory function.
- Physiotherapists should be well placed to contribute to potential donor optimisation as respiratory physiotherapy assessment and intervention can improve compromised gas exchange and chest x-ray changes.
- Physiotherapy for the potential organ donor is a limited field of practice within critical care and so can be difficult to amass clinical experience.
- Utilising professional networks, local specialist nurses in organ donation, accessing available physiotherapy management protocols can all contribute to narrowing knowledge gaps, but ultimately UK based research is needed to explore current physiotherapy practice for this patient group.

FUNDING

None to declare.

DECLARATION OF INTEREST

None to declare.

Submitted: July 30, 2024 GMT, Accepted: October 04, 2024 GMT

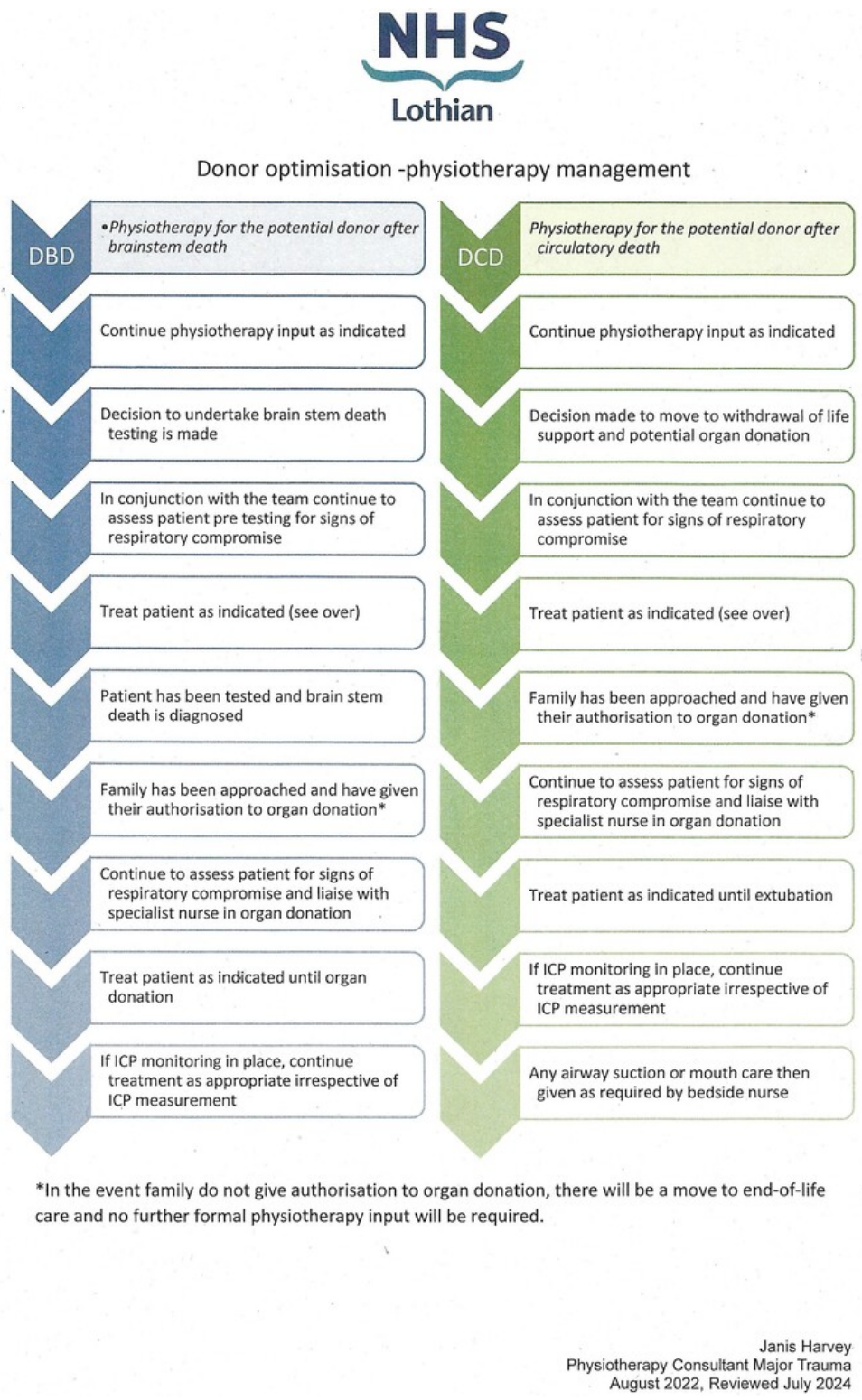


Image 1

REFERENCES

1. NHS Blood and Transplant. Organ and Tissue Donation and Transplantation- Activity Report 2023/2024. 2024. Accessed July 26, 2024. https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/33778/activity-report-2023-2024.pdf

2. Wood KE, Becker BN, McCartney JG, et al. Care of the potential organ donor. *New England Journal of Medicine*. 2004;351(26):2730-2739. doi:10.1056/NEJMra013103

3. Intensive Care Society. Guidelines for the Provision of Intensive Care Services v2.1. 2022. Accessed July 26, 2024. https://www.ficm.ac.uk/sites/ficm/files/documents/2022-07/GPICS%20V2.1%20%282%29.pdf

4. NHS Blood and Transplant. Donation After Death Using Neurological Criteria- Donor Optimisation Care Bundle- Adult. 2023. Accessed July 29, 2024. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fnhsbtdbe.blob.core.windows.net%2Fumbraco-assets-corp%2F29992%2Ffrm7261.docx&wdOrigin=BROWSELINK

5. NHS Blood and Transplant. Donation After Death Using Neurological Criteria- Donor Optimisation Care Bundle- Paediatric. 2024. Accessed July 30, 2024. https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/33301/frm7352.docx

6. Fleming G, Thomson EM. Organ Donation and Management of the Potential Organ Donor. *Anaesthesia & Intensive Care Medicine*. 2021;22(8):475-481. doi:10.1016/j.mpaic.2021.06.007

7. Mascia L, Pasero D, Slutsky AS, et al. Effect of a Lung Protective Strategy for Organ Donors on Eligibility and Availability of Lungs for Transplantation: A Randomized Controlled Trial. *JAMA*. 2010;304(23):2620-2627. doi:10.1001/jama.2010.1796

8. Raios C, Skinner EH, Keating JL. Lung Management Protocols Increase the Incidence of Lung Procurement and Organ transplantation: A meta-analysis. *Physiotherapy Theory and Practice*. 2018;36(4):1-10. doi:10.1080/09593985.2018.1488907

9. Raios C, Keating JL, Stitt N, et al. Challenges in Providing Timely Physiotherapy and Opportunities to Influence Outcomes for Potential Lung Donors. *Progress in transplantation*. 2016;27(2):112-124. doi:10.1177/1526924816680098

10. O'Connor LR. Physiotherapy in Patients on the Organ Donation Pathway: A Survey of Current Practice. *Transplantation Proceedings*. 2021;53(7):2157-2161. doi:10.1016/j.transproceed.2021.07.034

11. Raios C, Keating JL, Skinner EH, et al. Exploring Current Physiotherapy Practices in the Care of People who are Potential Lung donors: A Qualitative Study. *Australian critical care*. 2024;7(4):539-547. doi:10.1016/j.aucc.2023.12.003

Morrison L, Bryant S, Lipman M. Expectations and reality: A survey of UK physiotherapy practice in the management of non-tuberculous mycobacterial pulmonary disease. *ACPRC Journal*. 2024;54(3):7-12. doi:10.56792/DCAM9578

Long term conditions

Expectations and reality: A survey of UK physiotherapy practice in the management of non-tuberculous mycobacterial pulmonary disease

Lisa Morrison[1], Sarah Bryant[2], Marc Lipman[3,4]

[1] Physiotherapy, Queen Elizabeth University Hospital, [2] Administrative support, NTM Network, [3] Respiratory Medicine, University College London, [4] Chair, NTM Network

Keywords: NTM-pulmonary disease, physiotherapy, service, standards of care

https://doi.org/10.56792/DCAM9578

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

Abstract

Introduction

The incidence of non-tuberculous mycobacterial infection and pulmonary disease (NTM-PD) is increasing nationally and globally. This is not only related to enhanced mycobacterial surveillance, but also host and environmental factors. Physiotherapy is a key component of the management strategy for NTM-PD but is not routinely available to all UK patients. NTM Network UK are developing multi-disciplinary national standards of care with the aim of supporting clinicians, promoting health-care provider education, and ensuring that people with NTM can access high-quality services throughout the UK.

Methods

Prior to the development of the national standards of care we undertook the first national survey designed to better understand current physiotherapy management of people with NTM-PD and identify barriers to service provision. This survey was distributed and completed over a two-month period in 2022.

Results

Responses received from 52 experienced physiotherapists caring for people living with NTM-PD identified considerable variation in access to physiotherapy resources, with 33% of respondents not having the capacity to see new patients referred with respiratory symptoms related to their NTM-PD (defined as NTM disease identified within the preceding 6 months), and 40% of respondents unable to offer routine outpatient physiotherapy reviews to people with established NTM. Barriers to service provision included a scarcity of funding for staff and devices for airway clearance, a lack of specific NTM-PD national guidance, and limited experience of personnel in relation to sputum surveillance and overall management of NTM-PD.

Conclusion

Alongside extra financial resources, our results support the need for national quality physiotherapy standards for NTM-PD that can help minimise the identified variation in clinical practice. These should include the provision of training, education and experiential practice and reflection for physiotherapists.

INTRODUCTION

The incidence of non-tuberculous mycobacterial pulmonary infections and disease (NTM-PD) is increasing both in the UK and globally.[1,2] Whilst improved detection methods, greater awareness amongst healthcare professionals, and enhanced surveillance may account for some of this, a number of studies suggest that the underlying incidence is rising.[1-3] Possible explanations for this: include declining rates of *M. tuberculosis* infection potentially reducing population immunity to mycobacteria; increases in environmental exposure to NTM e.g. through the use of energy-conserving lower temperature settings for home water heaters plus greater use of showers leading to more NTM-containing aerosol exposure; increased long-term antibiotic usage in inflammatory lung diseases, potentially creating a more favourable lung niche for NTM as normal bacterial flora are reduced; greater use of medications that might impair usual

host immunity to NTM e.g., immunosuppressive drugs; and the potential impact of person-to-person transmission of certain NTM species in some patient cohorts such as people living with Cystic Fibrosis (CF).[3-6]

In associated conditions such as bronchiectasis, persistent detection of NTM in a patient's sputum is associated with worse outcomes, such as weight loss and increased frequency of pulmonary exacerbation.[7] International guideline-recommended approaches to mitigate these are based on clinical studies and pragmatic expert opinion.[8,9] These include physiotherapy review, advice on sputum clearance, sputum surveillance and lifestyle management. For example, sputum collection, either expectorated or via sputum induction, for microbial culture is recommended every 3-4 months in a person with NTM-PD. Anecdotally, good clinical practice suggests that this is carried out by a respiratory physiotherapist experienced in airway clearance methods and sputum induction techniques that allow adequate sample retrieval. Through this regular surveillance, personalised treatment implementation and monitoring can occur. The wider role of the physiotherapist in NTM-PD can further minimise the consequences of repeated respiratory exacerbations in people with underlying lung disease such as bronchiectasis by educating patients in airway clearance techniques, as well as the use of adjunctive and nebulised therapies.[9]

Despite the potential patient benefits of specialist respiratory physiotherapy in this setting, a recent UK survey of clinicians managing patients with NTM-PD found that less than 50% had access to physiotherapy services that could support sputum retrieval, implementation of appropriate airway clearance or advice on physical activity and lifestyle.[10]

There are no UK data on clinical physiotherapy practices for patients with NTM. We wanted to better understand: 1) the current physiotherapy management of people with NTM-PD, and 2) why the recommendations for physiotherapy in NTM guidelines are not being met by >50% of services.

METHODS

NTM Network UK is a multi-professional grouping with membership from over 200 UK centres with a clinical or research interest in improving care for people affected by NTM. Its Physiotherapy Interest Group, which comprises 18 physiotherapists from 13 UK clinical sites with experience of managing patients with NTM infection, developed a physiotherapy-specific national survey to explore the services available to patients with NTM. This survey contained 23 questions relating to referrals to physiotherapy, airway clearance provision/advice, sputum microbiology surveillance, and current physiotherapy patient management of inpatients and outpatients, as well as people who were and were not on specific treatment for NTM. The survey was initially piloted within the NTM Physiotherapy Interest group and modifications made according to expert opinion, current practices and other feedback received. The second iteration formed the final survey, with questions using phrasing that avoided influencing respondent choice, and the opportunity to submit free-text responses where appropriate. Respondent characteristics were also collected.

The survey was designed to examine physiotherapy involvement in the NTM care pathway across the NHS. For this reason, the inclusion criteria specified UK-based respiratory physiotherapists who identified as being in the care of children and/or adults with NTM.

The survey was distributed electronically via the Associations of Chartered Physiotherapists in Cystic Fibrosis (ACPCF) and Respiratory Care (ACPRC) in an email to their respective members. The survey was open from February to April 2022, with one additional email prompt to respond during this time.

Responses were stored securely and analysed in Microsoft Excel. As this was a survey of practice using professional networks for recruitment with no specific participant interviews, neither formal ethics review nor written consent were required. There was no sharing of confidential personal information or NHS specific data beyond basic numerical statistics of people living with NTM. No independent verification of data/reports from local services was performed.

RESULTS

RESPONDENTS' PLACE OF WORK AND SPECIALIST INTERESTS

Fifty-two responses were received. As shown in Table 1, 80% of respondents were from university hospitals or CF units and 20% District General hospitals. Two-thirds of respondents treated adults, and almost half had a sub-specialty interest in bronchiectasis or CF.

PHYSIOTHERAPY REFERRALS

Most inpatient and outpatient referrals to physiotherapy services were from medical staff (reported by 20/52 (62%) and 38 (82%) of respondents respectively). Nursing and ward staff, including allied health professionals, were identified as responsible for referrals by 19 (35%) of survey participants. Indications for referral are shown in Figure 1 with sputum clearance being the predominant reason in 98% of cases.

FREQUENCY OF PHYSIOTHERAPY REVIEW

One-third of respondents did not have the capacity to see new patients (defined as NTM disease identified within the preceding 6 months) and 40% of respondents were unable to offer routine outpatient physiotherapy review to established NTM patients. Barriers to service provision were highlighted as a scarcity of funding for staff, devices for airway clearance, plus a lack of clinician experience and national guidance.

Where physiotherapy review was available, it was scheduled every 1–3 months for 40% of new NTM patients and most established NTM patients, with an annual review as a minimum. Physiotherapy review took place mainly in hos-

Table 1. Respondent workplace and specialism

	Number of respondents, N=52 (%)
Workplace setting	
University hospital	27 (52%)
District general hospital	10 (19%)
Regional referral centre for NTM	3 (6%)
Community setting	2 (4%)
Other (includes Cardio thoracic, cystic fibrosis and paediatric tertiary centres)	10 (19%)
Specialty	
Adult Respiratory medicine	33 (63%)
Paediatric Respiratory medicine	12 (23%)
Adult General medicine	1 (2%)
Adult Infectious diseases	1 (2%)
Paediatric Infectious diseases	0 (0)
Other (includes adult and paediatric Cystic fibrosis centres)	5 (10%)
Sub-specialty	
Bronchiectasis	25 (48%)
Cystic fibrosis	25 (48%)
No subspeciality	9 (17%)
NTM disease	4 (8%)
Tuberculosis	0 (0)
Other (includes ILD, Home Oxygen service, complex chest, COPD, difficult asthma and breathing pattern disorders)	10 (19%)

COPD, Chronic obstructive pulmonary disease; ILD, Interstitial lung disease

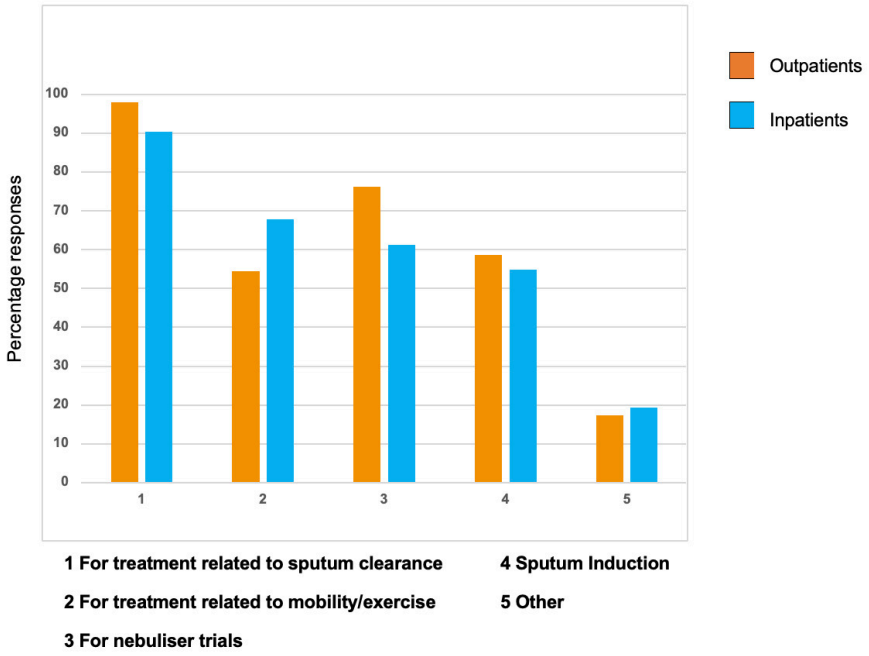


Figure 1. Indications for referral to Physiotherapy.

pital clinics (83%), though there was the occasional opportunity to be seen in the community (22%).

AIRWAY CLEARANCE

Airway clearance techniques plus device provision, depended on the experience of the physiotherapist and funding. Over 40% of survey respondents (21/52) reported experiencing funding issues; these were worse in settings where physiotherapists only reviewed out-patients. Breathing techniques predominated as the technique most frequently taught, followed by Positive Expiratory Pressure (PEP) devices or oscillatory PEP devices.

SPUTUM SAMPLING & NEBULISED ANTIBIOTICS

Sputum surveillance was performed routinely by 75% of respondents (39/52) for both in- and out-patients and included obtaining 2–3 mycobacterial cultures plus bacteriology.

Fifty-two percent (27/52) of physiotherapists were involved in nebulised antibiotic challenges including adherence monitoring.

GUIDELINES ADHERENCE

Where standards of care or guidelines (including for infection prevention and control) were reported as being followed (in 21/52, 40%, responses), lifestyle and management advice was predominantly extrapolated from CF, British Thoracic Society or European Respiratory Society statements.[7-10] These guidelines included room ventilation, decontamination of environments, segregation practices and timing of interventions, however the responses did not specify which guideline components were followed.

DISCUSSION

To our knowledge, this is the first survey of clinical physiotherapy practices used in the management of people with NTM-PD both nationally and internationally. We find that despite being guideline-recommended 15 of 52 (33%) of survey participants reported that their UK physiotherapy service could not routinely assess new patients, and 21/52 (40%) were unable to provide ongoing physiotherapy review to patients established on long-term anti-NTM treatment.[5, 6] Whilst of considerable concern in themselves, these findings disguise the wide variation in what can be offered by specialist respiratory UK physiotherapy services as part of their package of care to people with NTM-PD. When specifically asked about the barriers to providing an appropriate physiotherapy service for people with NTM-PD, this appeared to be largely due to financial and service provision limitations (including staffing and training 15/52, 29%). Based on the high frequency with which patients were referred to physiotherapy from other services, we believe that the value of specialist physiotherapy to patients with NTM-PD is recognised by other members of the multidisciplinary team. However, in the current physiotherapy workforce crisis and funding constraints, the provision of suitable physiotherapy services for this patient cohort is both poorly funded and staffed. If not urgently addressed, we believe that the majority of UK NTM services may soon be unable to offer a basic level of care to the increasing numbers of NTM-PD patients now being managed across the UK and any future standards of care may be unachievable.

We identified several areas of consistent good practice. These included 75% of services providing high-quality sputum sampling for microbiology surveillance (crucial to guide management yet often not performed routinely in a busy medical clinic setting), and the capability to offer nebulised antibiotic assessments in over half of responding services. There was also considerable expertise and support for patients, though it is important to note that many respondents work in specialist units, and so our results may not fully reflect practice where most UK NTM-PD is managed (i.e. outside of these regional or specialist centres). Given the complexities of NTM infections, their associated treatment regimens and options for alternative physiotherapy techniques, we believe that in addition to extra financial resource, the provision of training and education for physiotherapists, plus experiential practice and reflection, are necessary if we are to improve NTM-PD physiotherapy management and develop quality services for the future management of this rapidly expanding patient population.

LIMITATIONS

Although the survey was supported and distributed by both the ACPCF and ACPRC, we cannot accurately determine whether all relevant physiotherapists saw it; and of those who did, the proportion who chose to complete it or their geographical location. The relatively small sample size is likely to be skewed towards specialist units, and hence care needs to be taken when extrapolating the results. Given this, it would be expected that our results are better than the national average as we have targeted respiratory physiotherapists, and hence general medical physiotherapists may not have had the opportunity to respond. To ensure maximal response to this first UK survey our questionnaire was intentionally brief. Detailed information on some aspects of current service delivery was, therefore, limited and could be explored through further studies including single person interviews and more specific questions.

FUTURE WORK

The lack of comparator studies both nationally and internationally argues for similar work to ours to be performed elsewhere. These would provide important information on both global physiotherapy staffing and practice in people with NTM-PD; and support the development of national standards of care for people affected by NTM. Physiotherapy services have a central role within this and the findings from this survey have been instrumental in the delivery of the NTM-PD aspect of these standards.[11] In addition, this survey has highlighted areas where physiotherapy-specific guidance based on best clinical practice (and ultimately good-quality evidence) is needed. With this in mind, we are developing supplementary standards to support physiotherapy practice. These will both complement and enhance the overarching NTM Network standards of care. It should be noted that there is significantly less information on people with NTM-PD reviewed in a community setting for example; how care is delivered, frequency, quality and both positive or negative effects on the patient. This is another important area for future work.

CONCLUSION

Our results highlight considerable practice-pattern variation and argue for national physiotherapy quality standards for NTM-PD, plus the necessary funding to support these. NTM Network UK's work in this area aims to support physiotherapists, promote health-care provider education, and ensure that people with NTM can access high-quality services throughout the UK.

Key Messages

1. There is a wide variation in access to NTM physiotherapy services across the UK. This includes the provision and frequency of review for both new and existing patients.
2. Barriers to NTM physiotherapy service delivery include limited funding for staff and devices for airway clearance, a lack of clinical physiotherapy experience and national guidance on NTM management.
3. National standards of care and physiotherapy-specific guidance based on best clinical practice for people affected by NTM are needed.

ACKNOWLEDGEMENTS

The authors would like to thank Jo Pond for the initial survey development and the ACPCF and ACPRC for assistance with its dissemination.

ETHICAL APPROVAL

Not required

FUNDING

No funding received for this work. Until May 2023, administrative support for NTM Network UK was funded by an unrestricted grant from Insmed Limited, who had no input into Network activities including the study reported here.

DECLARATION OF INTEREST

LM reports a position as unpaid Chair of the NTM Network UK Physiotherapy Interest Group. ML reports positions as unpaid Chair of NTM Network UK and unpaid Trustee of NTM Patient Care UK. SB reports a position as paid Project Manager for NTM Network UK. JP reports no declaration of interest.

Submitted: January 26, 2024 GMT, Accepted: July 31, 2024 GMT

REFERENCES

1. Shah NM, Davidson JA, Anderson LF, Lalor MK, Kim J, Thomas HL, et al. Pulmonary Mycobacterium avium-intracellulare is the main driver of the rise in non-tuberculous mycobacteria incidence in England, Wales and Northern Ireland, 2007-2012. *BMC Infect Dis*. 2016;16:195. doi:10.1186/s12879-016-1521-3

2. Daniel-Wayman S, Abate G, Barber DL, Bermudez LE, Coler RN, Cynamon MH, et al. Advancing translational science for pulmonary nontuberculous mycobacterial infections. A road map for research. *Am J Respir Crit Care Med*. 2019;199(8):947-951. doi:10.1164/rccm.201807-1273PP

3. Haworth CS, Banks J, Capstick T, Fisher AJ, Gorsuch T, Laurenson IF, et al. British Thoracic Society Guideline for the management of non-tuberculous mycobacterial pulmonary disease (NTM-PD). *BMJ Open Respiratory Research*. 2017;4:e000242. doi:10.1136/bmjresp-2017-000242

4. Bryant JM et al. Emergence and spread of a human-transmissible multidrug-resistant nontuberculous mycobacterium. *Science*. 2016;354:751-757. doi:10.1126/science.aaf8156

5. Floto et al. US Cystic Fibrosis Foundation and European Cystic Fibrosis Society consensus recommendations for the management of non-tuberculous mycobacteria in individuals with cystic fibrosis. Published online 2016. doi:10.1136/thoraxjnl-2015-207360

6. Saiman L, Siegel J. Infection control recommendations for patients with cystic fibrosis: microbiology, important pathogens, and infection control practices to prevent patient-to-patient transmission. *Infection Control & Hospital Epidemiology*. 2003;24(5):S6-52. doi:10.1086/503485

7. Lin CY, Huang HY, Hsieh MH, Fang YF, Lo YL, Lin SM, et al. Impacts of Nontuberculous Mycobacteria Isolates in Non-cystic Fibrosis Bronchiectasis: A 16-Year Cohort Study in Taiwan. *Front Microbiol*. 2022;13:868435. doi:10.3389/fmicb.2022.868435

8. Floto RA, Olivier KN, Saiman L, Daley CL, Herrmann JL, Nick JA, et al. US Cystic Fibrosis Foundation and European Cystic Fibrosis Society consensus recommendations for the management of non-tuberculous mycobacteria in individuals with cystic fibrosis. *Thorax*. 2016;71:i1-i22. doi:10.1136/thoraxjnl-2015-207360

9. Hill AT, Sullivan AL, Chalmers JD, De Soyza A, Elborn SJ, Floto AR, et al. British Thoracic Society Guideline for bronchiectasis in adults. *Thorax*. 2019;74(Suppl 1):1-69. doi:10.1136/thoraxjnl-2018-212463

10. Malhotra AM, Bryant S, Kunst H, Haworth CS, Lipman M, NTM Network UK. Management of nontuberculous mycobacteria-pulmonary disease: Results from the first UK survey of clinical practice. *J Infect*. 2023;87(1):64-67. doi:10.1016/j.jinf.2023.04.009

11. Kumar K, Ponnuswamy A, Capstick TGD, et al. Non-tuberculous mycobacterial pulmonary disease (NTM-PD): Epidemiology, diagnosis and multidisciplinary management. *Clinical Medicine*. 2024;24(1). doi:10.1016/j.clinme.2024.100017

Introducing XtraCare™ HME-F

XtraCare™ HME-F includes an electrostatic filter that provides filtration irrespective of the direction of airflow

- Effective filtration of bacteria >99%*
- Effective filtration of viruses >99%*
- Protects you from airborne particles (such as viruses, bacteria, dust and pollen) by effective filtration of the air you breathe in through the tracheostomy.*
- An HME-F designed specifically for use in self-ventilating tracheostomy patients with minimal dead space.
- If supplemental oxygen is needed, XtraCare™ can be combined with O2 Adaptor.

It protects the patient from airborne particles such as viruses, bacteria, dust and pollen, by effective filtration of inspired air.

Provides humidification and improves lung health

XtraCare™ warms and humidifies the air your patient breathes in to help reduce coughing and mucus production.

Daily protection

Use it in crowded places such as schools, supermarkets and public transport – especially during the flu season. It can also be helpful while gardening, particularly during the high pollen season.

Find out more about the XtraCare™ HME by contacting our Customer Care team or visiting our website:

Call us:
01157 841 899

Email us:
info.uk@atosmedical.com

Visit our website:
www.atosmedical.co.uk

*Please note: since pathogens can enter and leave the human body in other ways (such as the mouth, nose and eyes), XtraCare can never guarantee complete protection. Please read the instructions for use for guidance.

Atos
Breathing–Speaking–Living
atosmedical.com

Finze H, Williams MA. Shoulder Rehabilitation for Patients Undergoing Neck Dissection for Head and Neck Cancer – The Case for Specialist Follow-up. *ACPRC Journal*. 2024;54(3):14-17. doi:10.56792/JKET4860

Commentary

Shoulder Rehabilitation for Patients Undergoing Neck Dissection for Head and Neck Cancer – The Case for Specialist Follow-up

Harriet Finze[1], Mark A Williams[2,3]

[1] Therapies Clinical Service Unit, Oxford University Hospitals NHS Foundation Trust, [2] Oxford Allied Health Professions Research and Innovation Unit (AHPRU), Oxford University Hospitals NHS Foundation Trust, [3] Centre for Movement, Occupational and Rehabilitation Sciences (MORES), Oxford Brookes University

Keywords: neck dissection, shoulder, spinal accessory nerve, rehabilitation

https://doi.org/10.56792/JKET4860

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

INTRODUCTION

More than 12,000 new cases of head and neck cancer (HNC) are diagnosed each year in the UK, with projections expecting this to increase to more than 16,000 every year by 2038-2040.[1] With growing numbers of younger patients diagnosed with Human Papillomavirus (HPV) positive HNC, people are now living longer with the lasting effects of HNC treatment.[2,3]

Neck dissection (ND) is an important treatment option, with almost half of patients diagnosed with tongue cancer in England and Wales between 2012-2013 undergoing this procedure.[4] In recent decades, ND surgery has become less aggressive whilst achieving comparable oncological results, resulting in less radical ND and modified-radical ND being used.[5-7]

Post-operative shoulder dysfunction is a widely recognised side effect of ND, although risk is variable depending on type of procedure and if there has been intra-operative injury to, or resection of, the spinal accessory nerve (SAN).[8] Despite preservation of the SAN, shoulder dysfunction, and subsequent impact on quality of life (QOL), remains a prevalent issue following even the most conservative ND approaches.[9]

The initial focus of physiotherapy management of HNC surgical patients is to reduce the risk of post-operative pulmonary complications associated with long general anaesthetic, recumbency and heavy smoking history.[10] Respiratory physiotherapists may often be the only member of the profession to have contact with this patient group during their hospital stay. Therefore, this physiotherapy speciality is well placed to identify and support HNC surgical patients with post-operative shoulder dysfunction, as part of their holistic care. Shoulder rehabilitation is beneficial for patients with reduced function following ND and it is recommended that they begin progressive resistance training as soon as possible.[11,12] Despite this, there is inconsistent provision of post-operative physiotherapy services.[13] The ability to provide necessary neuromusculoskeletal management to this specialist patient group is therefore a growing priority and concern for physiotherapy services.

Through review of current literature, this commentary explores evidence for which SAN preserving ND patients are in greatest need of post-operative shoulder rehabilitation. To reflect current surgical practices, focus of this commentary will be on selective ND procedures only, with limited consideration to radical and modified-radical procedures.

SELECTIVE NECK DISSECTION (SND) AND SHOULDER MORBIDITY

Lymph node levels considered low risk of cervical metastasis, and all non-lymphatic structures in the neck, are preserved in a SND.[14] The spread of cancer to lymph nodes from HNC is often predictable which now enables SND to be performed as an alternative to more extensive procedures.[15] SND's are associated with lower incidence of shoulder morbidity,[16] however, the issue is not eliminated as the SAN remains vulnerable to trauma.[9] This population is key for investigation given that a substantial proportion of patients with HNC undergo SND as part of their cancer treatment.[17]

The SAN descends within the posterior triangle of the neck and is encountered in lymph node levels 2 and 5.[15,18] Inclusion of these levels has been linked with increased risk of shoulder dysfunction given proximity of lymph nodes to the SAN.[15,19] Anatomically, the SAN divides level 2 into levels 2a and 2b, with level 2b lymph nodes situated posterior to the SAN. The relationship between dissection of level 2b and shoulder impairment and function has been of much interest within recent literature.

Three small experimental studies investigated shoulder morbidity outcomes for 2b-preserving, compared to non-preserving surgery.[5-7] Shoulder range of motion (ROM) and QOL outcome measures featured in each study, and all demonstrated superior outcomes in favour of preserving level 2b. Significantly greater impairment in shoulder abduction at four to six months follow-up in those who underwent level 2b dissection was a key finding amongst the three studies. The study populations represent the most common type of head and neck cancer,[1] potentially providing good generalisability.

PHYSIOTHERAPY PROVISION

Physiotherapy intervention after ND is indicated from existing literature.[12,20,21] A 2019 systematic review concluded that patients with shoulder dysfunction after ND benefit from physiotherapy intervention, however, acknowledged that all studies presented varying issues with design.[20] One included study demonstrated that progressive resistance exercise training has a beneficial effect on shoulder pain and function in patients with SAN dysfunction, and is now recommended within NICE guidelines.[11,12] Participants attended at least two supervised exercise sessions per week over a 12-week period.[12] When considering application to National Health Service practice, the feasibility of providing this level of supervised intervention is unrealistic due to funding and resource limitations. Group sessions would be more achievable in terms of resources; however, this may not be an effective delivery model given complex and varying patient presentations.

The benefits of physiotherapy, and evidence supporting prevalence of shoulder dysfunction in the least invasive ND procedures is clear.[5,6,12,18,20] Despite this, current provision of physiotherapy services within the UK is inconsistent and does not reflect patient need.[11,13] Only a third of centres provide routine inpatient physiotherapy following ND and none routinely offer outpatient follow-up to all patients.[13] Our own local patient feedback demonstrates a desire for specialist physiotherapy however given the growing population of patients with HNC and limited funding availability, it is unrealistic to offer all ND patients specialist outpatient physiotherapy follow-up. Therefore, there is a need to identify which patient groups are at highest risk of shoulder dysfunction and should be prioritised to receive specialist input.

CONCLUSION

All patients who undergo ND for HNC are at risk of shoulder dysfunction due to sacrifice or potential trauma to the SAN.[8] Highest risk groups are those who undergo more radical procedures.[8,16] SAN preservation does not eliminate risk of SAN injury, subsequent shoulder dysfunction and reduced QOL, even in the most conservative procedures.[5,6] Level 2b dissection places patients at higher risk of shoulder dysfunction within the SND population, due to proximity of lymph nodes to the SAN.[15,19] In the presence of limited resources, it is reasonable to consider prioritisation of rehabilitation for patients who have undergone resection of the SAN and/or level 2b dissection. Group interventions should be explored for efficiency and efficacy of delivery. Upskilling of the current physiotherapy workforce involved in the care of ND patients is required to deliver specialist intervention to this complex patient group.

Key Points

- All patients who undergo neck dissection for head and neck cancer are at risk of shoulder dysfunction.
- Inclusion of level 2b is associated with higher risk of shoulder dysfunction.
- Patients who undergo dissection of level 2b during neck dissection should be prioritised for post-operative specialist rehabilitation.

DECLARATION OF INTEREST

None of the authors have declared any conflict of interests.

FUNDING

No funding was provided for this commentary.

Submitted: July 04, 2024 GMT, Accepted: September 20, 2024 GMT

REFERENCES

1. Cancer Research UK. Head and neck cancers incidence statistics. 2022. Accessed May 16, 2024. https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/head-and-neck-cancers/incidence#heading-Three

2. Gallyer V, Smith T, Fordham B, Dutton S, Chester-Jones M, Lamb S, et al. Getting recovery right after neck dissection (GRRAND-F): Mixed methods feasibility study to design a pragmatic randomised controlled trial protocol. *BMJ Open*. Published online 2021. doi:10.1136/bmjopen-2020-045741

3. Schache AG, Powell NG, Cuschieri KS, Robinson M, Leary S, Mehanna H, et al. HPV-related oropharynx cancer in the United Kingdom: An evolution in the understanding of disease etiology. *Cancer Research*. 2016;76(22):6598-6606. doi:10.1158/0008-5472.CAN-16-0633

4. Health and Social Care Information Centre. National Head and Neck Cancer Audit 2013. 2014. Accessed January 11, 2022. https://files.digital.nhs.uk/publicationimport/pub14xxx/pub14257/clin-audi-supp-prog-head-neck-dahn-12-13.pdf

5. Pandey M, Karthikeyan S, Joshi D, Kumar M, Shukla M. Results of a randomized controlled trial of level IIb preserving neck dissection in clinically node-negative squamous carcinoma of the oral cavity. *World J Surg Onc*. 2018;16(1). doi:10.1186/s12957-018-1518-z

6. Rastogi S, Sharma A, Choudhury R, Tripathi S, Al Wayli H, Amrithraj A, et al. Is superselective neck dissection safer than supraomohyoid neck dissection for oral carcinoma patients with N0 neck in terms of shoulder morbidity and recurrence Rate? *Journal of oral and maxillofacial surgery*. 2018;76(3):647-655. doi:10.1016/j.joms.2017.08.002

7. Hamoir M, Silver CE, Schmitz S, Takes RP, Rinaldo A, Roigo JP, et al. Radical neck dissection: is it still indicated? *Eur Arch Otorhinolaryngol*. 2013;270(1):1-4. doi:10.1007/s00405-012-2237-7

8. Larsen MH, Lorenzen MM, Bakholdt V, Sørensen JA. The prevalence of nerve injuries following neck dissections - A systematic review and meta-analysis. *Danish medical journal*. 2020;67(8):1-15. https://content.ugeskriftet.dk/sites/default/files/scientific_article_files/2020-07/a08190464_web.pdf

9. Scott B, Lowe D, Rogers SN. The impact of selective neck dissection on shoulder and cervical spine movements. *Physiotherapy*. 2007;93(2):102-109. doi:10.1016/j.physio.2006.11.012

10. Homer JJ, Winter SC. Head and Neck Cancer: United Kingdom National Multidisciplinary Guidelines, Sixth Edition. *The Journal of Laryngology & Otology*. 2024;138(S1):S1-224. doi:10.1017/S002221512400032X

11. NICE. Cancer of the upper aerodigestive tract: assessment and management in people aged 16 and over. 2018. Accessed May 16, 2024. https://www.nice.org.uk/guidance/ng36

12. McNeely M, Parliament M, Seikaly H, Jha N, Magee D, Haykowsky M, et al. Effect of exercise on upper extremity pain and dysfunction in head and neck cancer survivors. *Cancer*. 2008;113(1):214-222. doi:10.1002/cncr.23536

13. Robinson M, Ward L, Mehanna H, Paleri V, Winter SC. Provision of physiotherapy rehabilitation following neck dissection in the UK. *Journal of laryngology and otology*. 2018;132(7):624-627. doi:10.1017/S0022215118000671

14. Bradley PJ, Ferlito A, Silver CE, Takes RP, Woolgar JA, Strojan P, et al. Neck treatment and shoulder morbidity: Still a challenge. *Head Neck*. 2011;33(7):1060-1067. doi:10.1002/hed.21495

15. Robbins KT, Clayman G, Levine PA, Medina J, Sessions R, Shaha A, et al. Neck dissection classification update: Revisions proposed by the American Head and Neck Society and the American Academy of Otolaryngology–Head and Neck Surgery. *Archives of otolaryngology, Head & Neck; neck surgery*. 2002;128(7):751-758. doi:10.1001/archotol.128.7.751

16. Gane EM, Michaleff ZA, Cottrell MA, McPhail SM, Hatton AL, Panizza BJ, et al. Prevalence, incidence, and risk factors for shoulder and neck dysfunction after neck dissection: A systematic review. *European Journal of Surgical Oncology*. Published online 2017:1199-1218. doi:10.1016/j.ejso.2016.10.026

17. Hutchison IL, Ridout F, Cheung SMY, Shah N, Hardee P, Surwald C, et al. Nationwide randomised trial evaluating elective neck dissection for early stage oral cancer (SEND study) with meta-analysis and concurrent real-world cohort. *Br J Cancer*. 2019;121(10):827-836. doi:10.1038/s41416-019-0587-2

18. Dziegielewski PT, Mcneely ML, Ashworth N, O'connell DA, Barber B, Courneya KS, et al. 2b or not 2b? Shoulder function after level 2b neck dissection: A double-blind randomized controlled clinical trial. *Cancer*. 2020;126(7):1492-1501. doi:10.1002/cncr.32681

19. Imai T, Sato Y, Abe J, Kumagai J, Morita S, Saijo S, et al. Shoulder function after neck dissection: Assessment via a shoulder-specific quality-of-life questionnaire and active shoulder abduction. *Auris, nasus, larynx*. 2021;48(1):138-147. doi:10.1016/j.anl.2020.06.013

20. Harris AS. Do patients benefit from physiotherapy for shoulder dysfunction following neck dissection? A systematic review. *Journal of laryngology and otology*. 2020;134(2):104-108. doi:10.1017/S0022215120000079

21. McGarvey AC, Chiarelli PE, Osmotherly PG, Hoffman GR. Physiotherapy for accessory nerve shoulder dysfunction following neck dissection surgery: A literature review. *Head Neck*. 2011;33(2):274-280. doi:10.1002/hed.21366

Pond J, Gustafson O. Prehabilitation service provision and preoperative clinical pathways for major oesophagogastric cancer surgery patients: A service evaluation. *ACPRC Journal*. 2024;54(3):18-27. doi:10.56792/IWGN2952

Surgery

Prehabilitation service provision and preoperative clinical pathways for major oesophagogastric cancer surgery patients: A service evaluation.

Julia Pond[1], Owen Gustafson[1]

[1] Therapies Clinical Service Unit, Oxford University Hospitals NHS Trust

Keywords: Prehabilitation, Preoperative, Cancer, Exercise, Surgery

https://doi.org/10.56792/IWGN2952

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

Abstract

Background

Prehabilitation is a multidisciplinary intervention aimed at optimising patients prior to surgery. Locally, integration of prehabilitation within the major oesophagogastric (OG) cancer preoperative clinical pathway is unclear.

Aim

To evaluate the prehabilitation service provision and preoperative clinical pathways for OG patients at a regional cancer centre.

Methods

A retrospective service evaluation of electronic patient records and staff survey was undertaken. Adults undergoing elective OG cancer resection surgery between October 2022 to October 2023 were included. Patient characteristics and details of preoperative interventions were collected, and a survey sent out to staff involved in the preoperative pathway. The findings were evaluated against the Macmillan prehabilitation guidance.

Results

Ninety-five patients were evaluated, of which 70 (73.7%) received physiotherapy as part of prehabilitation. Reasons for non-receipt included: no referral (n=12, 48%), clerical errors (n=5, 20%), and missed appointments (n=8, 32%). Patients not receiving physiotherapy were older (median 70 years, IQR 58-77 vs. 66, IQR 61-73), had a higher proportion of open surgeries (53% vs. 47%), heart disease (28% vs. 8.5%) and obesity (72% vs. 2.8%) compared to those who did. Only 29/95 (30%) received dietetics input and none received psychological support. The staff survey identified that there is no funded prehabilitation service for dietetics or psychological medicine. Potential areas of improvement to align with the Macmillan guidance included: starting interventions promptly, and to develop dietetics and psychological medicine services as part of the prehabilitation service.

Conclusions

These findings will contribute to the development of the current prehabilitation service and inform future research.

INTRODUCTION

Oesophagogastric (OG) cancer is the 14th most common cancer in the UK, accounting for 9,300 new cases annually.[1] This type of cancer typically presents with dysphagia, indigestion, and reflux, which can lead to malnutrition and affect functional and psychological health.[2,3] OG cancer is usually managed by radical treatment of neoadjuvant chemotherapy and surgical resection.[4]

Pre-treatment fitness assessment and optimisation can improve patients' ability to undergo these interventions.[4] Cardiorespiratory fitness is an independent risk factor for morbidity and mortality following surgery, and by optimising this through prehabilitation, it can improve overall post-operative outcomes.[5] The gold standard for assessment of patient cardiorespiratory fitness is through car-

diopulmonary exercise testing (CPET) which can determine a patient's physiological reserve to undergo neoadjuvant chemotherapy and surgical resection.[6] Prehabilitation is a multidisciplinary preoperative approach delivered by physiotherapists, dietitians, and psychiatrists to improve patients' functional, nutritional, and mental wellbeing before cancer resection surgery.[7] Prehabilitation has been found to be safe and effective at optimising patient function preoperatively[8] and potential benefits post-operatively.[9-12]

The optimal prehabilitation content is currently unknown due to heterogeneity of delivery and outcome measures in current literature.[8] Studies suggest that improving physical conditioning can reduce hospital stays, post-operative complications, and costs, while boosting patient outcomes and satisfaction.[9-12] Prehabilitation guidance has been created by Macmillan Cancer Support and suggests prehabilitation should include 150 minutes of moderate intensity activity and two resistance training sessions per week, healthy eating conversations, and compassionate communication and information giving.[7] This guidance includes all other aspects of prehabilitation including professions involved in delivering prehabilitation, timing of interventions before treatment, and prehabilitation setting.[7]

Locally, a prehabilitation service for OG surgical patients has been in place since 2015, however, it's integration into the wider preoperative pathway has yet to be evaluated. Given the potential benefits of prehabilitation, understanding prehabilitation within the preoperative clinical pathway is crucial for enhancing patient care and surgical outcomes.

Aim: To evaluate the prehabilitation service provision and preoperative clinical pathway for OG patients.

The objectives are to: (1) identify which patients access prehabilitation services, (2) understand the preoperative clinical pathways, (3) gain insights from specialist prehabilitation clinicians, and (4) evaluate the findings against Macmillan prehabilitation guidance.

METHODS

STUDY DESIGN

A mixed-methods retrospective service evaluation including a review of relevant electronic patient records and staff survey.

SETTING AND SAMPLE

The service evaluation took place at a regional cancer centre in South East England, UK. All adult patients undergoing elective OG cancer resection surgery between October 2022 and October 2023 were included. Participants undergoing emergency or non-cancer OG surgery were excluded. Purposive sampling was used for the staff survey with only specialist clinicians with experience of managing patients during the preoperative pathway invited.

ELECTRONIC RECORD DATA COLLECTION

The patient characteristic data collected included: procedure type, age, sex, ethnicity, index of multiple deprivation, smoking status, and comorbidities. The following intervention dates were collected: surgery referral, diagnostic assessments, OG surgery clinic, dietetics initial assessment, physiotherapy initial assessment, psychological medicine initial assessment, neoadjuvant chemotherapy start/end, CPET, patient education, surgery decision, and procedure date. Additionally, the number of attended and missed physiotherapy appointments were collected. The data were verified through random cross-checking against the patient record.

STAFF SURVEY

An online cross-sectional staff survey covering referrals, service provision, and outcome measure use was developed (Supplementary material). It included 39 possible questions (quantitative and qualitative) with conditional branching. Piloted by a third-party clinician, it was adjusted based on feedback. Hosted via Microsoft Teams, participants had six weeks to complete the survey.

DATA ANALYSIS

Patient and quantitative survey data were analysed with descriptive statistics. All data were assessed for normality of distribution with means and standard deviations of medians and interquartile ranges (IQR) being used. A narrative analysis was undertaken for the qualitative elements of the staff survey. All findings were evaluated against the Macmillan prehabilitation guidance.

ETHICAL CONSIDERATIONS

The project underwent a research classification review within the NHS Trust's research and development department. It was determined that ethical approval was unnecessary, and the project was registered as a service evaluation (Ulysses ID: 8756). All methods were performed in accordance with the relevant guidance and regulations.

RESULTS

Between October 16, 2022, and October 15, 2023, 152 patients were identified for elective OG cancer resection surgery. After applying exclusion criteria, 95 patients were included in the analysis (Figure 1). Patient characteristics are shown in Table 1, with the majority being male (n=71, 75%), a median age of 67 (IQR 59-74), and most undergoing an oesophagectomy (n=61, 64%).

PREOPERATIVE INTERVENTIONS

Of the patients eligible to attend a preoperative education session, 79% (71/90) attended. 7/25 (28%) of patients who did not receive physiotherapy underwent neoadjuvant chemotherapy. 69/95 (73%) received a CPET assessment before undergoing surgery. Only 29/95 (30%) received preoperative dietetics input. No patients were identified as having depression, therefore none received preoperative psychological support.

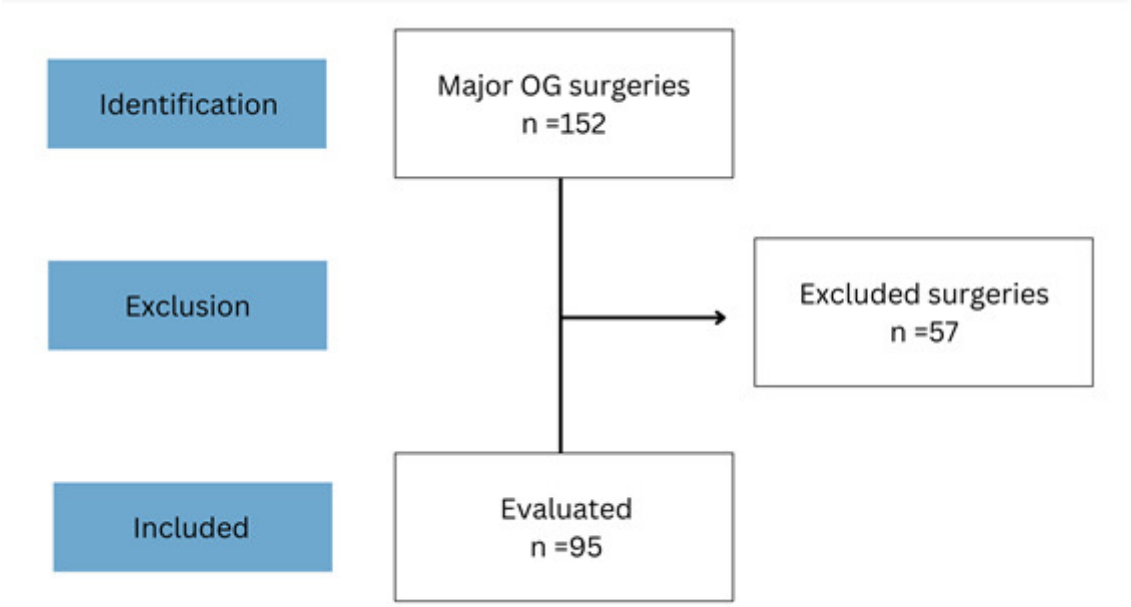


Figure 1. Flow diagram

Of the 95 patients, 70 (73.7%) received physiotherapy as part of prehabilitation. Reasons for not receiving physiotherapy included no referral (n=12, 48%), clerical errors (n=5, 20%), and missed appointments (n=8, 32%) (Figure 2). The reasons for clerical errors or missed appointments were unavailable. The median (IQR) number of physiotherapy appointments was 2 (1-3), with 33/202 (16%) missed. Patients not receiving physiotherapy had more open surgeries (53% vs. 47%), were older (median age 70, IQR 58-77 vs. 66, IQR 61-73), and had more comorbidities like heart disease (28% vs. 8.5%) and obesity (72% vs. 2.8%) compared to those who received physiotherapy (Table 1).

PREOPERATIVE PATHWAY

All aggregated data are presented as median (IQR). Figure 3 outlines the OG preoperative pathway. The referral-to-surgery duration was 153 (132-183) days. After the OG surgery clinic, days to dietetics review was 4 (0-78), physiotherapy referral 22 (4-35) days, neoadjuvant chemotherapy start 49 (30-64) days, and initial physiotherapy assessment 51.5 (32.5-74.5) days. Preoperative patient education occurred 98.5 (75-114.75) days before surgery, with surgery decisions made 21 (12.25-30) days prior, and CPET 16.5 (12.25-30) days before surgery.

STAFF SURVEY

The survey was sent to seven specialist clinicians working during the data collection period, including one physiotherapist, three dietitians, one psychiatrist, and two psychological medicine nurses. Four responses were received (one physiotherapist, two dietitians, and one psychological medicine nurse). It identified that there is no funded prehabilitation service for dietetics or psychological medicine.

REFERRALS

Dietitians review all OG cancer resection surgery patients due to their high malnutrition risk, identified in OG MDT meetings or referred by other clinicians. Dietitians find this system effective in ensuring no patients are missed. Psychological medicine screens all general oncology patients for depression, treating those who meet the criteria, and accepts referrals from other clinicians. Physiotherapists rely solely on referrals and believe the process could improve with clearer referral criteria and clinician awareness.

SERVICE PROVISION

Physiotherapy, dietetics, and psychological medicine are offered in a multimodal format including face to face, via telemedicine, or virtually. Dietetics and psychological medicine use screening tools for assessment, while physiotherapy does not. Dietitians assess weight loss, hand grip strength, symptom and malnutrition severity, while psychological medicine uses the PHQ-9. Dietitians attend OG MDT meetings, but physiotherapy and psychological medicine do not. Due to staffing constraints, dietitians prioritize high-risk patients and feel they do not provide adequate subsequent follow-up treatments. Physiotherapy follows Macmillan guidance, offering personalized exercise programs, including resistance training, aerobic and inspiratory muscle training using a POWERbreathe medic device. Lack of face-to-face contact remains a challenge for physiotherapy.

OUTCOME MEASURE USE

All specialities use outcome measures, but there is no wider service evaluation or patient feedback. Dietitians track weight and intake, while physiotherapists use 30-second sit to stand tests, 60-second step up test, 60-second wall

Table 1. Patient Characteristics

Patient Characteristic	Total Patients (n=95)	Patients who did receive preoperative physiotherapy (n=70)	Patients who did not receive preoperative physiotherapy (n=25)
Procedure n (%)			
Oesophogogastrectomy	61 (64%)	53 (76%)	8 (32%)
Gastrectomy	34 (36%)	17 (24%)	17 (68%)
Open procedures	46 (48%)	33 (47%)	13 (52%)
Minimally invasive procedures	49 (52%)	37 (53%)	12 (48%)
Index of multiple deprivation (median (IQR))	8 (6-9)	8 (6-9)	8 (6-9)
Age median (IQR)	67 (59-74)	66 (61.25-73)	70 (58-77)
Sex n (%)			
Male	71 (75%)	54 (77%)	17 (68%)
Female	24 (25%)	16 (23%)	8 (32%)
Comorbidities n (%)			
Asthma	17 (18%)	14 (20%)	3 (12%)
Heart disease	13 (14%)	6 (9%)	7 (28%)
Obesity or BMI of > 30kg/m2	20 (21%)	2 (3%)	18 (72%)
Functional comorbidity Index (median (IQR))	1 (0-2)	1 (0-2)	1 (1-2)
Eligible patients' attendance at a preoperative patient education session n (%)	71/90 (79%)	60/70 (86%)	11/20 (55%)
Neoadjuvant chemotherapy n (%)	41 (43%)	34 (49%)	7 (28%)
Cardiopulmonary Exercise Test n (%)	69 (73%)	58 (83%)	11 (44%)
Preoperative dietetics input n (%)	29 (31%)	26 (51%)	3 (12%)
Preoperative psychological input n (%)	0 (0%)	0 (0%)	0 (0%)
Attended preoperative physiotherapy sessions (median (IQR))	-	2 (1-3)	-
Missed preoperative physiotherapy sessions n (%)	-	33/202 (16%)	-

push up test, BORG rate of perceived exertion, and resistance level of the POWERbreathe medic device for inspiratory muscle training. Prehabilitation lacks leadership and collaboration with cancer networks.

MACMILLAN GUIDANCE

This evaluation identified potential areas for improvement to align with Macmillan prehabilitation guidance, as shown in Figure 4. Potential areas for improvement include reviewing all OG patients, physiotherapists attending cancer MDT meetings, timely interventions, physiotherapy screening tools, community-based delivery, better outcome monitoring, and developing dietetics and physiological medicine services to become part of prehabilitation.

DISCUSSION

This retrospective, single-centre service evaluation of prehabilitation before OG surgery identified potential areas for improvement. While physiotherapy was funded for prehabilitation, dietetics and psychological medicine were not. Despite all OG patients being eligible, not all received physiotherapy due to no referral into the service, clerical errors, and missed appointments. Evaluating prehabilitation in the context of the preoperative patient pathway demonstrated the delay in physiotherapy interventions relative to the start of neoadjuvant chemotherapy treatment. It also demonstrated that other important testing such as CPET is used towards the end of the preoperative pathway rather than during the patient optimisation period. Evaluating the service against the Macmillan guidance allowed for the identification of further areas for improvement, specifically exploring the setting in which prehabilitation takes place. Locally, further work is required to meet this guidance, and we recommend engaging stakeholders to create sustainable change.

In this service evaluation, physiotherapy was the main component of prehabilitation; however, a multimodal approach may better improve post-operative outcomes.[13,14] The LIPPSMAck POP trial[10] demonstrated that a single preoperative physiotherapy session reduced post-operative pulmonary complications, however others suggest that a multi-professional prehabilitation service may be more effective in reducing all post-operative complications.[13]

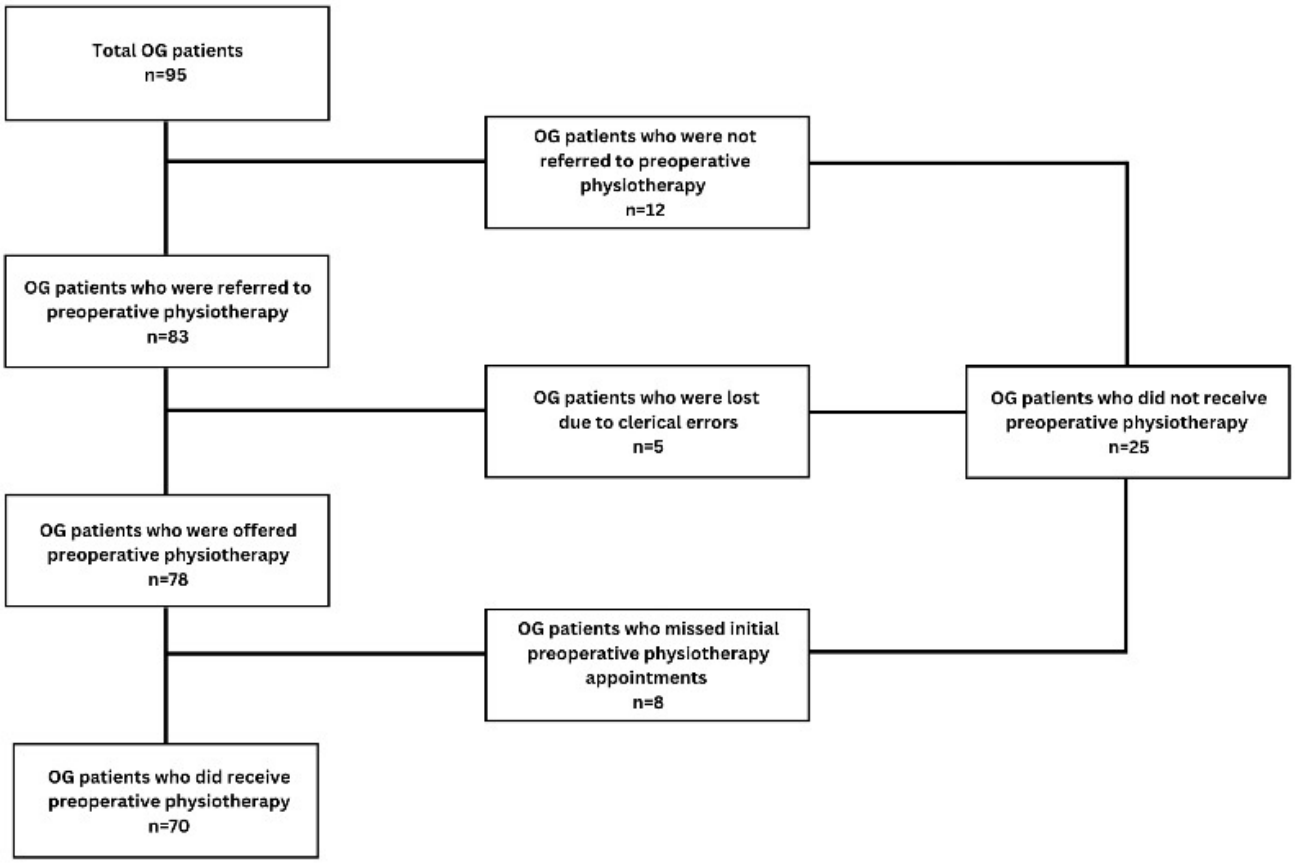


Figure 2. A flow diagram showing reasons patients did not receive preoperative physiotherapy.

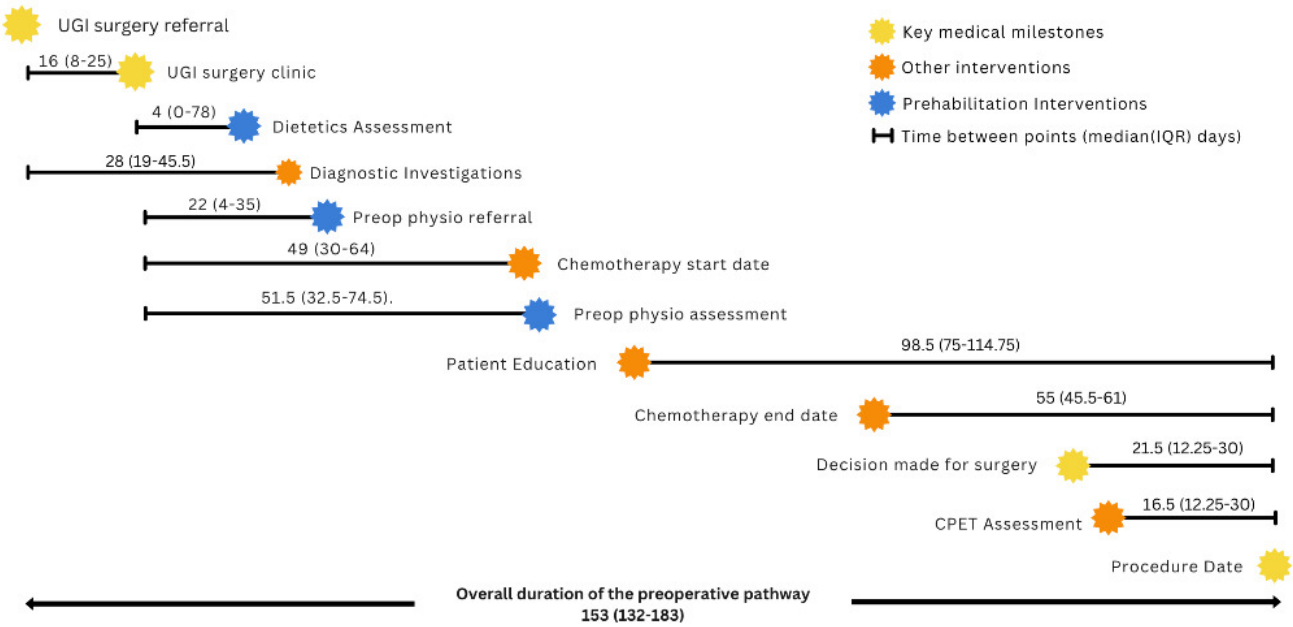


Figure 3. OG preoperative pathway. The timeline shows the time frames between preoperative interventions.

Macmillan guidance recommends multiprofessional input into patient physical, nutritional, and psychological health.[7] However, in a Macmillan evidence review, it was found that physical fitness optimisation by physiotherapy is commonly included within prehabilitation programmes, but input from professions such as dietetics and psychological medicine vary.[14] Due to the ongoing heterogeneity of prehabilitation interventions within the evidence base there are no conclusions that can be made regarding the optimal approach.

The assessment of prehabilitation within the preoperative pathway revealed physiotherapy interventions are de-

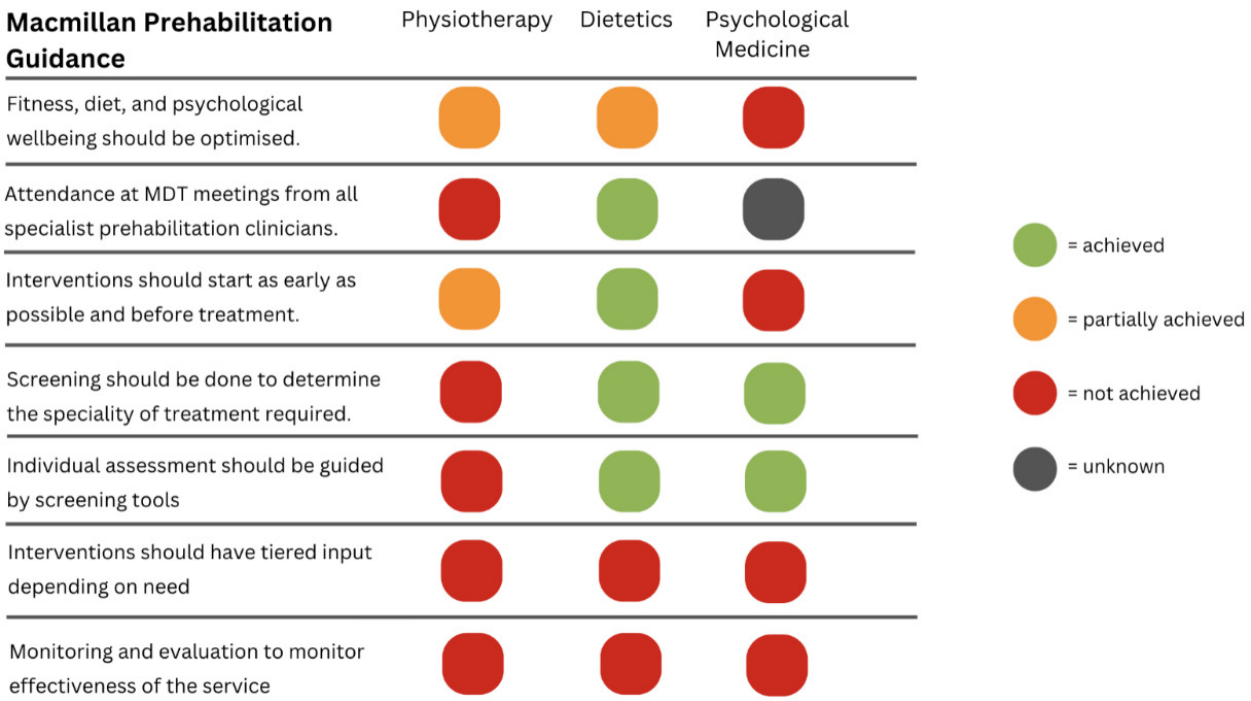


Figure 4. Traffic light table.

A traffic light table outlines how well the prehabilitation service is performing in relation to the Macmillan prehabilitation guidance. Green shows this is being achieved by the prehabilitation speciality. Yellow shows that it is partially being achieved and red shows that it is not being done.

livered late, with CPET instigated immediately before surgery to inform patient fitness for surgery. Optimising patient fitness before the start of chemotherapy treatment has been shown to improve the tolerance[15] and completion of chemotherapy.[16] In the local preoperative pathway, neoadjuvant chemotherapy started a median (IQR) of 49 (30-64) days after the OG clinic, whereas the initial physiotherapy assessment was a median (IQR) of 51.5 (32.5-74.5) days after. This shows that physiotherapy is commencing after the start of neoadjuvant chemotherapy treatment. Locally, physiotherapy interventions should be deployed sooner to potentially improve the completion of neoadjuvant chemotherapy treatment. Cardiorespiratory fitness is an independent risk factor for post-operative morbidity and mortality,[5] therefore, this assessment should be adopted earlier in the preoperative pathway as a screening tool to assess patient risk and guide further assessment and treatment.[6] CPET should be explored earlier in the preoperative pathway to guide individual prehabilitation and exercise prescription. Anaesthetists complete the local CPET evaluation in an isolated room, which prevents technicians from performing the test, making it costly to complete. By evaluating prehabilitation in the context of the preoperative pathway, it has demonstrated areas for change including timing of interventions and identifying suitable alternatives for fitness testing.

The local prehabilitation service operates face to face in the hospital, via telemedicine, or virtually. Home-based and telemedicine prehabilitation programmes have been found to be accessible, feasible, and easy to follow by patients for older patient groups,[17] but others have found the benefits of community and face to face support beneficial for their mood and adherence to prehabilitation.[18] A qualitative review of patients undergoing telemedicine prehabilitation found they appreciated the flexibility and accessibility but felt peer support would have been beneficial.[19] Understanding the barriers to receiving prehabilitation should be investigated to ensure those most at risk receive prehabilitation treatment. Tailoring the setting of prehabilitation to accommodate the diverse needs of the patient population may create an environment conducive to prehabilitation uptake and should be investigated in the future.

This evaluation has limitations. Findings are not generalizable beyond the local NHS Trust, but practical recommendations can be applied for service improvement. The staff survey was not validated, though it was refined through pilot testing. Some data were unavailable due to incomplete documentation. Strengths include the mixed-methods approach, consecutive sampling to reduce bias, and inclusion of multi-professional interventions. Prehabilitation was evaluated within the preoperative pathway, providing a comprehensive service review.

CONCLUSION

This retrospective, mixed-method, service evaluation identified several areas for improvement in the local prehabilitation service. 25/95 (26%) of OG patients were not identified to receive preoperative physiotherapy, despite all patients undergoing an elective cancer resection surgery. The preoperative pathway identified intervention timing and highlighted areas for optimising treatment. Evaluation of the service against the Macmillan guidance provides in-

sight into compliance and shows areas for improvement. Future areas for investigation should include audit against the Macmillan guidance, evaluation of prehabilitation on post-operative outcomes, exploring the role of CPET within the preoperative pathway, and understanding patient preferences regarding prehabilitation setting.

Key Points

- Prehabilitation should include optimisation of a patients functional, nutritional, and psychological health, yet physiotherapy is only funded profession in this local prehabilitation service.
- Understanding the prehabilitation service in context of the wider preoperative pathway will allow for optimisation of patient treatment.
- Evaluating the service against the Macmillan prehabilitation guidance shows clear areas for local improvement.

FUNDING

This work was funded by the NIHR Biomedical Research Centre Oxford.

Submitted: June 26, 2024 GMT, Accepted: October 04, 2024 GMT

REFERENCES

1. Oesophageal cancer statistics. Cancer Research UK. 2015. Accessed May 30, 2024. https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/oesophageal-cancer

2. Symptoms of oesophageal cancer. www.nhs.uk. 2023. Accessed May 30, 2024. https://www.nhs.uk/conditions/oesophageal-cancer/symptoms/

3. Body systems and cancer. Cancer Research UK. 2015. Accessed April 18, 2024. https://www.cancerresearchuk.org/what-is-cancer/body-systems-and-cancer

4. Phillips AM. Upper gastrointestinal cancers. In: Tadman M, Roberts D, Foulkes M, eds. *Oxford Handbook of Cancer Nursing*. Oxford University Press; 2019:351-364. doi:10.1093/med/9780198701101.003.0027

5. Rose GA, Davies RG, Appadurai IR, Williams IM, Bashir M, Berg RMG, et al. 'Fit for surgery': the relationship between cardiorespiratory fitness and postoperative outcomes. *Exp Physiol [Internet]*. 2022;107(8):787-799. doi:10.1113/ep090156

6. Association of Anaesthetists, Association of Surgeons of Great Britain and Ireland, British Thoracic Society, Centre for Perioperative Care, Summerton D, Federation of Surgical Specialty Associations, et al. *Preoperative Assessment and Optimisation for Adult Surgery*.; 2021.

7. Macmillan Cancer Support, Royal College of Anaesthetists, National Institute for Health Research Cancer and Nutrition Collaboration, NHS England, Transforming cancer Services Team, Macmillan Mental Health Clinical Lead, et al. *Principles and Guidance for Prehabilitation within the Management and Support of People with Cancer*.; 2020.

8. Stiger RJ, Williams MA, Gustafson OD, Woods A, Collett J. The effectiveness of prehabilitation interventions on biopsychosocial and service outcomes pre and post upper gastrointestinal surgery: a systematic review. *Disabil Rehabil [Internet]*. Published online 2024:1-24. doi:10.1080/09638288.2024.2310765

9. Tsimopoulou I, Pasquali S, Howard R, Desai A, Gourevitch D, Tolosa I, et al. Psychological prehabilitation before cancer surgery: A systematic review. *Ann Surg Oncol [Internet]*. 2015;22(13):4117-4123. doi:10.1245/s10434-015-4550-z

10. Boden I, Skinner EH, Browning L, Reeve J, Anderson L, Hill C, et al. Preoperative physiotherapy for the prevention of respiratory complications after upper abdominal surgery: pragmatic, double blinded, multicentre randomised controlled trial. *BMJ [Internet]*. Published online 2018:j5916. doi:10.1136/bmj.j5916

11. Michael CM, Lehrer EJ, Schmitz KH, Zaorsky NG. Prehabilitation exercise therapy for cancer: A systematic review and meta-analysis. *Cancer Med [Internet]*. 2021;10(13):4195-4205. doi:10.1002/cam4.4021

12. Waterland JL, McCourt O, Edbrooke L, Granger CL, Ismail H, Riedel B, et al. Efficacy of prehabilitation including exercise on postoperative outcomes following abdominal cancer surgery: A systematic review and meta-analysis. *Front Surg [Internet]*. Published online 2021:8. doi:10.3389/fsurg.2021.628848

13. Zhao B, Zhang T, Chen Y, Zhang C. Effects of unimodal or multimodal prehabilitation on patients undergoing surgery for esophagogastric cancer: a systematic review and meta-analysis. *Support Care Cancer [Internet]*. 2023;32(1):15. doi:10.1007/s00520-023-08229-w

14. Bloom E. Prehabilitation Evidence and Inisght Review. https://www.macmillan.org.uk. 2017. Accessed April 18, 2024. https://www.macmillan.org.uk/_images/prehabilitation-evidence-and-insight-review_tcm9-335025.pdf

15. Christodoulidis G, Halliday LJ, Samara A, Bhuva N, Park WHE, Moorthy K. Personalized prehabilitation improves tolerance to chemotherapy in patients with oesophageal cancer. *Curr Oncol [Internet]*. 2023;30(2):1538-1545. doi:10.3390/curroncol30020118

16. Barman S, Walker R, Knight W, Baker C, Kelly M, Gossage J, et al. OGC P15 analysing the impact of prehabilitation on patient outcomes in oesophagogastric cancer surgery: Combined data from four prospective clinical trials performed across the UK and Ireland. *Br J Surg [Internet]*. 2023;110(Supplement_8). doi:10.1093/bjs/znad348.213

17. Barnes K, Hladkowicz E, Dorrance K, Bryson GL, Forster AJ, Gagné S, et al. Barriers and facilitators to participation in exercise prehabilitation before cancer surgery for older adults with frailty: a qualitative study. *BMC Geriatr [Internet]*. 2023;23(1). doi:10.1186/s12877-023-03990-3

18. Van der Velde M, Van der Leeden M, Geleijn E, Veenhof C, Valkenet K. What moves patients to participate in prehabilitation before major surgery? A mixed methods systematic review. *Int J Behav Nutr Phys Act [Internet]*. 2023;20(1):75. doi:10.1186/s12966-023-01474-6

19. Wu F, Laza-Cagigas R, Rampal T. Understanding patients' experiences and perspectives of Tele-prehabilitation: A qualitative study to inform service design and delivery. *Clin Pract [Internet]*. 2022;12(4):640-652. doi:10.3390/clinpract12040067

SUPPLEMENTARY MATERIALS

Supplementary Material

Download: https://acprcjournal.scholasticahq.com/article/124348-prehabilitation-service-provision-and-preoperative-clinical-pathways-for-major-oesophagogastric-cancer-surgery-patients-a-service-evaluation/attachment/248110.pdf?auth_token=BPnt4Dh3_ZDH22pHIKbO

Clarke S, Milburn N. Physiotherapy service provision after cardiac surgery for children with congenital heart disease in the United Kingdom and Ireland: a service evaluation. *ACPRC Journal*. 2024;54(3):28-34. doi:10.56792/JODG4440

Paediatrics

Physiotherapy service provision after cardiac surgery for children with congenital heart disease in the United Kingdom and Ireland: a service evaluation

Stephanie Clarke[1], Natalie Milburn[2]

[1] Department of Physiotherapy, Birmingham Women's and Children's Hospital NHS Foundation Trust, [2] Department of Physiotherapy, Birmingham Women's and Children's Hospital NHS Foundation Trust

Keywords: Physiotherapy, Congenital heart disease, Rehabilitation, Paediatrics, Paediatric cardiac surgery

https://doi.org/10.56792/JODG4440

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

Abstract

Background

Congenital heart disease (CHD) is the most common form of congenital abnormality present at birth representing 57.1 per 10 000 live births in England. Many children with CHD will undergo lifesaving surgery, and a proportion will require post operative monitoring in a paediatric intensive care unit (PICU). Physiotherapy in PICU has historically focused on respiratory management. However, newer responsibilities include developmental assessment and rehabilitation of motor-delay and motor-function.

Aim

Explore physiotherapy service provision for children with CHD post cardiac surgery in the United Kingdom (UK) and Ireland.

Methods

Literature was used to develop a questionnaire, containing 32 questions. This was emailed to physiotherapists at 12 Trusts providing paediatric cardiac surgery in the UK and Ireland in July 2022. This questionnaire was registered and approved by the Trust as a service evaluation.

Results

Ten Trusts completed the questionnaire, with a response rate of 84%. There was variety in service provision. Respiratory physiotherapy assessments occurred at all sites (10, 100%). Rehabilitation referral processes, timing of assessments and treatment dosages differed. Sternal precaution advice was provided at eight sites (80%). Referral criteria and practice for outpatient follow-up and community physiotherapy varied.

Conclusion

Physiotherapy service provision for children with CHD in the UK and Ireland varied. Routine respiratory assessment is common practice, however, the effectiveness of subsequent interventions in ventilated children remains inconclusive. Routine outpatient physiotherapy is infrequent although the evidence highlights the importance of ongoing specialist rehabilitation. Further research is needed to develop guidelines and standardise care.

INTRODUCTION

Congenital heart disease (CHD) is the most common form of congenital abnormality present at birth representing 57.1 per 10000 live births in England.[1] In the United Kingdom (UK), approximately 4000 operations for CHD in children are performed annually. Of these, around 75% require a period of post-operative recovery on a Paediatric Intensive Care Unit (PICU).[2]

Physiotherapy practice on PICU has historically focused on respiratory management of ventilated patients. The effects of anaesthesia, surgery and mechanical ventilation can lead to reduced lung volume and secretion retention in children post cardiac surgery. This can increase the risk of developing ventilator acquired pneumonia (VAP). Higher

incidences of VAP have been reported in children with CHD post cardiac surgery compared to other patient groups on PICU.[3] Physiotherapists have in-depth knowledge regarding the assessment and management of secretion retention associated with being intubated and ventilated.

Due to increased awareness that a period of critical illness can lead to a loss or delay in motor function, physiotherapy practice on PICU has expanded to include assessment and rehabilitation of motor function.[4] A period of illness requiring a PICU admission can lead to motor delay or a loss of motor function in children.[5] CHD can impact antenatal brain development leading to motor developmental delay.[6] The effects of being critically ill on PICU, in addition to pathological risk factors associated with CHD, mean many children require rehabilitation following surgery. Physiotherapists have specialist skills in the assessment and rehabilitation of motor delay and loss of motor function.

Sternal precaution advice is routinely used in clinical practice for patients who have undergone a sternotomy.[7] However, this advice can impact developmental and rehabilitation activities completed by physiotherapists.

There is a role for physiotherapists in the assessment and management of children with CHD post cardiac surgery. However, there is a lack of literature exploring physiotherapy service provision and practice in this patient group.

This project evaluated physiotherapy practice and service structure for children with CHD post cardiac surgery in the UK and Ireland, in three key areas.

1. Respiratory physiotherapy practice and service provision in children following cardiac surgery.
2. Physiotherapy rehabilitation practice and service provision in children following cardiac surgery.
3. Clinical practice on sternal precaution advice.

METHODS

A self-completed questionnaire of physiotherapy departments in UK and Ireland level 1 centres providing paediatric cardiac surgery, was conducted. This method was chosen as it captured quantifiable data from individuals at a single point in time.[8] Although not a web-based questionnaire the project was designed using the CHERRIES guidelines.[9] As a service evaluation, this project was not classed as research, therefore formal ethical approval was not required, as per UK Health Research Authority guidance. It was registered and approved by the Trust (CARMS 31431).

The questionnaire content was derived from relevant literature and clinical experience of authors SC and NM ***(supplementary material 1).*** The questionnaire took approximately 15 minutes to complete and included 32 multiple-choice and open-ended questions. An e-link to the questionnaire was shared in July 2022. To ensure a variety of Trusts were represented nationally, demographic information collected was limited to the location of the responding Trusts. No identifiable personal information was collated. Face and content validity was achieved by pilot testing the questionnaire using physiotherapists from two Trusts. Following pilot testing, the introductory wording was modified, seven questions were rephrased, and the layout was altered.

The physiotherapy UK extracorporeal membrane oxygenation (ECMO) specialist interest group were approached regarding the project as this group had representatives in level 1 cardiac Trusts. A verbal explanation of the project was completed and an email mailing list of individuals within the specialist interest group was obtained. The questionnaire could be distributed to other physiotherapists within their organisation if these individuals were best placed to complete the questionnaire. The results were stored on a secure NHS drive. Descriptive statistics were used to analyse and report results.

RESULTS

Ten sites completed the questionnaire, with a response rate of 84%. All questionnaires were completed in full. Responses were from sites in the UK and Ireland.

All 10 sites provided physiotherapy input as part of their service provision. Four sites (40%) reported ring-fenced monies for physiotherapy staffing for post-surgical cardiac patients; of these, two (50%) reported one or more dedicated Whole Time Equivalent (WTE) (37/5 h/week) physiotherapists. All sites reported having other member(s) of the multidisciplinary team as part of their work force establishment in post-surgical cardiac patients ***(supplementary material 2).***

Post cardiac surgery, eight sites (80%) reported all new patients were automatically referred for respiratory physiotherapy assessments. Seven sites (70%) stated a respiratory assessment was completed for all patients post operatively, two sites (20%) completed assessments on specific patient groups and one site (10%) only completed assessments on patients that were referred.

Clinical practice when conducting a respiratory assessment varied. Five sites (50%) reported their assessment process included a full bedside assessment, bedside discussions, and chest radiography screening practice. Two sites (20%), used chest x-ray screening and bedside discussions, and a further two sites (20%) completed a full bedside assessment and one site (10%) used full bedside assessment and discussion.

Nine sites (90%) reported that, post cardiac surgery, routine assessment of motor delay and motor function were not completed on all new patients. Four sites (40%) used a formal referral criterion for assessment of motor delay and motor function. Other methods of referral included physiotherapy screening of patients (70%), members of the multidisciplinary team (50%) and parents (30%).

The timing of initial assessment of motor delay and motor function post operatively varied. Sites reported patients were commonly assessed either intubated or extubated on PICU (50%). One site (10%) reported assessment occurred on the cardiac ward and one site (10%) stated it was not part of their service provision ***(Table 1).***

Seven sites (70%) used standardised outcome measures as part of their assessment process; amongst these sites,

Table 1. Completion of initial developmental and motor assessment

Completion of initial assessment	Sites n (%)
Stable intubated or extubated on PICU	5 (50)
Stable intubated on PICU	2 (20)
Stable extubated PICU	1 (10)
Stable ward	1 (10)
Not part of service	1 (10)

PICU, paediatric intensive care unit.

the Alberta Infant Motor Scale (AIMS) was the most reported measure (n=5, 71%), followed by the Bayley Scale of Infant Development (n=4, 58%). Other measures reported included Peabody Developmental Motor Score, Hammersmith Infant Neurological Examination, and Prechtal's General Movement Assessment (each at 1 site, 14%).

Rehabilitation of motor delay and loss of motor function in children post cardiac surgery varied. Five sites (50%) did not offer a standardised treatment frequency or length, and eight sites (80%) did not have a standard duration of treatment ***(Table 2)*.**

The practice of providing families formal developmental advice prior to discharge also differed. Six sites (60%) gave developmental advice prior to discharge, either on PICU or the wards, via a combination of verbal advice, written literature or by individual treatment plans ***(Table 3)*.**

Eight sites (80%) did not offer outpatient physiotherapy follow up after discharge. At the two sites where outpatient follow up occurs, referral practice and follow up format varied ***(Table 4)*.**

Seven sites (70%) referred patients to community physiotherapy services however, referral criteria differed (***supplementary material 3)***

Eight sites (80%) provided advice on sternal precautions. Advice was delivered to families on the cardiac ward at seven sites (n=7, 87%). Four sites (n=4, 50%) also reported providing advice on sternal precautions on PICU, and one site (12%) prior to admission. Sternal precaution advice was shared verbally or via written literature. Four sites (50%) used written literature, two sites (25%) a combination of written literature and verbal advice, and two sites (25%) provided verbal advice only. Physiotherapists commonly delivered sternal precaution advice to families (n=7, 87%). Other professionals included cardiac nurse specialists (n=4, 50%), occupation therapists (n=2, 25%) and therapy assistants (n=1, 12%). Sternal precaution advice varied across each site (*Table 5*).

DISCUSSION

To our knowledge, this is the first project to evaluate UK paediatric physiotherapy practice, and service provision, for children with CHD post cardiac surgery. All responding sites reported providing postoperative physiotherapeutic intervention to children with CHD but clinical practice and service delivery varied.

Adult intensive care guidelines recommend one WTE physiotherapist for every four, level three ICU beds.[10] This is a higher staffing ratio compared to paediatric critical care quality standards, which recommend one physiotherapist five days a week.[11] Protected funding and recommendations regarding physiotherapy staffing ratios for specialist service provision including CHD are currently lacking in the UK. This is reflected in our findings.

Table 2. Rehabilitation frequency, duration and length of treatment

How often is treatment	Sites n (%)	How long are treatment sessions	Sites n (%)	Standard number of treatment sessions	Sites n (%)
Daily	0	<30mins	2 (20)	Yes	1 (10)
X1 a week	3 (30)	30-60mins	2 (20)	No	8 (80)
X2 a week	0	>60mins	0	Not part of service	1 (10)
X3 a week	1 (10)	Not part of service	1 (10)		
Monthly	0	Other- variable	5 (50)		
Not part of service	1 (10)				
Other- variable	5 (50)				

Table 3. Information provision on motor development

Development advice provided on discharge	Sites n (%)	When is advice provided	Sites n (%)	What format in advice given in	Sites n (%)
Yes	6 (60)	PICU	5 (83)	Verbal	5 (83)
No	4 (40)	Ward	6 (100)	Literature	6 (100)
				Treatment plans	5 (83)

PICU, paediatric intensive care unit.

Table 4. Outpatient service provision

Outpatient referrals completed by	Sites n (%)	Outpatient follow up format	Sites n (%)
AHP	2 (100)	Face-to-face single therapist clinic	2 (100)
CNS	1 (50)	MDT virtual clinic	1 (50)
Medical team	1 (50)	MDT face-to-face clinic	1 (50)
Ward staff	1 (50)	Single therapist outpatient appointment	1 (50)

AHP, allied health professional; CNS, cardiac nurse specialist; MDT, multi-disciplinary team.

This project demonstrated that respiratory physiotherapy was the most reported service provision. However, the effectiveness of ongoing respiratory physiotherapy treatment in ventilated children remains inconclusive.[12] Furthermore, the completion of prophylactic chest physiotherapy in patients post cardiac surgery failed to prevent pneumonia or reduce episodes of atelectasis.[13] Further evidence is needed to guide respiratory physiotherapy service provision in this patient group. This is emulated in this project as a variety of clinical assessment processes and service provision were demonstrated.

Rehabilitation practice and service provision differed within this project. Most sites used screening methods to highlight at-risk patients. Practice recommendation guidelines for early rehabilitation and mobilisation in children endorsed the process of screening for eligibility within 24 hours of admission.[14] This may explain why sites are adopting this practice. The positive impact of early rehabilitation and mobilisation during a period of critical illness is documented in adult literature.[15] There is a lack of evidence establishing the impact of early rehabilitation and mobilisation, and what dosage of rehabilitation is optimal in children.[16] This is reflected in this project with many sites offering different frequencies, duration and lengths of treatment sessions.

Sternal precautions are utilised within many hospitals with the aim of minimising complications such as wound dehiscence, and poor sternal healing following median sternotomy.[7] Local sternotomy protocols, as shown in this project, vary and can be based on institutional preference, adult literature, and historical practice.[7] The development of an evidence-based national guideline could be used to support the standardisation of sternal precaution practice in children.

The importance of, and need for, ongoing developmental screening and referral for specialist rehabilitation in children with CHD is recognised in the literature.[17] Multiple small studies have demonstrated improvements in motor function, strength, and developmental milestones in children with CHD who access ongoing outpatient physiotherapy.[18,19] This project highlights that outpatient physiotherapy service provision is lacking and referral to community physiotherapy services varies.

The variances in clinical practice and service provision demonstrated in this project may be due to a lack of clinically impactful literature and guidelines. Research to evaluate the impact of physiotherapy in children with CHD could aid standardisation of care, although the heterogeneity of this population may make this challenging.

LIMITATIONS

Limitations of this project include obtaining responses from only one physiotherapist per site, as this assumes everyone follows the same clinical practice. The use of the ECMO paediatric physiotherapy specialist interest group relied on therapists disseminating the questions. Asking physiotherapists to comment on clinical practical and service provision across a heterogeneous population may have diluted differences in service provision across conditions, ages, and types of surgery.

Table 5. Sternal precaution recommendations

Recommendation(s)
To avoid tummy time for 6 weeks To avoid picking up under arms - bottom scoop instead for 6 weeks
Two weeks of caution to allow wound healing. After two weeks can progress as able. Tummy time two weeks, return to nursery / school 4-6 weeks, rough play / lifting under arms / swimming / cycling 6 weeks.
No tummy time for 2 weeks, closer caution with or suspected wound infection
No tummy time for 6 weeks No pulling/ lifting under the arms for 6 weeks No lifting/carrying heavy objects for 6 weeks, adapted to individual needs depending on age. No contact sport, scooters, riding bike for 8-12 weeks
Scoop lift for 6 weeks Not allowed tummy time for 6 weeks (unless tummy time on parent's chest) however if crawling or rolling then do not worry too much if they get themselves into this position.
Tummy time can commence as pain allows - usually 1-2 weeks post operative, Not lifting under the arms for 3 months

CONCLUSION

This service evaluation indicates children with CHD have access to physiotherapists following cardiac surgery but there is a disparity of service provision and a variety of clinical practice. The results of this project highlight that certain sites offer a more comprehensive level of service provision. These sites could be used for benchmarking in local service development projects thus aiding standardisation of care.

Key Points

1. Children with CHD commonly access respiratory physiotherapy post-operatively.
2. Rehabilitation practice post-operatively and on discharge varies between sites.
3. Further development of guidelines may lead to standardisation of care.

ACKNOWLEDGEMENTS

We thank the paediatric physiotherapists who completed the questionnaire and the ECMO paediatric physiotherapy specialist interest group.

FUNDING

This project received no specific grant from any funding agency in the public, commercial or not-for-profit sectors

ETHICAL AND R&D APPROVAL

As a service evaluation, formal ethical approval was not required as this project was not deemed as research, as per UK Health Research Authority guidance. The project was registered and approved by Birmingham Women's and Children's NHS Trust (CARMS 31431).

Submitted: October 31, 2023 GMT, Accepted: June 12, 2024 GMT

REFERENCES

1. Stevens S, Platt MW. The national congenital anomaly and rare disease registration service (NCARDRS). *Reproductive Toxicology*. 2018;80:139. doi:10.1016/j.reprotox.2018.07.023

2. de Belder M, Pow R, Deanfield Jo. NICOR publishes National Cardiac Audit Programme (NCAP) Annual Report 2021. NICOR. 2021. https://www.nicor.org.uk/2021/10/14/nicor-publishes-national-cardiac-audit-programme-ncap-annual-report-2021/

3. Roeleveld PP, Guijt D, Kuijper EJ, Hazekamp MG, de Wilde RBP, de Jonge E. Ventilator-associated pneumonia in children after cardiac surgery in The Netherlands. *Intensive Care Medicine*. 2011;37(10):1656-1663. doi:10.1007/s00134-011-2349-3

4. Hawkins E, Jones A. What is the role of the physiotherapist in paediatric intensive care units? A systematic review of the evidence for respiratory and rehabilitation interventions for mechanically ventilated patients. *Physiotherapy*. 2015;101(4):303-309. doi:10.1016/j.physio.2015.04.001

5. Ong C, Lee JH, Leow MKS, Puthucheary ZA. Functional Outcomes and Physical Impairments in Pediatric Critical Care Survivors. *Pediatric Critical Care Medicine*. 2016;17(5):e247-59. doi:10.1097/PCC.0000000000000706

6. Sprong MCA, Broeders W, van der Net J, Breur JMPJ, de Vries LS, Slieker MG, et al. Motor Developmental Delay After Cardiac Surgery in Children With a Critical Congenital Heart Defect: A Systematic Literature Review and Meta-analysis. *Pediatric Physical Therapy*. 2021;33(4):186-197. doi:10.1097/PEP.0000000000000827

7. Rodman Uher L, Nguyen N, Monge M. Sternal Precautions After Pediatric Cardiac Surgery: A Survey of Current Practice. *American Journal of Occupational Therapy*. 2016;70(4_Supplement_1):7011510235p1. doi:10.5014/ajot.2016.70S1-PO7104

8. Lavrakas P. Encyclopedia of Survey Research Methods. *Encyclopedia of Survey Research Methods*. 2008;1(1). doi:10.4135/9781412963947

9. Eysenbach G. Improving the Quality of Web Surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *Journal of Medical Internet Research*. 2004;6(3):e34. doi:10.2196/jmir.6.3.e34

10. FICM. Guidelines for the Provision of Intensive Care. Services - Version 2. 2019. Accessed October 18, 2021. https://www.ficm.ac.uk/sites/default/files/gpics-v2.pdf

11. Quality Standards for the Care of Critically Ill or Injured Children 6 th Edition. October 2021. https://pccsociety.uk/wp-content/uploads/2021/10/PCCS-Standards-2021.pdf

12. Shkurka E, Wray J, Peters M, Shannon H. Chest Physiotherapy for Mechanically Ventilated Children: A Systematic Review. *Journal of Pediatric Intensive Care*. Published online August 17, 2021. doi:10.1016/j.physio.2022.11.004

13. Beningfield A, Jones A. Peri-operative chest physiotherapy for paediatric cardiac patients: a systematic review and meta-analysis. *Physiotherapy*. 2018;104(3):251-263. doi:10.1016/j.physio.2017.08.011

14. Choong K, Canci F, Clark H, Hopkins R, Kudchadkar S, Lati J, et al. Practice Recommendations for Early Mobilization in Critically Ill Children. *Journal of Pediatric Intensive Care*. 2017;07(01):014-026. doi:10.1055/s-0037-1601424

15. Wang YT, Lang JK, Haines KJ, Skinner EH, Haines TP. Physical Rehabilitation in the ICU. *Critical Care Medicine*. 2021;(3).

16. Wieczorek B, Burke C, Al-Harbi A, Kudchadkar S. Early Mobilization in the Pediatric Intensive Care Unit: A Systematic Review. *Journal of Pediatric Intensive Care*. 2015;04(04):212-217. doi:10.1055/s-0035-1563386

17. Marino BS, Lipkin PH, Newburger JW, Peacock G, Gerdes M, Gaynor JW, et al. Neurodevelopmental Outcomes in Children With Congenital Heart Disease: Evaluation and Management. *Circulation*. 2012;126(9):1143-1172. doi:10.1161/CIR.0b013e318265ee8a

18. Ferrer-Sargues FJ, Peiró-Molina E, Cebrià i Iranzo MÀ, Carrasco Moreno JI, Cano-Sánchez A, Vázquez-Arce MI, et al. Effects of Cardiopulmonary Rehabilitation on the Muscle Function of Children with Congenital Heart Disease: A Prospective Cohort Project. *International Journal of Environmental Research and Public Health*. 2021;18(11):5870. doi:10.3390/ijerph18115870

19. Fourdain S, Simard MN, Dagenais L, Materassi M, Doussau A, Goulet J, et al. Gross Motor Development of Children with Congenital Heart Disease Receiving Early Systematic Surveillance and Individualized Intervention: Brief Report. *Developmental Neurorehabilitation*. 2020;24(1):56-62. doi:10.1080/17518423.2020.1711541

Clearway 2

#BeMore

Clearway 2 – Advanced Airway Clearance Made Simple

Breathe easier with Clearway 2, Breas' advanced second-generation MI-E device. With cutting-edge TreatRepeat® technology, clinicians can manually set insufflation and exsufflation cycles for automatic repetition—enhancing accuracy, speeding up titration, and simplifying setup. The result? Improved airway clearance, efficient cough assistance, and greater comfort for patients.

Key Benefits:

- Advanced Titration Technology: Exclusive TreatRepeat function
- Multiple Mode Options: Automatic, IPPB, NIV, and manual modes
- Enhanced Patient Synchrony: iTrigger® and Synchrony Beep® for precise, synchronized treatment

Upgrade to Clearway 2 for advanced, reliable airway clearance that delivers better care with ease.

Breas Medical Ltd. Unit A2, The Bridge Business Centre · Timothy's Bridge Road · Stratford-Upon-Avon Warwickshire CV379HW · UK · Phone +44 (0)1789 293 460

Jones L, Twose P, Nunn J. Person Centred Care in the ICU. *ACPRC Journal*. 2024;54(3):36-38. doi:10.56792/UWCT1621

Critical care

Person Centred Care in the ICU

Laura Jones, BSc, MSc[1,2], Paul Twose, BSc, MSc[1,2,3], Jason Nunn, BSc[1,2]

[1] Physiotherapy, Cardiff and Vale University Health Board, [2] Critical care, Cardiff and Vale University Health Board, [3] School of Healthcare Sciences, Cardiff University

Keywords: Critical care, Person centred care

https://doi.org/10.56792/UWCT1621

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

The importance of person-centred care is widely acknowledged within healthcare, forming part of core standards of care as well as becoming integrated into organisations' strategic plans and healthcare policies.[1-3] Person-centredness refers to a philosophy of healthcare practice which reflects the needs, values, and preferences of the individual to optimise their experience of care.[4] Research has demonstrated benefits including improved patient experience, reduced length of hospital stay and improved physical and social wellbeing.[5,6] Within critical care, deliberate attention to promote active involvement of both patients and their families is recognised as an integral part of their care and rehabilitation.[7]

A huge range of skills and approaches are required for healthcare professionals to successfully integrate patient and family values into healthcare.[8] Physiotherapists are well placed within the critical care team to offer continuity of care in an environment with frequent changes of staff throughout a patient's admission and build therapeutic relationships with patients, providing a foundation for person centred care to be outworked.[9] Consistency and an individualised approach are recognised as important factors in the weaning of ventilation[10] and rehabilitation of patients within critical care[11] and were key components of success for this case study. Permission has kindly been given by the patient's parents for this case report to be shared.

An 18-year-old male was admitted to critical care with acute on chronic type two respiratory failure and a community acquired pneumonia. He had a background of restrictive lung disease due to a significant scoliosis. He also had complex behavioural and learning needs with a comprehensive community care plan and risk assessment in place. His respiratory team had previously attempted to initiate nocturnal non-invasive ventilation (NIV) but this had been unsuccessful due to issues with tolerance of the NIV mask. Initially he was intubated, ventilated and sedated with physiotherapy intervention for airway clearance. Weaning from mechanical ventilation and sedation were started with time taken to achieve an optimal balance between management of agitation and requirement to wean high levels of pressure support. Active rehab commenced while the patient remained intubated and sitting out in a chair occurred regularly as this was particularly enjoyable for him. Repeated failure of spontaneous breathing trials (SBTs) and frequent adjustments to the weaning plan with regular changes of medical staff lead to some autonomy being given to physiotherapy staff to co-ordinate and guide weaning. The combination of significant weakness, repeated inability to tolerate SBTs and concerns around secretion clearance, as evident in this patient, often result in the need for a tracheostomy. However, concerns around his behavioural difficulties and discharge destinations able to meet these needs, meant that the focus was placed on 'tracheostomy avoidance', with a plan for early extubation to NIV.

Image 1. Standing to transfer into chair

Consistent and dependable therapeutic support for the patient during this process was instrumental to achieving liberation from mechanical ventilation and use of NIV as well as adjusting communication and goal setting to match the patient's needs. The ability to lead the patient's weaning allowed physio staff the freedom to balance his respiratory needs, rehabilitation and functional goals. His family were essential to his care and provided activities, enrichment and support to optimise the environment as well as advocate for him during an undoubtedly stressful time. To help prepare for using a NIV mask he responded well to a personalised video from a local fire station of firefighters

wearing masks and explaining their importance. Time spent reassuring the patient and engaging in his chosen activities was rewarded with development of trust and respect, and ability of staff to encourage the use of NIV after extubation which occurred 40 days after admission. Re-intubation was required two days later with subsequent treatment for a chest infection. A week later a second attempt at extubation was made with the risks of 'failure' acknowledged.

Initially, after changing the type of mask to reduce discomfort it was tolerated well and he was able to make trips off unit wearing the NIV mask. This ability to leave critical care, spend time with his family and experience a change of environment was hugely important for him. To help with weaning NIV support during the day a picture timetable was used to establish NIV periods and time off using high flow nasal oxygen to support weaning. With significant time spent reassuring, encouraging and facilitating the patient's desired activities in and out of normal working hours, he was established to nocturnal NIV and was self-ventilating on room air during the day. He was able to mobilise short distances and have regular trips off the unit in a wheelchair. Co-ordinating his care with nursing staff, therapists and input from the home ventilation team gradually allowed his parents to carry out much of his care and input from physiotherapists was stepped back. Fifty-nine days after admission he was discharged home with follow up from the home ventilation team and learning disabilities therapy team for ongoing rehabilitation.

Patient and family centred care is of vital significance yet often challenging to implement in practice.[7] This experience of caring for a young man with complex needs has reminded us of the importance of adopting and promoting an environment in which the patient and their family can be actively involved and participate in the patient's care and rehabilitation. We learned that being consistent as well as flexible and willing to adapt our approach leads to a respectful therapeutic alliance that is mutually beneficial. This alliance allowed us to more confidently advocate for him to achieve the best outcome. We are grateful to have a supportive wider critical care team to allow us some autonomy to lead and co-ordinate weaning as well as other allied health professionals to provide joined up care with patient and family focussed goals.

Image 2. Wearing the NIV mask

Key Points

- Using a person-centred approach to physiotherapy interventions is imperative in supporting the needs of patients with long-term complex physical and behavioural needs
- Having a consistent and joined up approach to mechanical ventilation weaning and transitioning to NIV in this case study helped reduce chances of weaning failure

Submitted: August 09, 2024 GMT, Accepted: September 19, 2024 GMT

REFERENCES

1. Care Quality Commission. The Fundamental Standards. 2024. http://www.cqc.org.uk/about-us/fundamental-standards

2. Guastello S, Jay K. Improving the patient experience through a comprehensive performance framework to evaluate excellence in person-centred care. *BMJ Open Quality*. 2019;8:e000737. doi:10.1136/bmjoq-2019-000737

3. World Health Organisation. *People-Centred Health Care: A Policy Framework*. World Health Organisation; 2007. https://iris.who.int/handle/10665/206971

4. Killingback C, Green A, Naylor J. Development of a framework for person-centred physiotherapy. *Physical Therapy Reviews*. 2022;27(6):414-429. doi:10.1080/10833196.2022.2129157

5. Tringale M, Stephen G, Boylan A, et al. Integrating patient values and preferences in healthcare: a systematic review of qualitative evidence. *BMJ Open*. 2022;12:e067268. doi:10.1136/bmjopen-2022-067268

6. Kuipers SJ, Cramm JM, Nieboer AP. The importance of patient-centered care and co-creation of care for satisfaction with care and physical and social well-being of patients with multi-morbidity in the primary care setting. *BMC Health Services Research*. 2019;19(13). doi:10.1186/s12913-018-3818-y

7. Secunda KE, Kruser KM. Patient-Centered and Family-Centered Care in the Intensive Care Unit. *Clinical Chest Medicine*. 2022;43(3):539-550. doi:10.1016/j.ccm.2022.05.008

8. Tringale M, Stephen G, Boylan AM, et al. Integrating patient values and preferences in healthcare: a systematic review of qualitative evidence. *BMJ Open*. 2022;12(11):e067268. doi:10.1136/bmjopen-2022-067268

9. Miciak M, Mayan M, Brown C, et al. The necessary conditions of engagement for the therapeutic relationship in physiotherapy: an interpretive description study. *Archives of Physiotherapy*. 2018;8:3. doi:10.1186/s40945-018-0044-1

10. Akella P, Voigt LP, Chawla S. To Wean or Not to Wean: A Practical Patient Focused Guide to Ventilator Weaning. *Journal of Intensive Care Medicine*. 2022;37(11):1417-1425. doi:10.1177/08850666221095436

11. National Institute for Health and Care Excellence. *Rehabilitation after Critical Illness in Adults*. NICE Quality Standard; 2017. https://www.nice.org.uk/guidance/qs158

Davies R, Jerrard K. Inspiratory muscle training in adult intensive care units: A survey of UK physiotherapy practice. *ACPRC Journal*. 2024;54(3):39-44. doi:10.56792/VYLM5362

Critical care

Inspiratory muscle training in adult intensive care units: A survey of UK physiotherapy practice

Rebecca Davies[1], Kirsty Jerrard[2]

[1] Department of Physiotherapy, King's College Hospital NHS Foundation Trust, [2] Department of Physiotherapy , King's College Hospital NHS Foundation Trust

Keywords: Inspiratory muscle training, Mechanical ventilation, Weaning, Intensive care

https://doi.org/10.56792/VYLM5362

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

Abstract

Introduction

Inspiratory muscle training (IMT) is a safe and feasible treatment modality for critically ill patients presenting with respiratory muscle weakness. IMT has been shown to increase respiratory muscle strength, accelerate weaning and reduce length of stay.

Objectives

To explore the clinical use of IMT by physiotherapists working in adult intensive care units (ICUs) in the United Kingdom (UK).

Methods

An online survey was developed and distributed to respiratory physiotherapists in the UK via the Association of Chartered Physiotherapists in Respiratory Care social media platform and the UK Respiratory Physiotherapy Leaders group. The survey was available for completion between November 2020 and January 2021.

Results

Eligible responses were received from 45 ICUs. Eleven ICUs (24%) used IMT, five (11%) were in the process of procurement and 29 (65%) did not use IMT.

There was variation between ICUs in the type of IMT device used and patient populations who received IMT. The most commonly reported clinical indications for IMT use were failure to wean (n=8; 73%) and prolonged mechanical ventilation of more than seven days (n=5; 45%).

The most commonly reported outcome measure used to guide treatment parameters and determine effectiveness of IMT was maximal inspiratory pressure (MIP) (n=8; 70%).

Conclusions

IMT is not a common treatment modality used by physiotherapists within UK adult ICUs. There is a need for increased education regarding IMT implementation and the development of an evidence based national guideline to enable a standardised approach to IMT delivery, and to promote its use within the UK.

INTRODUCTION

Respiratory muscle weakness is a well known complication of mechanical ventilation and is highly prevalent within the adult intensive care population.[1] The presence of respiratory muscle weakness, associated with prolonged periods of mechanical ventilation, can result in an increased intensive care unit (ICU) length of stay (LOS).[2] The development of diaphragm dysfunction has been shown to occur twice as frequently as ICU acquired weakness at the time of ventilator liberation.[3] Within the literature, significant reductions in diaphragm thickness have been observed within as little as 18 hours of mechanical ventilation, with reported reductions of up to 26% within the first 72 hours.[4] Reductions in inspiratory muscle endurance have also been observed in up to a third of patients mechanically ventilated for more than seven days.[5] Literature has shown that a reduction in respiratory muscle strength can result in a longer duration of mechanical ventilation and subsequent increased risk of secondary complications.[6] Physiotherapists commonly employ strategies to enable and accelerate weaning from me-

chanical ventilation. This may include the use of inspiratory muscle training (IMT).

IMT has been shown to be a feasible and well tolerated modality within the intensive care population.[7] A systematic review and meta-analysis demonstrated meaningful improvements in measures of inspiratory muscle strength in critically ill patients receiving IMT.[8] IMT has also been shown to reduce the duration of mechanical ventilation[9] and improve quality of life scores.[10]

Within the literature, both spring-loaded mechanical threshold devices and electronic tapered flow devices have been utilised within the ICU setting, both providing titratable resistance and adaptability for use with mechanically ventilated patients via an endotracheal tube and tracheostomy.[6] Mechanical threshold devices utilise a spring-loaded flow-independent one way valve, providing external loading to the respiratory muscles throughout inspiration. These single patient use devices can create a resistance of between 9-41 cmH_20. Comparably, electronic tapered flow resistive loading IMT devices provide a gradual decrease in load throughout inspiration, matching the decline in flow and volume of the patient effort.[6] Tapered flow devices offer a lower starting resistance of 0 cmH_20 and can feature in-built maximal inspiratory pressure (MIP) testing functions. In healthy individuals, performing IMT with a tapered flow device improved MIP and increased maximal inspiratory flow generating capacity compared to use with mechanical threshold devices.[8] In difficult to wean patients, tapered flow devices were also found to allow for increased lung volume expansion, higher inspiratory flows and better patient tolerance than mechanical threshold devices.[11] However, the comparable difference in MIP scores, respiratory weaning duration, ICU LOS and longer-term quality of life scores between devices are yet to be established within the ICU patient cohort.

In an international cross-sectional survey of physiotherapy practice, 63% (n=270) of respondents reported utilisation of IMT within their intensive care units.[12] In an earlier survey of French physiotherapists, IMT use was reported by just 36% (n=106) of the respondents, citing lack of knowledge regarding clinical procedures and limited resources as common barriers to IMT usage.[13] With a growing evidence base within the ICU population, it is important to understand the prevalence of IMT within UK adult intensive care units. This will also help establish current clinical practices and barriers to its implementation within the UK.

OBJECTIVES

The aim of this study was to explore the clinical use of IMT within UK adult ICUs.

METHODS

A survey was developed on an online platform (Survey Monkey) and informed by literature relating to IMT.[6,8,14] The survey comprised of seventeen questions specific to IMT, both open and multiple choice, pertaining to:

- Current use of IMT within intensive care
- Device selection
- Patient eligibility and exclusion criteria
- IMT training regimes and clinical procedures
- Patient related outcome measures
- Staff training and competency processes

The NHS Health Research Authority decision making tool[15] was utilised, and ethical approval was deemed not required for completion of this survey.

The survey was advertised via the Association of Chartered Physiotherapists in Respiratory Care social media platform and monthly newsletter. In addition, an invitation to take part in the survey was sent to members of the UK Respiratory Physiotherapy Leaders group via email. The survey was open for completion for a period of ten weeks (November 2020 - January 2021).

Survey results were extracted from the online platform and entered into an Excel database for analysis.

RESULTS

Responses were received from 48 ICUs. Two surveys were discounted due to incompletion and one discounted as it originated from outside the UK. The geographical location of respondent ICUs are shown in table 1.

Of the 45 respondents, 11 ICUs (24%) used IMT, five (11%) were in the process of procurement and the majority (n=29; 65%) did not use IMT. Lack of knowledge regarding IMT implementation and absence of funding were the most commonly reported reasons as to why IMT was not used.

Of the 11 ICUs using IMT and the five in the process of procurement, device selection varied. Ten respondents (63%) used mechanical threshold IMT devices. Five (32%) used tapered flow devices and two (13%) utilised inspiratory trigger adjustment on the ventilator as a means of delivering IMT. Five respondents utilised more than one modality. One ICU did not specify the type of modality used.

Within the 11 ICUs that used IMT, patient inclusion criteria varied (Table 2), with failure to wean (n=8; 73%) and prolonged mechanical ventilation of more than seven days (n=5; 45%) mentioned most frequently by survey respondents. Three respondents also outlined additional exclusion criteria for the use of IMT (Table 3). One survey respondent included extracorporeal membrane oxygenation (ECMO) and presence of severe bullae/pulmonary cavitations on CT as precautions to be considered prior to IMT use.

The most commonly utilised training regime, outlined by six respondents, was a set threshold of 50% MIP, five sets of six breaths daily with gradual incrementation of 1-2 cmH_20 every 1-2 days. The respondents all reported their regimes were informed by the same published literature.[14] Five respondents (45%) reported utilising IMT with ventilator dependent patients delivered via an endotracheal tube, nine (82%) utilised IMT on ventilator dependent patients with a tracheostomy and ten respondents (91%) used IMT on self-ventilating patients delivered via a facemask.

Table 1. Geographical location of respondent ICUs.

UK regions	total number of ICU responses (n=)	number of ICUs using IMT (n=)	number of ICUs in the process of procuring IMT (n=)	number of ICUs not using IMT (n=)
North West of England	7	1	0	6
North East of England	0	0	0	0
Yorkshire	4	0	0	4
East Midlands	5	0	0	5
West Midlands	4	0	0	4
East of England	3	1	0	2
South East of England	3	1	0	2
South West of England	5	2	1	2
London	10	3	4	3
Wales	2	1	0	1
Scotland	0	0	0	0
Northern Ireland	2	2	0	0
Total	45	11	5	29

ICU = intensive care unit, IMT = Inspiratory muscle training.

Table 2. Reported patient inclusion criteria for IMT use.

Inclusion criteria	number of respondents (n=)
Failure to wean	8
Mechanical ventilation >7 days	5
Alert, cooperative and able to follow commands	4
Able to trigger spontaneous breaths	3
Able to form a seal around a mouthpiece	3
FiO2 <60%	3
PEEP <10	3
RR <25	3
MIP <30 cmH_20	2
Diagnosis of critical illness myopathy	2
PIP <30	1
PS +PEEP combined <30	1
Failed SBTs	1
Cognitively intact	1

PEEP = Positive end expiratory pressure, FIO2 = Fraction of inspired oxygen, RR = Respiratory rate, MIP = Maximal inspiratory pressure, PIP = Peak Inspiratory pressure, PS = Pressure support, SBT = spontaneous breathing trial.

There was variability in the use of outcome measures used by respondents to guide IMT treatment parameters and determine effectiveness of the intervention (Table 4). The most commonly reported outcome measure was MIP (70%; n=8).

All survey respondents that were utilising IMT reported that it was a physiotherapist delivered treatment modality. One respondent also reported that alongside registered physiotherapists, therapy assistants were also involved in the delivery of IMT. One ICU reported that they had a formal competency process for IMT.

DISCUSSION AND CONCLUSIONS

The main finding from this study indicates that IMT is not a common treatment modality utilised within adult intensive care units in the UK.

Despite the growing evidence base for IMT within the intensive care population, just 24% (n=11) of respondents were identified as currently using IMT within their establishments. The most commonly reported reasons as to why IMT was not used centred around lack of knowledge regarding IMT use and lack of funding for device procurement. These results echo that of a previous survey of French physiotherapists[13] and an international survey of IMT use,[12]

Table 3. Reported exclusion criteria for IMT use.

Exclusion criteria	number of respondents (n=)
Mechanical ventilation of <7 days	1
PEEP of >10	2
PS + PEEP combined >30	1
High FiO2 requirements	2
Inability to follow commands	2
CAM-ICU positive	1
Patients undergoing nitric therapy	1
Prostacyclin/ilioprost nebs	1
High frequency oscillatory ventilation	1
Suspected or undrained pneumothorax	1
Intracranial pressure >20mmhg	1
Blocked/excessive extra ventricular drainage	1
Cardiovascular instability	1

PEEP = Positive end expiratory pressure, PS = Pressure support, CAM-ICU = Confusion assessment method for the intensive care unit.

Table 4. Outcome measures used by survey respondents

Outcome measure	number of respondents (n=)
MIP	8
Respiratory rate	3
Duration of weaning	3
Patient feedback	2
Negative inspiratory force test	2
SaO2	2
Sniff nasal inspiratory pressure test	1
Oxygen requirements	1
Maximal expiratory pressure score	1
Cardio pulmonary exercise test score	1
Borg scale	1

MIP = Maximal inspiratory pressure score, SaO2 = Oxygen saturation of arterial blood.

identifying commonalities in barriers to the implementation of IMT globally.

A high proportion of survey respondents reported delivering IMT to patients who were mechanically ventilated, both via tracheostomy and endotracheal tube. Within the literature, early commencement of IMT is championed by authors[6] and advocated for as a feasible and well tolerated modality for intensive care patients.[7] The most commonly utilised IMT training regime identified from our survey followed a high intensity, low repetition interval approach. Within the literature training regimes vary, adopting either an endurance based or a high intensity interval approach to application.[6,8,14,16,17] In a multi-disciplinary guide for clinicians,[14] the high intensity low repetition interval approach has been suggested as effective and well tolerated by ICU patients who often cannot sustain repeated resistance over a prolonged period of time. However, it is acknowledged within the wider literature that the optimal training approach for ICU patients is yet to be established.

Mechanical threshold devices were the most commonly utilised device amongst the survey respondents. One reason for this may be the lower cost of purchase for these devices. Additionally, as the tapered flow devices are newer to the market, many ICUs may have opted not to purchase these devices in addition to existing mechanical threshold devices. Within our data, IMT was also identified as a purely physiotherapist led modality. However, as the survey was circulated through social media platforms and email groups targeted only at physiotherapists, it is possible that some ICUs within the UK, where IMT is delivered by other members of the MDT, could have been excluded.

Although the highest number of survey respondents were located in London ICUs, there is good geographical spread observed across the survey respondents, representing a mix of large major trauma hospitals, specialist centres and district general hospitals from across the UK, with the exception of Scotland (Table 1). The increased number of ICU respondents from London (n=10) is likely due to the high prevalence of ICUs within the geographical region

compared to other parts of the UK. However, it is recognised that due to the relatively small sample size it could be argued that the data may not be fully representative of UK wide physiotherapy practice. Measures to increase survey responses such as advertising via speciality specific networks and approaching specific ICUs were not undertaken and is a limitation to the study.

The variability of responses relating to IMT implementation from this survey demonstrates a lack of standardised physiotherapy practice across UK adult ICUs. This may be a reflection of the variation in the current literature regarding the optimal approach to IMT delivery in the ICU population. Due to the heterogeneous nature of ICU patients, further research would be beneficial, specifically regarding longer-term patient outcomes following use of IMT and optimal training parameters that can be generalised to the ICU population. In addition, creation of a national clinical guideline could help inform local business cases for procurement of devices, clinician training/competency requirements and standardising training regimes for delivery of IMT to a variety of ICU patient cohorts.

The authors acknowledge that since the dissemination of this survey the evidence base for IMT use within the intensive care environment has continued to grow. In view of this, a repeat survey may also be beneficial.

Key Points

- At the time of this survey IMT was not a common treatment modality utilised by UK adult ICUs.
- Mechanical threshold devices were the most commonly utilised device amongst physiotherapists working in UK adult ICUs.
- Further research exploring different training parameters specific to ICU patients could be beneficial.

ACKNOWLEDGEMENTS

We would like to thank the survey respondents for taking the time to submit their responses.

DECLARATION OF INTEREST

The authors have no declarations of interest.

FUNDING

Funding was not required for the completion of this work.

ETHICAL AND R&D APPROVAL

The NHS Health Research Authority decision making tool[15] was utilised and ethical approval was deemed not required for completion of this survey.

Submitted: April 17, 2024 GMT, Accepted: August 02, 2024 GMT

REFERENCES

1. Goligher E, Dres M, Fan E, et al. Mechanical Ventilation-induced Diaphragm Atrophy Strongly Impacts Clinical Outcomes. *Am J Respir Crit Care Med*. 2018;197(2):204-213. doi:10.1164/rccm.201703-0536OC

2. Magalhães P, Camillo C, Langer D, et al. Weaning failure and respiratory muscle function: What has been done and what can be improved? *Respir Med*. 2018;134:54-61. doi:10.1016/j.rmed.2017.11.023

3. Dres M, Dubé B, Mayaux J, et al. Coexistence and Impact of Limb Muscle and Diaphragm Weakness at Time of Liberation from Mechanical Ventilation in Medical Intensive Care Unit Patients. *Am J Respir Crit Care Med*. 2017;195(1):57-66. doi:10.1164/rccm.201602-0367OC

4. Schepens T, Verbrugghe W, Dams K, et al. The course of diaphragm atrophy in ventilated patients assessed with ultrasound: a longitudinal cohort study. *Crit Care*. 2015;19:422. doi:10.1186/s13054-015-1141-0

5. Bissett B, Leditschke I, Neeman T, et al. Weaned but weary: one third of adult intensive care patients mechanically ventilated for 7 days or more have impaired inspiratory muscle endurance after successful weaning. *Heart Lung*. 2015;44(1):15-20. doi:10.1016/j.hrtlng.2014.10.001

6. Bissett B, Gosselink R, Van Haren F. Respiratory Muscle Rehabilitation in Patients with Prolonged Mechanical Ventilation: A Targeted Approach. *Crit Care*. 2020;24(1):103. doi:10.1186/s13054-020-2783-0

7. Nickels M, Erwin K, McMurray G, et al. Feasibility, safety, and patient acceptability of electronic inspiratory muscle training in patients who require prolonged mechanical ventilation in the intensive care unit: A dual-centre observational study. *Aust Crit Care*. Published online 2023. doi:10.1016/j.aucc.2023.04.008

8. Vorona S, Sabatini U, Al-Maqbali S, et al. Inspiratory Muscle Rehabilitation in Critically Ill Adults. A Systematic Review and Meta-Analysis. *Annals of the American Thoracic Society*. 2019;15(6):735-744. doi:10.1513/AnnalsATS.201712-961OC

9. Worraphan S, Thammata A, Chittawatanarat K, et al. Effects of Inspiratory Muscle Training and Early Mobilization on Weaning of Mechanical Ventilation: A Systematic Review and Network Meta-analysis. *Arch Phys Med Rehabil*. 2020;101(11):2002-2014. doi:10.1016/j.apmr.2020.07.004

10. Bissett B, Leditschke I, Neeman T, et al. Inspiratory muscle training to enhance recovery from mechanical ventilation: a randomised trial. *Thorax*. 2016;71(9):812-819. doi:10.1136/thoraxjnl-2016-208279

11. Van Hollebeke M, Pleysier S, Poddighe D, et al. Comparing two types of loading during inspiratory muscle training in patients with weaning difficulties: An exploratory study. *Aust Crit Care*. 2023;36(4):622-627. doi:10.1016/j.aucc.2022.07.001

12. Hearn E, Gosselink R, Freene N. Inspiratory muscle training in intensive care unit patients: An international cross-sectional survey of physiotherapist practice. *Australian Critical Care*. 2022;35(5):527-534. doi:10.1016/j.aucc.2021.08.002

13. Bonnevie T, Villiot-Danger J, Gravier F, et al. Inspiratory muscle training is used in some intensive care units, but many training methods have uncertain efficacy: a survey of French physiotherapists. *J Physiother*. 2015;61(4):204-209. doi:10.1016/j.jphys.2015.08.003

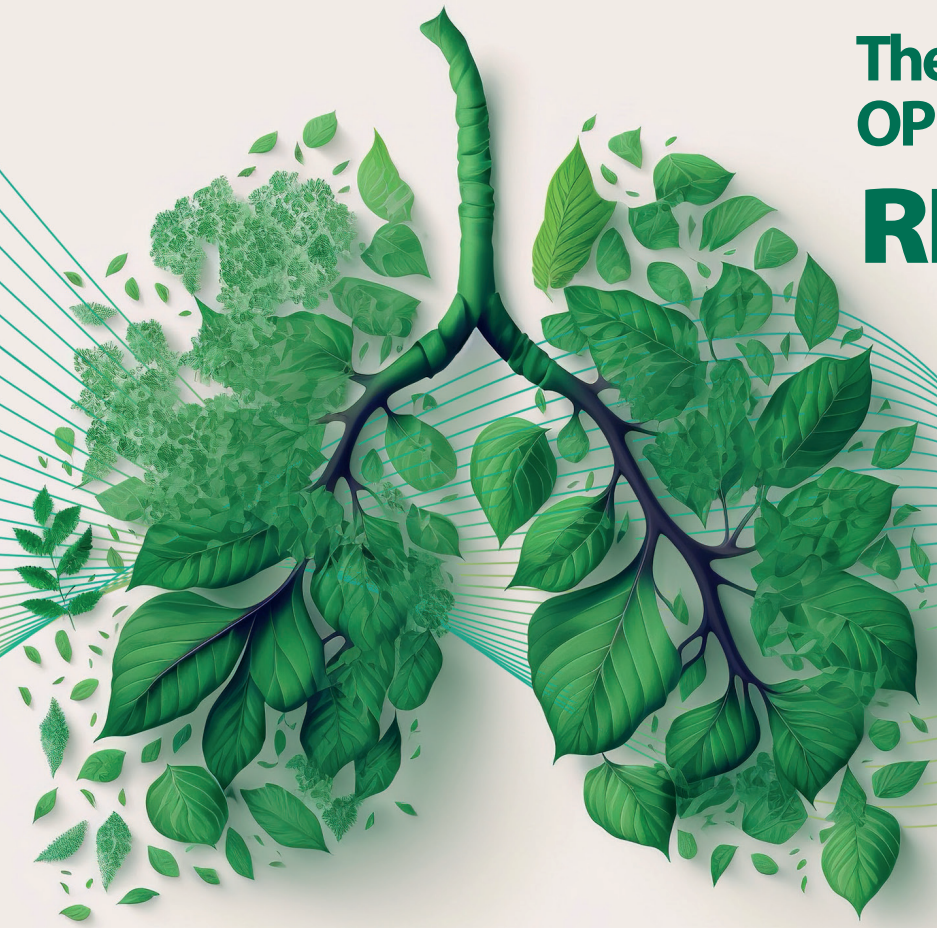
14. Bissett B, Leditschke I, Green M, et al. Inspiratory muscle training for intensive care patients: A multidisciplinary practical guide for clinicians. *Australian Critical Care*. 2019;32:249-255. doi:10.1016/j.aucc.2018.06.001

15. NHS Health Research Authority.org. October 2022. Accessed June 2024. https://www.hra-decisiontools.org.uk/research/

16. Moodie L, Reeve J, Elkins M. Inspiratory muscle training increases inspiratory muscle strength in patients weaning from mechanical ventilation: a systematic review. *J Physiother*. 2011;57(4):213-221. doi:10.1016/S1836-9553(11)70051-0

17. Bissett B, Leditschke I, Neeman T, et al. Does mechanical threshold inspiratory muscle training promote recovery and improve outcomes in patients who are ventilator-dependent in the intensive care unit? The IMPROVE randomised trial. *Australian Critical Care*. 2023;36(4):613-621. doi:10.1016/j.aucc.2022.07.002

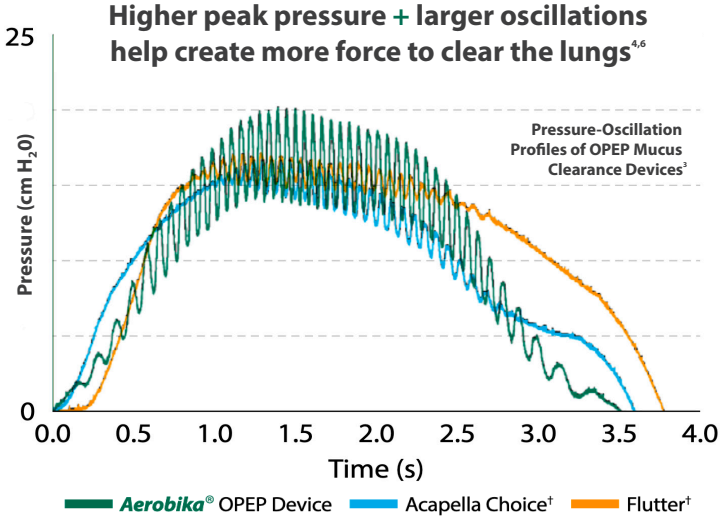
The #1 recommended OPEP device is NOW RECYCLABLE[1,‡]



Latest GOLD and BTS guidelines recommend **OPEP therapy** for mucus hypersecretion[2,3]

The most efficient and effective OPEP device[4]

Higher peak pressure + larger oscillations help create more force to clear the lungs[4,6]



20-30% MORE EFFICIENT PER BREATH

\+

Up to 4× MORE EFFECTIVE[4,5**]

** Greater pressure amplitude is related to therapeutic effectiveness.

= Greater mucus clearance potential and optimal patient benefit.[4,5]

TRUDELL MEDICAL UK LIMITED

AerobiKA

Scan to order your FREE demo kit

‡ The Aerobika* OPEP device is recyclable. Recycling may be limited in your jurisdiction or local regulations may not permit it. Please consult with your community's recycling guidelines to determine availability of curbside recycling or recycling at a drop-off facility. Clean your device prior to recycling.

† In vivo data, compared to Acapella and Flutter ‡ greater pressure amplitude is related to therapeutic effectiveness

1 GpRx Primary Care Data [Feb 2024]. **2** GOLD 2023 Report. **3** Hill AT *et al.*, British Thoracic Society Guideline for bronchiectasis. **4** Van Fleet H, *et al.* Respiratory Care 2017;62(4):451-458. **5** Suggett, J. *et al.* CHEST 2017.**6** Coppolo, *et al.* Pulmonary Therapy (2021)..

Mansell SK, Barnfield E, Bendall A, et al. Simulation Based Education in pre-registration and postgraduate respiratory physiotherapy: An ACPRC position statement. *ACPRC Journal*. 2024;54(3):46-48. doi:10.56792/XRTY3249

Education

Simulation Based Education in pre-registration and postgraduate respiratory physiotherapy: An ACPRC position statement

Stephanie K. Mansell, MSc, BSc(Hons), MCSP[1,2], Emily Barnfield[3], Amy Bendall[4], Gabriella Cork[5], Amanda J Thomas[6], Kate Grafton[7], Georgina Eckersley[5], Agnieszka Lewko[8]

[1] Institute of Cardiovascular Science , University College London, [2] Therapy Services , Royal Free London NHS Foundation Trust, [3] Simulation Centre, Gloucestershire Hospitals NHS Foundation Trust, [4] School of Health Care Sciences, Cardiff University, [5] School of Allied Health Professions and Nursing, University of Liverpool , [6] Critical Care Outreach , Barts Health NHS Trust, [7] School of Health, Leeds Beckett University , [8] Centre for Healthcare and Communities, Coventry University

Keywords: Simulation based education, preregistration education, postgraduate education, cardiorespiratory physiotherapy

https://doi.org/10.56792/XRTY3249

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

INTRODUCTION

This ACPRC position statement recognises the high levels of interest and potential impact of simulation-based education (SBE) use for education and training in the cardiorespiratory physiotherapy field. This position statement is relevant to both pre-registration and postgraduate settings and is designed to provide best practice points for physiotherapists facilitating SBE across the spectrum of educational interventions.

The evidence base for SBE in cardiorespiratory physiotherapy has been described in a previously published scoping review[1] and thus is not discussed in any detail. Readers are encouraged to read this position statement alongside the ACPRC commentary on SBE, also presented in this journal issue. SBE should be delivered in concordance with the Association for Simulated Practice in Healthcare (ASPiH) standards.[2,3] Educators should ensure local guidance is also adhered to such as Health Education England's National Framework for Simulation Based Education (SBE),[4] Health Education and Improvement Wales's All Wales Simulation-Based Education and Training Strategy[5] and the Chartered Society of Physiotherapy's Simulation toolkit for pre-registration physiotherapy education and training.[6] More local guidance and resources may also apply, and SBE faculty and educators should contact their simulation network and simulation centre where these exist.

BEST PRACTICE POINTS

Delivery of simulation based education:

1. In concordance with ASPiH standards, when designing an educational intervention utilising SBE, planning should include clear learning outcomes. These learning outcomes should then inform the intervention including the equipment used, the location and the attendees.
2. Whilst there are occasions when SBE should be delivered uni-professionally, those delivering SBE should strive to deliver SBE interprofessionally as this is reflective of clinical practice and may confer additional benefits.
3. In concordance with Health and Care Professionals Council standards of proficiency for physiotherapists[7] and ASPiH standards, SBE should be delivered in a non-discriminatory and inclusive manner.
4. In concordance with ASPiH standards, SBE should be designed with thought given to sustainability and the ecological impact of all aspects of SBE.

Considerations for faculty training and development:

1. When delivering SBE, faculty should ensure they have knowledge and understanding of adult learning theories and ensure these are implemented throughout the educational intervention.
2. In concordance with ASPiH standards, educators delivering SBE must have undergone adequate faculty training, which should include, as a minimum: adult learning theories, scenario design, pre-brief and debrief.
3. Basic, advanced and refresher faculty courses are necessary and new faculty members should be mentored by more experienced facilitators.[8]
4. Faculty training is recommended for interprofessional SBE to maximise the learning opportunities and identify any interprofessional issues that may arise.[9]

Outcome measures and assessment:

1. In concordance with ASiPH standards, SBE faculty should consider the use of SBE as part of a formal assessment of competence while prioritising psychological wellbeing and creating a safe learning environment. Competence assessment requires an objective, external evaluation by instructors using procedural checklists or global rating scales.[10]
2. In concordance with ASPiH standards, the construct underlying the use of SBE as a teaching modality should determine the outcome selected to evaluate its effectiveness and learning impact domain. For example, SBE designed to develop awareness of human

factors would require a different evaluation to SBE designed to develop clinical reasoning.

3. Faculty should acknowledge that learning outcomes from SBE depend upon context including: learning setting, learner experience, and course content and objectives. Faculty should recognise learning mechanisms via SBE can be multifactorial and might include: learning needs identification, technical skills, human factors reflection and self-efficacy. Faculty should acknowledge that both context and learning mechanisms interact with each other in a complex manner before, during and after a SBE learning event. Faculty should also recognise that learner outcomes might be individual and not related to pre-set learning objectives.[11]
4. SBE should be subject to an iterative evaluation process, consisting of triangulation of data from various outcome instruments to simultaneously evaluate multiple learning domains and identify unanticipated or unexpected learning outcomes.[11]
5. Physiotherapist satisfaction with SBE has been effectively answered in previous literature and future research should aim to evaluate the impact of SBE at higher Kirkpatrick levels[1] (beyond level 2).[12]
6. New measures exploring application, integration and longer-term change are required to advance our understanding of the impact of SBE within physiotherapy education.[12] Developing and testing novel tools capable of reflecting transformational change in participant behaviour (Kirkpatrick Level 3) and longer-term impacts on patient metrics, organisational or safety systems (Kirkpatrick Level 4) are required to fully understand the impact of SBE within cardiorespiratory physiotherapy.

ACKNOWLEDGEMENTS

Association of Chartered Physiotherapists in Respiratory Care editorial board.

Submitted: April 10, 2024 GMT, Accepted: April 12, 2024 GMT

1 Kirkpatrick's evaluation framework classifies training outcomes into 4 levels: reaction/satisfaction, learning/knowledge, behaviour/practice change, and results/impact

REFERENCES

1. Mansell SK, Grafton K, Barnfield E, et al. Simulation-based education within respiratory physiotherapy training: a scoping review Journal of the Association of Chartered Physiotherapists in Respiratory Care. 2024;56:37-51.

2. Purva M, Nicklin J. ASPiH standards for simulation-based education: process of consultation, design and implementation. *BMJ Simul Technol Enhanc Learn*. 2018;4(3):117-125. doi:10.1136/bmjstel-2017-000232

3. Diaz-Navarro C, Laws-Chapman C, Moneypenny MPM. The ASPiH Standards - 2023: guiding simulation-based practice in health and care. 2023. https://aspih.org.uk

4. Health Education England. Framework for Simulation Based Education. https://www.hee.nhs.uk/sites/default/files/documents/National%20framework%20for%20simulation%20based%20education.pdf2018

5. Health Education and Improvement Wales. All Wales Simulation-Based Education and Training Strategy for the Healthcare Workforce. https://heiw.nhs.wales/files/all-wales-simulation-strategy-mg-draft-6pdf/2022

6. Heneghan N, Thackray D, Stiger R, et al. Simulation toolkit for pre-registration physiotherapy education/training. Chartered Society of Physiotherapy. 2023. https://www.csp.org.uk/system/files/publication_files/002042_A4_tab_Final.pdf:

7. Health & Care Professions Council. The standards of proficiency for physiotherapists. Health & Care Professions Council. 2023. https://www.hcpc-uk.org/standards/standards-of-proficiency/physiotherapists/:

8. Fanning RM, Gaba DM. The role of debriefing in simulation-based learning. *Simul Healthc*. 2007;2(2):115-125. doi:10.1097/sih.0b013e3180315539

9. Boet S, Bould MD, Layat Burn C, Reeves S. Twelve tips for a successful interprofessional team-based high-fidelity simulation education session. *Med Teach*. 2014;36(10):853-857. doi:10.3109/0142159x.2014.923558

10. L'Her E, Geeraerts T, Desclefs JP, et al. Simulation-based teaching in critical care, anaesthesia and emergency medicine. *Anaesthesia Critical Care & Pain Medicine*. 2020;39(2):311-326. doi:10.1016/j.accpm.2020.03.010

11. Graham AC, McAleer S. An overview of realist evaluation for simulation-based education. *Adv Simul*. 2018;3(1):13. doi:10.1186/s41077-018-0073-6

12. Quiben M, Greenwood KC, Gorman SL, et al. Simulation-Based Education in Physical Therapist Education: Perspectives From the Strategic Initiative Panel on Simulation in Physical Therapist Education. *Physical therapy*. 2022;102:pzac135.

Mansell SK, Thomas AJ, Barnfield E, et al. Simulation Based Education in pre-registration and postgraduate cardiorespiratory physiotherapy: An ACPRC commentary. *ACPRC Journal*. 2024;54(3):49-55. doi:10.56792/OIBW3257

Commentary

Simulation Based Education in pre-registration and postgraduate cardiorespiratory physiotherapy: An ACPRC commentary

Stephanie K. Mansell[1,2], Amanda J Thomas[3], Emily Barnfield[4], Amy Bendall[5], Gabriella Cork[6], Kate Grafton[7], Georgina Eckersley[6], Agnieszka Lewko[8]

[1] Institute of Cardiovascular Science, University College London, [2] Therapy Services , Royal Free London NHS Foundation Trust, [3] Critical Care Outreach , Barts Health NHS Trust, [4] Professional Education, Gloucestershire Hospitals NHS Foundation Trust, [5] School of Health Care Sciences, Cardiff University, [6] School of Health Sciences, University of Liverpool, [7] School of Health, Leeds Beckett University, [8] Research Centre for Healthcare and Communities, Coventry University

Keywords: Simulation based education, preregistration education, postgraduate education, cardiorespiratory physiotherapy

https://doi.org/10.56792/OIBW3257

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 54, Issue 3, 2024

INTRODUCTION

Readers are encouraged to read this commentary alongside the ACPRC position statement and scoping review[1] on simulation based education (SBE) in cardiorespiratory physiotherapy. This commentary is designed to:

- Provide an introduction to SBE
- Discuss the importance of faculty training
- Discuss the outcome measures evaluating SBE within cardiorespiratory physiotherapy

Recommendations for future research have been made in the scoping review.[1]

WHAT IS SIMULATION BASED-EDUCATION

There are numerous definitions for simulation based education (SBE) across multiple settings.[2,3] Common amongst definitions is the principle that SBE is a learning technique with conditions resembling real life. SBE allows participants to practice analysing and responding to realistic situations without fear of negative consequences for patients.[3-6] SBE is associated with high levels of learner satisfaction.[7] Furthermore, SBE is underpinned by the philosophy of psychological safety, where learners are supported within a safe, educational environment facilitated by shared agreements, shared beliefs, confidentiality, fiction contracts and a flattened hierarchy.[8,9] Psychologically safe environments promote interpersonal risk-taking and positively impact collaborative learning and participant well-being.[10]

Various modalities are available to deliver SBE, providing varying degrees of fidelity (realism) and activity design. The modality, fidelity and simulation design selected should be determined by the intended learning outcomes.[11] Full-body computerised mannequins capable of real-time physiological parameters feature predominantly in uni-professional SBE for cardiorespiratory physiotherapists[12] and where physiotherapists were included in SBE for allied health[5] or interprofessional learning.[1] Other SBE modalities reported in cardiorespiratory physiotherapy include standardised patients, where learners interact with actors,[7] and part task trainers which facilitate deliberate practice of clinical skills.[12,13] Computer simulations have been reported within cardiorespiratory physiotherapy education,[14] but other immersive technologies, such as virtual reality (VR) and augmented reality (AR), have not yet appeared despite their uptake in other professions.[15]

In situation simulation ("in situ") refers to practicing a skill in the natural environment. In situ simulation training involves the actual multiprofessional team using equipment and resources available in their usual workplace.[8] In situ supports the capability of healthcare teams to manage high-risk clinical emergencies, with an emphasis on improving human factors skills.[12,16-18] In situ has not yet been described as a modality for uni-professional respiratory physiotherapy SBE.

There is growing interest in the application of SBE in the context of simulated practice learning (SPL) within Physiotherapy.[19] Systematic reviews suggest SBE may be just as, or more, effective than traditional clinical placement in meeting pre-registration proficiencies. The KNOWBEST Project[19] recommended that 25% of the 1000 hours pre-registration clinical practice hours be met through SPL.

INTERPROFESSIONAL SIMULATION BASED EDUCATION

SBE facilitates interprofessional education (IPE) through understanding roles and responsibilities, promoting teamwork and communication, thus improving patient outcomes.[20,21] Research into IPE including cardio-respiratory physiotherapists has predominantly been conducted in the pre-registration arena.[16] Common learning objectives for IPE SBE include interprofessional communication, teamwork, roles and responsibilities, values and ethics. The majority of research in IPE included physiotherapists within medicine and nursing specialities. Current educational theories encourage SBE be delivered in multi-professional ways, which more closely represent the clinical environment.[22-24]

LEARNING THEORIES

SBE is underpinned by a blend of learning theories[25] Notable among these is "constructivism", whereby learners construct knowledge and understanding through their experiences. "Experiential learning theory",[26] has the most resonance with SBE.[27] Experiential learning posits learning as a process incorporating concrete experience (the simulation itself), reflection on the experience (the early debrief), abstract conceptualisation (the latter debrief) and active experimentation (learning transformation into practice). Experiential learning theory also accommodates both reflection-on-action and reflection-in-action. There are limited examples in the physiotherapy simulation literature describing the application of learning theory to the design and delivery of SBE.

The assessment of clinical performance using SBE requires careful consideration. There is a historically problematic relationship between SBE and formative assessment.[28] Measures that provide formative assessment may support SBE participants to identify personal learning needs.[29] The use of SBE for summative or "high stakes" assessment needs careful management to protect learners' psychological safety and ensure the assessment retains the key features of SBE. The ASPIH standards[11] include recommendations for implementing SBE for summative assessment. Although there has been a reluctance to develop summative assessment within SBE performance, compared with traditional assessment methods, simulated clinical settings create controlled environments with standardised scenarios for all learners.[30]

FACULTY

The ASPIH Standards[11] refer to faculty as "individuals with experience in simulation-based practice and content experts in the subject being delivered". This includes technicians, simulated patients and facilitators.[11] However, the expertise of facilitators in utilising SBE can differ significantly.[31] Faculty training is widely recognised as being important in ensuring scenarios are well designed and delivered in a psychologically safe environment, with key learning opportunities identified within the debrief, which may need to include content experts. Specific faculty qualification requirements vary between organisations[11] and the Chartered Society of Physiotherapy (CSP) commissioned the development of the KNOWBest project to support physiotherapy educators in developing and delivering SBE.[19] Learning during SBE is highly reflective and requires a skilled faculty to ensure it is delivered safely and effectively.[32] Therefore, investment in appropriate training for both the debrief structure and cognitive and leadership skills, which create a psychologically safe environment, is key to ensuring learning opportunities are not missed. Faculty training is of particular importance in more complex interdisciplinary environments.[33] Simulation faculty need to be able to design scenarios curricula and understand learning needs across a spectrum of disciplines and settings to ensure SBE is fit for purpose.[34] Train the trainer courses, and meta-debriefing are recommended to enable faculty to refine their skills through guided reflection.[19] Continued investment in appropriate training is necessary as faculty development is a lifelong process and should be supported by mentorship to provide confidence among educators.[35] Currently, the lack of facilitators who have cardiorespiratory physiotherapy experience may limit access to SBE for cardiorespiratory physiotherapists.[35]

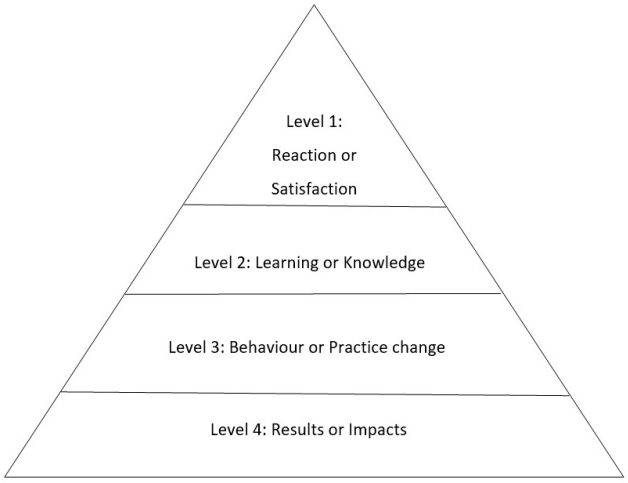


Figure 1. Kirkpatrick's framework

OUTCOME MEASURES

The educational value of SBE can be challenging to determine and is subject to a high degree of methodological variability in its application.[36] Learning outcomes associated with SBE can be classified according to cognitive, affective, or psychomotor learning that occurs as described by Bloom's Taxonomy[37]; or associated with Kirkpatrick's framework that classifies training outcomes into four levels of reaction or satisfaction, learning or knowledge, behaviour or practice change, and results or impacts.[38-40] The choice of evaluation should be determined by the aims of the SBE.[11]

Table 1. summarises outcome measures used within cardiorespiratory physiotherapy SBE.

In terms of learning domain, Kirkpatrick and Kirkpatrick[53] expand the Level 2 scope to include the extent to which participants "perceive" they will apply learnt knowledge or skills (confidence) or "intend" to apply knowledge/skills (commitment). Tools evaluating confidence require a pre/post design analysis and have been included in the "New World" Kirkpatrick Level 2 outcomes.[40,54]

What cannot be determined from an improvement in confidence or self-efficacy is the degree of competence of the participant. Kruger and Dunning[55] recognised that high self-efficacy can be associated with low competence (unconscious incompetence) and vice versa.

Evaluation of Kirkpatrick Level 3 clinical performance outcomes derived through SBE are limited in the cardiorespiratory physiotherapy literature by a lack of longitudinal

Table 1. Summary of outcome measures used in SBE cardiorespiratory physiotherapy

Name of Tool	Type	References
INTERPROFESSIONAL EDUCATION AND TEAM WORK SCALES		
Interdisciplinary Education Perception Scale (IEPS)	Self-report	Wellmon et al (2017)[41] Lefebvre et al (2015)[42]
Readiness for Interprofessional Learning Scale (RIPLS)	Self-report	Wellmon et al (2017)[41] Rossler et al (2016)[23] Lefebvre et al (2015)[42]
Attitudes toward Health Care Teams Scale (AHCTS)	Self-report	Wellmon et al (2017)[41] Lefebvre et al (2015)[42]
The Health Professional Collaboration Scale [HPCS)	Self -report	Rossler et al (2016)[23]
The Team Skills Scale (TSS)	Self-report	Lefebvre et al (2015)[42]
Interprofessional Collaborative Competencies Attainment Survey (ICCAS)	Self-report	King et al (2016)[43]
SIMULATION EXPERIENCE SURVEYS		
Self-Report Simulation Effectiveness Tool – Modified (SET-M) questionnaire	Self-report	Roos et al (2022)[44]
Satisfaction with Simulation Experience Scale (SSES)	Self-report	Ohtake et al (2013)[45]
Student satisfaction and self confidence in learning scale	Self-report	Wellmon et al (2017)[41]
ACUTE CARE CONFIDENCE, PREPAREDNESS, SELF EFFICACY AND SELF EVALUATED COMPETENCE		
Acute Care Confidence Survey	Self-report	Sliberman et al[46]
ACPRC Respiratory/On Call self-evaluation of competence questionnaire	Self-report	Mansell et al[29]
Clinical Confidence Measure	Self-report	Wright et al[47]
Self-perceived level of clinical preparedness.	Self-report	Silberman et al[24]
Self-Efficacy Scale (SES)	Self-report	Jones and Sheppard[48]
SUPERVISOR RATING OF PERFORMANCE		
Assessment of Physiotherapy Practice (APP)	Supervisor completed rating	Wright et al[47] Jones et al[49] Jones and Sheppard[48] Blackstock et al[50]
THEMATIC ANALYSIS TECHNIQUES		
Video Analysis	Videos were watched several times, and coded to describe the content. Similar codes were grouped to form categories, similar categories, then were grouped to form themes	Thackray and Roberts[6]
Think out Loud Analysis	Verbal data was transcribed and managed using a framework approach	Thackray and Roberts[6]
Focus Groups		Silberman et al[46] Mansell et al[29]

INTERPROFESSIONAL EDUCATION AND TEAM WORK SCALES		
		Rossler and Kimble[23]
Semi structured interviews		Thackray et al[6]
Nominal Group Technique		Roos et al[44]
RESEARCHER DEVELOPED TOOLS		
Researcher Developed Tools Author Generated Outcome Measure	Self report preparedness for practice Clinical Instructor Surveys of students preparedness University Simulation Laboratory Questionnaire – self report Open ended questions for thematic Analysis Student confidence, usefulness of the SBE – self report Educators impression of performance and patient impression of communication Self-Assessment of Confidence and Interest in Acute Care – self report Educational benefit of simulation	Thomas et al[20] Nithman et al[51] King et al[43] (2016) Roos et al[44] Silberman et al[24] Blackstock et al[50] Bednarek et al[52]

studies exploring the impact of SBE on sustained transferability and longer-term skill retention.[56]

Kirkpatrick Level 4 evaluates whether learning transferred to the clinical setting improves patient outcomes. None of the SBE cardiorespiratory physiotherapy literature reports impacts on patient or organisational quality or safety metrics. Level 4 outcomes may be evaluated with patient satisfaction survey, review of critical incidents, complaints, and serious untoward incidents in participant clinical settings.[28] Unlike literature concerning SBE in medical and nursing cohorts, there are few examples in the cardiorespiratory physiotherapy SBE literature that specifically propose to advance knowledge or performance of the behavioural skills inherent for safe and effective healthcare. Jepsen et al.[57] reviewed the development of 23 instruments used to assess behavioural skills in healthcare settings but reflects that allied health professions are under-represented in both development and application cohorts.

Although the use of standardised outcome measures is considered best practice in research design[58]The cardiorespiratory physiotherapy SBE literature presents numerous measures that have been generated by authors (Table 1.) It is likely that only face validity exists within author-generated measures, which otherwise lack psychometric development and evaluation.[21]

Therefore, future research in SBE in cardiorespiratory physiotherapy is recommended to address outcomes that explore the impact on the translation of knowledge learnt in SBE into clinical practice. Readers are encouraged to review the previous scoping review,[1] providing further context and direction to future research opportunities. The publication of standardised reporting guidelines for healthcare simulation research,[59] which details elements to include in relation to data sources/management, is also a useful guide for advocating for clear and concise reporting that will support maximising the quality of SBE studies.

SUMMARY

In summary, simulation-based education should be facilitated using standards and guidelines. Simulation faculty should undergo appropriate training to ensure safe and effective delivery of SBE. Simulation-based education should be evaluated using outcome measures appropriate to the intervention with adequate psychometric properties.

FUNDING

This work was unfunded

ACKNOWELDGEMENTS

Association of Chartered Physiotherapists in Respiratory Care editorial board.

Submitted: February 01, 2024 GMT, Accepted: June 05, 2024 GMT

REFERENCES

1. Mansell SK, Grafton K, Barnfield E, Eckersley G, Bendall A, Cork G, et al. Simulation-based education within respiratory physiotherapy training: a scoping review. *Journal of the Association of Chartered Physiotherapists in Respiratory Care*. 2024;56:37-51.

2. Gaba DM. The future vision of simulation in health care. *Quality and Safety in Health Care*. 2004;13:i2-i10. doi:10.1136/qhc.13.suppl_1.i2

3. Hawker C, Jones B, Cook SC, et al. Developing an All-Wales definition of Simulation-Based Education. *International Journal of Healthcare Simulation*. 2022;2:A40-A41. doi:10.54531/INHM4618

4. Blackstock FC, Jull GA. High-fidelity patient simulation in physiotherapy education. *Australian Journal of Physiotherapy*. 2007;53:3-5. doi:10.1016/S0004-9514(07)70056-9

5. Jones A, Sheppard L. Physiotherapy education: A proposed evidence-based model. *Advances in Physiotherapy*. 2008;10:9-13. doi:10.1080/14038190701470250

6. Thackray D, Roberts L. Exploring the clinical decision-making used by experienced cardiorespiratory physiotherapists: A mixed method qualitative design of simulation, video recording and think aloud techniques. *Nurse education today*. 2017;49:96-105. doi:10.1016/j.nedt.2016.11.003

7. Anderson JE, Ross A. Human Factors Applications of Simulation. In: Deutsch ES, Perry SJ, Gurnaney HG, eds. *Comprehensive Healthcare Simulation: Improving Healthcare Systems*. Springer International Publishing; 2021:15-22. doi:10.1007/978-3-030-72973-8_2

8. Somerville SG, Harrison NM, Lewis SA. Twelve tips for the pre-brief to promote psychological safety in simulation-based education. *Medical Teacher*. 2023;45:1349-1356. doi:10.1080/0142159X.2023.2214305

9. Madireddy S, Rufa EP. Maintaining confidentiality and psychological safety in medical simulation. *StatPearls [Internet]*. Published online 2023.

10. McClintock AH, Fainstad T, Blau K, Jauregui J. Psychological safety in medical education: A scoping review and synthesis of the literature. *Medical Teacher*. 2023;45:1290-1299. doi:10.1080/0142159X.2023.2216863

11. Diaz-Navarro C, Laws-Chapman C, Moneypenny MPM. The ASPiH Standards - 2023: guiding simulation-based practice in health and care. doi:10.54531/nyvm5886

12. Brown L, Ilhan E, Pacey V, Hau W, Van Der Kooi V, Dale M. The Effect of High-Fidelity Simulation–Based Learning in Acute Cardiorespiratory Physical Therapy—A Mixed-Methods Systematic Review. *Journal of Physical Therapy Education*. 2021;35:146-158. doi:10.1097/JTE.0000000000000183

13. Hassam M, Williams M. Education via simulation: teaching safe chest percussion for pre-term infants. *Hong Kong Physiotherapy Journal*. 2003;21:22-28. doi:10.1016/S1013-7025(09)70036-3

14. Rezayi S, Shahmoradi L, Ghotbi N, et al. Computerized Simulation Education on Physiotherapy Students' Skills and Knowledge: A Systematic Review. *Biomed Res Int*. 2022;2022:4552974. doi:10.1155/2022/4552974

15. Tang YM, Chau KY, Kwok APK, Zhu T, Ma X. A systematic review of immersive technology applications for medical practice and education-trends, application areas, recipients, teaching contents, evaluation methods, and performance. *Educational Research Review*. 2022;35:100429. doi:10.1016/j.edurev.2021.100429

16. Stockert B, Silberman N, Rucker J, Bradford J, Gorman SL, Greenwood KC, et al. Simulation-Based Education in Physical Therapist Professional Education: A Scoping Review. *Physical therapy*. Published online 2022. doi:10.1093/ptj/pzac133

17. Martin A, Cross S, Attoe C. The use of in situ simulation in healthcare education: current perspectives. *Advances in Medical Education and Practice*. Published online 2020:893-903. doi:10.2147/AMEP.S188258

18. Hough J, Levan D, Steele M, Kelly K, Dalton M. Simulation-based education improves student self-efficacy in physiotherapy assessment and management of paediatric patients. *BMC Medical Education*. 2019;19:463. doi:10.1186/s12909-019-1894-2

19. Lowe DCM, Heneghan DN, Herbland DA, Atkinson DK, Beeton PK. KNOWBEST: The KNOWledge, BEhaviours and Skills required of the modern physioTherapy graduate including the future role of practice based learning. In: Physiotherapy CSo, ed. https://www.csp.org.uk/documents/knowbest-project-summary2023

20. Thomas EM, Rybski MF, Apke TL, Kegelmeyer DA, Kloos AD. An acute interprofessional simulation experience for occupational and physical therapy students: Key findings from a survey study. *J Interprof Care*. 2017;31:317-324. doi:10.1080/13561820.2017.1280006

21. Gough S, Hellaby M, Jones N, MacKinnon R. A review of undergraduate interprofessional simulation-based education (IPSE). *Collegian*. 2012;19:153-170. doi:10.1016/j.colegn.2012.04.004

22. Kolb SE, Shugart EB. *Evaluation: Is Simulation the Answer?* SLACK Incorporated; 1984:84-86. doi:10.3928/0148-4834-19840201-12

23. Rossler KL, Kimble LP. Capturing readiness to learn and collaboration as explored with an interprofessional simulation scenario: A mixed-methods research study. *Nurse Educ Today*. 2016;36:348-353. doi:10.1016/j.nedt.2015.08.018

24. Silberman NJ, Panzarella KJ, Melzer BA. Using human simulation to prepare physical therapy students for acute care clinical practice. *Journal of Allied Health*. 2013;42:25-32.

25. Karlsaune H, Antonsen T, Haugan G. Simulation: A historical and pedagogical perspective. In: *How Can We Use Simulation to Improve Competencies in Nursing?*. Springer International Publishing; 2022:1-11. doi:10.1007/978-3-031-10399-5_1

26. Kolb DA. *Experiential Learning: Experience as the Source of Learning and Development*. FT press; 2014.

27. Ross S. Simulation-based learning: from learning theory to pedagogical application. *Internet Journal of Allied Health Sciences and Practice*. 2021;19:15. doi:10.46743/1540-580X/2021.2056

28. Purva M, Fent G, Prakash A. Enhancing UK Core Medical Training through simulation-based education: an evidence-based approach. A report from the joint JRCPTB/HEE Expert Group on Simulation in Core Medical Training. In: England HE, ed. Health Education England; 2016.

29. Mansell SK, Harvey A, Thomas A. An exploratory study considering the potential impacts of high-fidelity simulation based education on self-evaluated confidence of non-respiratory physiotherapists providing an on-call respiratory physiotherapy service: a mixed methods study. *BMJ Simulation and Technology Enhanced Learning*. Published online 2019. doi:10.1136/bmjstel-2019-000444

30. Arrogante O, González-Romero GM, López-Torre EM, Carrión-García L, Polo A. Comparing formative and summative simulation-based assessment in undergraduate nursing students: nursing competency acquisition and clinical simulation satisfaction. *BMC nursing*. 2021;20:1-11. doi:10.1186/s12912-021-00614-2

31. Koivisto JM, Hannula L, Bøje RB, et al. Design-based research in designing the model for educating simulation facilitators. *Nurse education in practice*. 2018;29:206-211. doi:10.1016/j.nepr.2018.02.002

32. Fanning RM, Gaba DM. The role of debriefing in simulation-based learning. *Simul Healthc*. 2007;2:115-125. doi:10.1097/SIH.0b013e3180315539

33. van Soeren M, Devlin-Cop S, MacMillan K, Baker L, Egan-Lee E, Reeves S. Simulated interprofessional education: An analysis of teaching and learning processes. *Journal of Interprofessional Care*. 2011;25:434-440. doi:10.3109/13561820.2011.592229

34. Boet S, Bould MD, Layat Burn C, Reeves S. Twelve tips for a successful interprofessional team-based high-fidelity simulation education session. *Med Teach*. 2014;36:853-857. doi:10.3109/0142159X.2014.923558

35. Gough S, Jones N, Hellaby M. Innovations in interprofessional learning and teaching: providing opportunities to embed patient safety within the pre-registration physiotherapy curriculum. A Pilot Study. *Physical Therapy Reviews*. 2013;18:416-430. doi:10.1179/1743288X13Y.0000000103

36. L'Her E, Geeraerts T, Desclefs JP, Benhamou D, Blanié A, Cerf C, et al. Simulation-based teaching in critical care, anaesthesia and emergency medicine. *Anaesthesia Critical Care & Pain Medicine*. 2020;39:311-326. doi:10.1016/j.accpm.2020.03.010

37. Forehand M. Bloom's taxonomy: Original and revised. *Emerging perspectives on learning, teaching, and technology*. 2005;8:41-44.

38. La Duke P. How to evaluate training: using the Kirkpatrick model. *Professional safety*. 2017;62:20.

39. Tamkin P, Yarnall J, Kerrin M. *Kirkpatrick and Beyond: A Review of Models of Training Evaluation*. Institute for Employment Studies; 2002.

40. Kirkpatrick J. *An Introduction to the New World Kirkpatrick Model*. Kirkpatrick Partners; 2015:2019. doi:10.1515/9781580468619

41. Wellmon R, Lefebvre KM, Ferry D. Effects of High-Fidelity Simulation on Physical Therapy and Nursing Students' Attitudes Toward Interprofessional Learning and Collaboration. *J Nurs Educ*. 2017;56:456-465. doi:10.3928/01484834-20170712-03

42. Lefebvre K, Wellmon R, Ferry D. Changes in Attitudes Toward Interprofessional Learning and Collaboration Among Physical Therapy Students Following a Patient Code Simulation Scenario. *Cardiopulmonary Physical Therapy Journal*. 2015;26:8-14. doi:10.1097/CPT.0000000000000003

43. King J, Beanlands S, Fiset V, Chartrand L, Clarke S, Findlay T, et al. Using interprofessional simulation to improve collaborative competences for nursing, physiotherapy, and respiratory therapy students. *J Interprof Care*. 2016;30:599-605. doi:10.1080/13561820.2016.1189887

44. Roos R, van Aswegen H, Casteleijn D, Thurling CH. Perceptions of students and educators regarding a once-off pre-clinical ICU simulation activity. *S Afr J Physiother*. 2022;78:1830. doi:10.4102/sajp.v78i1.1830

45. Ohtake PJ, Lazarus M, Schillo R, Rosen M. Simulation experience enhances physical therapist student confidence in managing a patient in the critical care environment. *Physical therapy*. 2013;93:216-228. doi:10.2522/ptj.20110463

46. Silberman NJ, Litwin B, Panzarella KJ, Fernandez-Fernandez A. High Fidelity Human Simulation Improves Physical Therapist Student Self-Efficacy for Acute Care Clinical Practice. *Journal of Physical Therapy Education*. 2016;30:14-24. doi:10.1097/00001416-201630010-00003

47. Wright A, Moss P, Dennis DM, et al. The influence of a full-time, immersive simulation-based clinical placement on physiotherapy student confidence during the transition to clinical practice. *Advances in Simulation*. 2018;3:3. doi:10.1186/s41077-018-0062-9

48. Jones A, Sheppard L. Self-efficacy and clinical performance: A physiotherapy example. *Advances in Physiotherapy*. 2011;13:79-84. doi:10.3109/14038196.2011.565072

49. Jones A, Sheppard L. Use of a human patient simulator to improve physiotherapy cardiorespiratory clinical skills in undergraduate physiotherapy students: A randomised controlled trial. *The Internet Journal of Allied Health and Science Practice*. 2011;9:1-11. doi:10.46743/1540-580X/2011.1338

50. Blackstock FC, Watson KM, Morris NR, Jones A, Wright A, McMeeken JM, et al. Simulation can contribute a part of cardiorespiratory physiotherapy clinical education: two randomized trials. *Simulation in Healthcare: The Journal of The Society for Medical Simulation*. 2013;8:32-42. doi:10.1097/SIH.0b013e318273101a

51. Nithman RW, Spiegel JJ, Lorello D. Effect of High-Fidelity ICU Simulation on a Physical Therapy Student's Perceived Readiness for Clinical Education. *Journal of Acute Care Physical Therapy*. 2016;7:16-24. doi:10.1097/JAT.0000000000000022

52. Bednarek M, Downey P, Williamson A, Ennulat C. The use of human simulation to teach acute care skills in a cardiopulmonary course: a case report. *Journal of Physical Therapy Education*. 2014;28:27-34. doi:10.1097/00001416-201407000-00005

53. Kirkpatrick JD, Kirkpatrick WK. *Kirkpatrick's Four Levels of Training Evaluation*. Association for Talent Development; 2016.

54. Liao SC, Hsu SY. Evaluating a continuing medical education program: new world Kirkpatrick model approach. *International Journal of Management, Economics and Social Sciences (IJMESS)*. 2019;8:266-279.

55. Kruger J, Dunning D. Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*. 1999;77:1121. doi:10.1037/0022-3514.77.6.1121

56. Heuer A, Bienstock J, Zhang Y. Simulation-based training within selected allied health professions: an evidence-based systematic review. *Journal of Allied Health*. 2022;51:59-71.

57. Jepsen RM, Østergaard D, Dieckmann P. Development of instruments for assessment of individuals' and teams' non-technical skills in healthcare: a critical review. *Cognition, Technology & Work*. 2015;17:63-77. doi:10.1007/s10111-014-0306-y

58. Quiben M, Greenwood KC, Gorman SL, Bradford J, Macauley K, Nordon-Craft A, et al. Simulation-Based Education in Physical Therapist Education: Perspectives From the Strategic Initiative Panel on Simulation in Physical Therapist Education. *Physical therapy*. 2022;102:pzac135.

59. Cheng A, Kessler D, Mackinnon R, Chang TP, Nadkarni VM, Hunt EA, et al. Reporting guidelines for health care simulation research: extensions to the CONSORT and STROBE statements. *Advances in Simulation*. 2016;1:25. doi:10.1186/s41077-016-0025-y

Make Every Breath Count

Hospital. Home. Anywhere.

Easy to use, clean, and disinfect, Acapella Choice™ Blue can help you deliver positive expiratory pressure (PEP) therapy in just half the time of traditional physiotherapy.

How to Order

- NHS supply chain
- On prescription
- Order direct through ICU Medical

Ordering Information

MPC	NPC	Product Description
27-8000	FDE85034	Acapella choice device with mouthpiece
27-8001	FDK85404	Acapella choice device (individually boxed)

To learn more, visit www.icumed.com/acapella

icumedical
human connections

The product complies with current legislation and has the corresponding CE marking.
For additional information, warnings and / or safety precautions, refer to the Instructions for Use.

+44 (0)845 850 0445 | www.icumed.com

Thank You
Reviewers 2024

Anna Alderslade
Dalia Barghouthy
Amy Bendall
Frances Butler
Richard Chantry
Rachel Colclough
Rebecca Dalton
Allaina Eden
Catrin Emery
Rebekah Haylett
Alice Finch
Sarah Knight
Adam Lewis
Agnieszka Lewko
Clair Martin
Rebecca Masterman
Paul McCallion
Harriet Shannon
Robyn Stiger
Chris Swindale
Ema Swingwood
Melissa Webb
Zoe Van Willigen

Inspiring excellence in cardio–respiratory care

www. acprc. org. uk