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Contents

Editor foreword

Welcome to Volume 54, Issue 2 for the Journal of the Association of Chartered Physiotherapists in Respiratory Care.

This edition of the journal continues to reflect the diversity of the areas in which respiratory physiotherapists work. The volume starts with Driver et al. who report on an evaluation of the experiences of an ECMO (extracorporeal membrane oxygenation) clinical support team implemented during the COVID-19 pandemic. A further service evaluation by Sayer et al. who report on the characteristics and therapy needs of COVID-19 survivors during an enhanced therapy service provision between critical care and discharge is also presented. Lewis and Twose present a quality improvement project centred on 'rehabilitation after critical illness (RaCI) enhanced physiotherapy input following critical care discharge' and Shepherd et al. also present a service evaluation on the accuracy of electronic prescriptions used to calculate nebulised medication adherence in adult with cystic fibrosis. In the first of two review papers in the journal, McCallion et al. have undertaken a systematic review of the use of shared decision making in airway clearance techniques in adults with bronchiectasis. The volume also includes a further output from the ACPRC editorial board, led by Dr. Una Jones. The editorial board is tasked with leading the scoping, commissioning, co-ordination, and delivery of all new ACPRC guidance documents and resources and in this publication, Grafton et al. present a scoping review on 'post-upper gastrointestinal (GI) surgery physiotherapy management'.

As always, we hope that you enjoy reading this issue of the ACPRC journal, and that you are inspired to write up and submit your work. We have now made a change to the submission process, with two submission windows per year closing on the 1st April and 1st November followed by two publications per year. Submission guidelines are available on the ACPRC website www.acprc.org.uk and are due to undergo some updates, so please review them prior to submitting to the journal. Please remember that we also provide members with support through the research officer and as editors we are very happy to discuss any potential article ideas with you too.

Kind regards

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An evaluation of the experiences of an ECMO clinical support team implemented during the COVID-19 pandemic

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Abstract

Introduction

The COVID-19 pandemic led to an increased demand for critical care provision, with healthcare services and staff having to adopt novel ways of working to meet patient needs.

Aims

This service evaluation explores the experience and implementation of a team of healthcare staff voluntarily redeployed to a newly created role supporting staff and patients on an intensive care unit (ICU) providing extracorporeal membrane oxygenation (ECMO) to patients with COVID-19 during the first wave of the pandemic.

Method

This service evaluation presents a qualitative analysis of the team members' responses to a questionnaire.

Results

Respondents found participation in the team to be a positive experience. This was attributable to effective training, support and positive feedback from the existing staff, as well as feelings of being valued, contributing to patient care and developing new skills. Learning points were highlighted, including the need for a timely implementation of such a team, with extended training to enhance the team's collaboration with

the existing staff. Comprehensive communication of the role of the team to the existing staff and an agreed list of tasks could enable the team to be utilised more effectively.

Conclusions

Staff can be successfully redeployed into a support role on ICU without prior experience of the environment. These findings can inform workforce planning and the implementation of similar support teams in the event of future crises.

Introduction

The first confirmed case of coronavirus in the United Kingdom (U.K.) was reported at the end of January 2020, a day after the World Health Organisation (WHO) declared the novel coronavirus outbreak as a 'public health emergency of international concern'. By the end of February 2020 COVID-19 had spread across six continents, leading to the outbreak being declared a pandemic in March 2020 (WHO 2020). By September 2020, in the U.K. there had been 341,628 reported cases of COVID-19 infection (date of specimen) (PHE 2020a) and 41,544 deaths (within 28 days of positive test) (PHE 2020b). Approximately 4% of people with COVID-19 required an intensive care unit (ICU) admission for respiratory support (Wu & McGoogan 2020), with most patients requiring mechanical ventilation within the first 24 hours of critical care (Mahase 2020).

The rapidly evolving pandemic has led to unprecedented disruption to health services across the world. In response to a steady rise in cases occurring in the U.K. since January 2020, nationwide and local measures were introduced in the National Health Service (NHS) hospitals to meet this emergent challenge. Elective procedures were cancelled or deferred, higher quantities of ventilators and personal protective equipment were sourced, new hospitals were built, and NHS staff were redeployed and trained to new roles to meet the increased demands for critical care provision (Stevens 2020; Vera San Juan 2021).

Furthermore, the COVID-19 pandemic has posed multiple challenges for healthcare workers internationally. When working during a pandemic, these staff face elevated risks of infection, disruption of their work routines and of their professional development (Stevens 2020), as well as concerns about their mental well-being (Spoorthy 2020).

It was approximated that 5% of patients with COVID-19 may have more severe disease complications, including respiratory failure and acute respiratory distress syndrome (ARDS) (WHO 2020). As extracorporeal membrane oxygenation (ECMO) has previously resulted in a reduced mortality in Middle East respiratory syndrome (MERS) (Alhazzani et al. 2020) and Venous-Venous ECMO (VV-ECMO) enables total lung rest, it was considered that VV-ECMO may also be helpful in treating patients with an ARDS-like response to COVID-19 with refractory hypoxemia for whom mechanical ventilation was insufficient (WHO 2020). In April 2020, 898 patients were referred to ECMO services nationally, an increase of 995% from

April 2019, 18% of whom were accepted and admitted to an ECMO centre (Warren 2020). As one of only five NHS commissioned ECMO centres in England, Manchester University NHS Foundation Trust contributed to an increase in ECMO provision by increasing capacity on its cardiothoracic critical care unit (CTCCU).

ECMO is resource-intensive and requires specialist trained staff to manage patients receiving it (Yang 2020), therefore the cardiothoracic critical care management team requested staff to volunteer to form a support team that would carry out basic nursing care and provide additional support for the moving and handling of adult patients on ECMO, thus releasing the nursing team to perform more highly skilled tasks. Amongst the volunteers were a mixture of clinical and non-clinical staff, including physiotherapists (Kimberley Driver, Danielle Shaffi) and physiotherapy assistants, who had been redeployed from their usual roles.

The purpose of this study is to evaluate the implementation of a novel ECMO clinical support team (ECST) that aided nurses caring for adult patients with COVID-19 and requiring ECMO. In order to do so, this study presents the views and opinions of the staff comprising the ECST.

Methodology

Study design and sample

Two questionnaires were distributed in printed and electronic format to be completed anonymously by staff during the last two weeks of the ECST's deployment. One questionnaire aimed to gather information regarding the CTCCU nursing staff's experiences of being supported by the ECST; these data are presented elsewhere (Shaffi et al., manuscript submitted for publication). The second questionnaire (Appendix 1) invited all staff members of the ECST to anonymously share their views and experiences of their redeployment. Seven completed surveys were returned, a response rate of 44%.

Ethical approval

This service evaluation was discussed with the research office in the Trust and was deemed to not require ethical approval. It was approved and supported by the cardiothoracic critical care senior management team. All participants consented to their responses being shared anonymously.

Data Analysis

In order to analyse data qualitatively whilst also providing a descriptive account of the frequency of different categories and themes (Gbrich 2007), survey responses were analysed using inductive content analysis (Elo & Kyngas 2008). This type of analysis is appropriate for studies when there is scarce or no prior research regarding the study topic, as it provides a systematic and objective means of describing and quantifying phenomena (Schreier 2012). In order to derive findings by means of focused evaluation questions, narrative data

is categorised into coded categories and themes derived directly from the text rather than from specific hypotheses or theoretical frameworks (Thomas 2006).

Two authors (Kimberley Driver and Emma Shaw Núñez) read all data repeatedly to attain an overarching understanding of the dataset, and the data were transcribed to facilitate subsequent steps of analysis. Both authors inductively coded these data by initially labelling condensed meaning units, then formulating codes and grouping codes into categories (Erlingsson 2017). Categories were derived both from counts of codes within the data and based on how they related to a specific issue or idea. All authors reviewed the emergent categories, and the third researcher (Danielle Shaffi) was involved for the remainder of the analysis process for triangulation purposes. The emergent categories were grouped and organised into meaningful themes (Table 1).

Table 1: A breakdown of themes and categories.

Themes	CST staff expectations	Training for the role	Experience of the role	Change and development
Categories	Role and responsibility	Positive training experience	Team organisation	New skills
	CTCCU staff prior knowledge of the role	Understanding the role	Feeling supported	Appreciation of CTCCU staff
		Feeling prepared	Team working	New perception of self
			CTCCU staff knowledge of the role	Role development
			The reality of the role	
			Positive experience	
			Valued/ contributing	

Results

Of the seven questionnaires returned, five were completed by staff members who were part of the ECST during the period of increased pressure on CTCCU staff (9 weeks). Two respondents had ended their redeployment early at 1 week and at 6 weeks after returning to their

original workplace due to not feeling needed in the ECST and due to an aggravated back injury, respectively. Of the seven respondents, five staff members had no prior experience of working in critical care and were mainly outpatient-based, one had extensive past experience and one had some past experience of working in critical care in a therapy role.

Four main themes were identified from staff's feedback:

1 ECMO clinical support team staff expectations.
2 Training for the role.
3 Experience of the role.
4 Change and development.

Derived from these findings, salient good practices and recommendations to improve future implementations of support teams in an ICU setting are discussed.

ECMO clinical support team staff expectations

Staff provided accounts of their understanding of the role of the ECST, as well as their individual responsibilities, at the time of joining this newly formed team. Prior to their training, staff had broad and generic expectations about what their role would entail and the tasks they would be conducting as a team, which were based on the limited information they had received.

> 'The role was described first as the "proning team" but after the training day I soon realised we would be helping with personal care'. (P5).

They expected to be involved in patient handling, particularly oriented towards proning patients, and to assist nurses.

> 'I went into the training with very little expectations as we hadn't received much information before attending the training. I knew we would be involved with patient handling and that all patients would be Covid+ but apart from that I kept an open mind about what we would be expected to do'. (P4).

Additionally, several staff members who participated in the ECST highlighted that some of the CTCCU colleagues they joined appeared to not be aware of the role of the team, prompting suggestions to communicate this in advance to all staff involved if a future ECST was to be implemented in the future.

Training for the role

All staff provided positive feedback about the face-to-face one day training they received from practice education facilitators with ICU nursing backgrounds, which for most participants was their first experience in auxiliary care within an ICU environment. They found the training was an overall positive experience which enabled them to understand their role better and feel prepared for it.

'I felt confident the day I started on CTCCU to jump in and offer help where needed.' (P4).

'The trainers were friendly and made me feel at ease and reassured.' (P7).

Prior to attending the training, staff were unsure about the tasks they would be required to contribute to. Four staff members expressed that attending the training increased their preparedness for the ECST role they were about to commence and made them feel more competent and comfortable.

'I was unsure what additional tasks we would be asked to do prior to the training however felt more competent to complete these after training'. (P2).

Three respondents also identified areas of training that they would have found beneficial to expand on, including more training about the CTCCU environment and additional hands-on training. Overall, the training was well received, and staff reflected on it being informative and well delivered, helping them to understand better their role by clarifying their expectations.

'There were a couple of tasks I didn't expect to be doing but after the training felt a bit more comfortable with the role'. (P5).

Experience of the role

Participants largely found the experience a positive one, both valuing the opportunity to support a team under considerable pressure and uncertainty, as well as feeling valued for their contribution to patient care during a challenging period. This was reinforced by the positive feedback that the CTCCU nursing team gave them.

'It was a challenging yet positive experience because I felt like I could offer help and assistance under difficult circumstances to take some of the pressure off the nursing team'. (P7).

'The nurses have provided very positive feedback and are always grateful for support therefore I feel it has been successful'. (P2).

When reflecting on their experience of their role within the ECST, participants highlighted the level of support they received from critical care staff, senior staff and colleagues:

'The support from everyone on CTCCU has been amazing, everyone… cleaners, nurses, students, doctors, management, porters'. (P7).

However, two team members indicated that it was challenging to work without direct supervision from a senior member of staff.

'It wasn't always clear who we should speak to if a problem arose, especially if it was on a day [ECMO clinical support team leader] wasn't working'. (P4).

When asked about areas for improvement, three members felt an earlier implementation may have improved the impact of the ECST.

> 'I feel team was implemented too late and was told by various people 2–3 weeks prior to team starting was when they needed us'. (P1).

As part of their feedback, members of the team provided suggestions that would have made their role more efficient:

> 'We also occasionally would receive mixed messages about where we should work which would mean that too many or too little of us would end up in Covid+ areas'. (P4)

> '… … was often stood for long periods not doing anything'. (P1).

Communication was also highlighted as an area for attention, with six of the seven team members commenting on the critical care staff having a lack of awareness of the ECST's presence or role.

> 'The nurses at the beginning were not sure of our role or expecting us to be working with them'. (P3).

Some team members felt that ensuring the nurses were fully informed would have empowered them to use the ECST more effectively.

> '… therefore took time to build up rapport and trust and confidence to complete additional tasks.' (P2).

Most (5/7) of the ECST commented on the positive way in which the members of the team bonded and worked well together in a short time. They also described the nursing team as accommodating and helpful, which enabled effective cross-team working.

> 'All members of the team worked well together and it never felt like there was any friction even though we had all come from different professions, bands and experience levels'. (P4).

> 'To witness first-hand the professionalism, dedication and care from everyone on CTCCU towards the patients just fills me with awe and gratitude for everything they do and represent'. (P6).

Change and development

ECST members reported they developed new skills from the role they occupied during their time on CTCCU. Largely, the group did not provide specific examples, however one individual cited infection prevention as something they would take back to their workplace.

ECST members' accounts depicted a newly gained perception of their skills and abilities. Most (5/7) team members described realising their resilience and growing in confidence as a result of their experiences.

'I have become more confident and feel I am a team player'. (P5).

'This experience has taught me I am more resilient than I previously believed'. (P4).

Five respondents described how their role developed over time. This was as a result of support team members becoming more familiar with critical care staff, more confident and adapting to the role.

One member commented the role could develop with additional jobs being assigned to the ECST:

'Once on CTCCU we realised there were more jobs for us to do, stocking, emptying bins and catheters and as we got more confident helping out a bit more'. (P5).

The role undertaken by respondents also grew as the nursing team's confidence in the ECST developed, resulting in the nurses utilising the ECST more frequently and effectively.

'We found the longer we were there the more involved we got'. (P3).

'I could sense the confidence from the nursing staff in our ability to undertake tasks grow as the shifts progressed'. (P6).

Team members indicated their admiration for the CTCCU staff and made reference to their work ethic, dedication and care. Some ECST members had previous experience of critical care, either professionally or personally. Working as part of the critical care team in this role deepened their appreciation of the care provided. Other members of the ECST had no experience of critical care and expressed similar appreciation for the care provided to patients in CTCCU.

'They have shown true courage and skill during pandemic'. (P2).

'All the staff are so committed 100% to their jobs'. (P5).

'The team are all fantastic and dedicated and work so hard'. (P7).

Discussion

This work presents a service evaluation of an ECMO clinical support team in a busy ICU during the COVID-19 pandemic. Additionally, it identifies a set of good practice points and recommendations stemming from staff feedback, aiming to further improve the implementation of such staff workforce if required in the future.

Firstly, despite the team having limited knowledge initially about what the role they were volunteering for would entail, the training provided served to clarify this, with ECST members reporting it adequately prepared them for the task. Secondly, to maximise the scope and usefulness of the training, staff have suggested it could be expanded to incorporate further hands-on skills and further opportunities to experience the critical care environment. Thirdly, staff felt supported whilst working as part of the team, particularly by senior staff

and colleagues, but may have benefited from direct supervision and direction. Fourthly, staff indicated that strategies such as a predetermined list of tasks that ECST staff would be responsible for undertaking, clear direction regarding which areas of the critical care unit required assistance, a rota to match the number of staff on shift to the required level of support at the time, and more extensive communication to nursing colleagues about the implementation and the role of the team could be measures that would improve the efficiency and value of the ECST.

In short, staff feedback suggests that a timely implementation with appropriate training and a designated list of tasks with direct supervision would enable a similar critical care support group to be redeployed more efficiently. Informing CTCCU staff of the presence and role of the ECST would enable the team to be utilised more effectively and to increase the team's capabilities over time.

It is noteworthy that members of the ECST felt valued and useful during a time of uncertainty and of great, rapid changes to the healthcare systems and provision, including staff redeployment. Contributing to the ECST made staff feel part of something special and was perceived as a positive experience. The team worked well as a unit, despite their multiple backgrounds, skills and experience and, following their first-hand experience, they expressed an appreciation for the work and dedication that characterised the CTCCU staff they worked alongside. Furthermore, their responses highlight that staff gained and developed new skills, confidence and perspective through their role.

These findings are important in the context of healthcare systems worldwide preparing for probable future viral outbreaks that will necessitate temporary but timely changes to care provision. Staff views and suggestions elicited by this evaluation could be utilised to understand and thereby improve the experience of healthcare staff redeployment into an ECST in the future. Thus, these findings can aid planning workforce restructuring during future viral outbreaks or other similar crises and contribute to safeguarding the well-being of healthcare staff at a time when both staff and whole healthcare systems are navigating new and rapidly changing pressures.

A number of limitations of this evaluation have been considered. Firstly, this evaluation required an inductive content analysis approach, which can present issues of validity and trustworthiness. Through the conduct of this evaluation attention was paid to its catalytic validity, as evidenced by the potential implications of the findings for clinical practice and for further research (Kincheloe & McLaren 2000). Additionally, a focus on dependability, confirmability, credibility and transferability (Guba 1981; Shenton 2004) was maintained by means of an open account of the methodology and process of analysis, a collaborative interpretation of the data between researchers, the use of triangulation, and consideration of relevant characteristics about the participants and the wider context in which the findings are situated.

Secondly, the use of questionnaires for this study was preferred to other methods of data collection due to social distancing measures in the workplace and time efficiency. However, it is recognised that gathering data by means of focus groups or interviews would have enabled more in-depth accounts and richer data.

Finally, possible selection biases may influence the findings. Staff were voluntarily redeployed from their usual roles to the ECST and self-selected to contribute to this evaluation, therefore respondents in this study might have different views to those who did not opt to participate. Two authors (Kimberley Driver, Danielle Shaffi) were members of the ECST, which could be argued may limit their ability to be objective. However, this could also enable these authors to have a deeper understanding of the context described by respondents. The evaluation also did not provide an in-depth examination for the reasons why some staff members did not join the ECST nor why some ended their redeployment early.

This timely and novel evaluation adds to a growing body of data on the innovative redeployment and training strategies implemented by health systems worldwide, often under unprecedented time and staffing pressures, to provide care to patients with COVID-19 and high care needs (Vera San Juan 2021). Future studies are needed to understand the experiences of staff adapting their work roles following the COVID-19 pandemic, to explore the impact on the well-being of existing and redeployed staff, and to evaluate the effectiveness of workforce restructuring measures taken to support the provision of care for COVID-19 patients in critical care settings.

Key points

1. Redeployed staff can successfully provide meaningful support in a critical care unit without extensive training or prior experience of the environment.
2. This is not at the detriment to the well-being of these staff, who can have a positive experience and gain valuable transferable skills.
3. A defined support structure and comprehensive communication are essential to ensure both existing and new staff have a good understanding of the newly formed team's role.

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Clinical support team – team questionnaire

1 *What was your experience of critical care prior to starting on the clinical support team?*

2 *What were your expectations of the clinical support team role?*

3 *What were your feelings after attending the support team training day? Was the training day what you expected? Were the tasks included what you expected?*

4 *What was your experience of the clinical support team role? Was it as described? Did it change over time?*

5 *Has being part of the clinical support team changed your view/experience of critical care?*

6 *What do you feel went well?*

7 *What did you feel did not go as well?*

8 *If a new team were to be introduced in the future, what improvements would you make?*

9 *How did you find your level of support during your role on the clinical support team? For example nurses, wider MDT, peers, and so on.*

10 *Do you feel that the clinical support tem has achieved its aim? How did you conclude this?*

11 *What will you take away from this experience?*

12 *Any additional comments.*

What is your usual role within the NHS

Clinical ☐

Non clinical ☐

How long did you spend in the clinical support role.

What was the reason for finishing your role.

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Characteristics and therapy needs of COVID-19 survivors during an enhanced therapy service provision between critical care and discharge: A service evaluation

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Keywords | Physiotherapy, occupational therapy, COVID-19, therapy support, intervention.

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Abstract

Background

There was a significant change in therapy structure at the Royal London Hospital in response to the COVID-19 pandemic. This provided us with an opportunity to review the therapy interventions given to survivors between critical care and hospital discharge.

Aims

To describe the therapy needs and characteristics of COVID-19 survivors between critical care and acute hospital discharge during enhanced service provision.

Method

Notes screened retrospectively (30th March and 31st May 2020) and therapy interventions coded to allow a temporal analysis. This included 21 individual interventions provided by physiotherapists, occupational therapists and therapy support workers.

Results

Thirty-five patients were included. Demographics: 71% were male, average age was 53 (±13.7) and 55% identified as Black, Asian or Minority Ethnic (BAME). The mean length of stay was 23 days (±16.3). Critical care background: mean intubation time 13.6 (±6.4), 51% were delirious, 71% received oxygen therapy and three patients required tracheostomies. The mean Chelsea Critical Care Physical Assessment (CPAX) score was 30 (±11.3) following critical care. Therapy Interventions: 170 sessions were completed with a mean of 4.85 (±5). Mean time from step down to discharge was 9.74 days (±9.4). 57% returned to independence with the mean improvement of 9.7 (±8.7) on the CPAx score.

Conclusion

This descriptive analysis has helped the team gain a greater understanding of the therapy needs of COVID-19 survivors following a critical care admission and identified areas for development within the team. It has also demonstrated the resilience of the inpatient therapy team and redeployed staff in response to the first peak of the pandemic. Future work will explore the establishment of a critical care step down pathway to help establish individual rehabilitation complexity and therapy needs.

Introduction

In the United Kingdom the first COVID-19 case was observed on the 31st of January 2020. The ensuing COVID-19 pandemic reached its peak in early April 2020 and required a rapid response from the National Health Service (NHS). This included the expansion of critical care services and the redeployment of multiple staff groups to increase capacity. At our institution in East London in the United Kingdom (The Royal London Hospital, Barts Health NHS Trust), critical care capacity was increased from the 44 beds to almost 90 beds during the first wave of the pandemic. This translated into an increased number of patients requiring a step-down bed on an acute ward following their critical care admission.

Critical care admissions are associated with multiple short- and long-term impairments in both physical and non-physical domains (Needham et al. 2012; Thomas et al. 2019). For example, muscle weakness acquired during the critical care period (ICUAW) can take several months to improve and has a major impact on quality of life (Kress & Hall 2014).

Early work suggests high acuity and prolonged ventilation in patients admitted to ICU with COVID-19. Rehabilitation has been shown possible, however there can be delays to patients starting therapy due to the severity of the illness (McWilliams et al. 2021). We aim to build on this work completed in Birmingham to further understand the rehabilitation needs of COVID-19 survivors.

We proposed to describe the therapy needs of COVID-19 survivors between critical care and acute hospital discharge during enhanced service provision. In addition, we proposed to capture the therapy interventions delivered to our COVID-19 critical care survivors, to determine the type, incidence and frequency of interventions. This will contribute to our understanding of the recovery and rehabilitation needs to support future inpatient and community workforce planning and skill development.

Method

Setting

The Royal London Hospital (Barts Health NHS Trust) is a major teaching organisation and operates over four discreet sites (The Royal London Hospital, Whipps Cross University

Hospital, Newham University Hospital, and St Bartholomew's Hospital) providing local and specialist tertiary care services.

We collected data retrospectively for patients transferred from our adult critical care units to the acute inpatient wards at the Royal London Hospital following an admission with COVID-19 related illness, over a nine-week period (30th March and 31st May 2020). Patients were handed over by the critical care therapy team daily. We excluded patients who were discharged by therapists in critical care, those who were repatriated within 24 hours, and those who were transferred to wards outside our service remit (Figure 1).

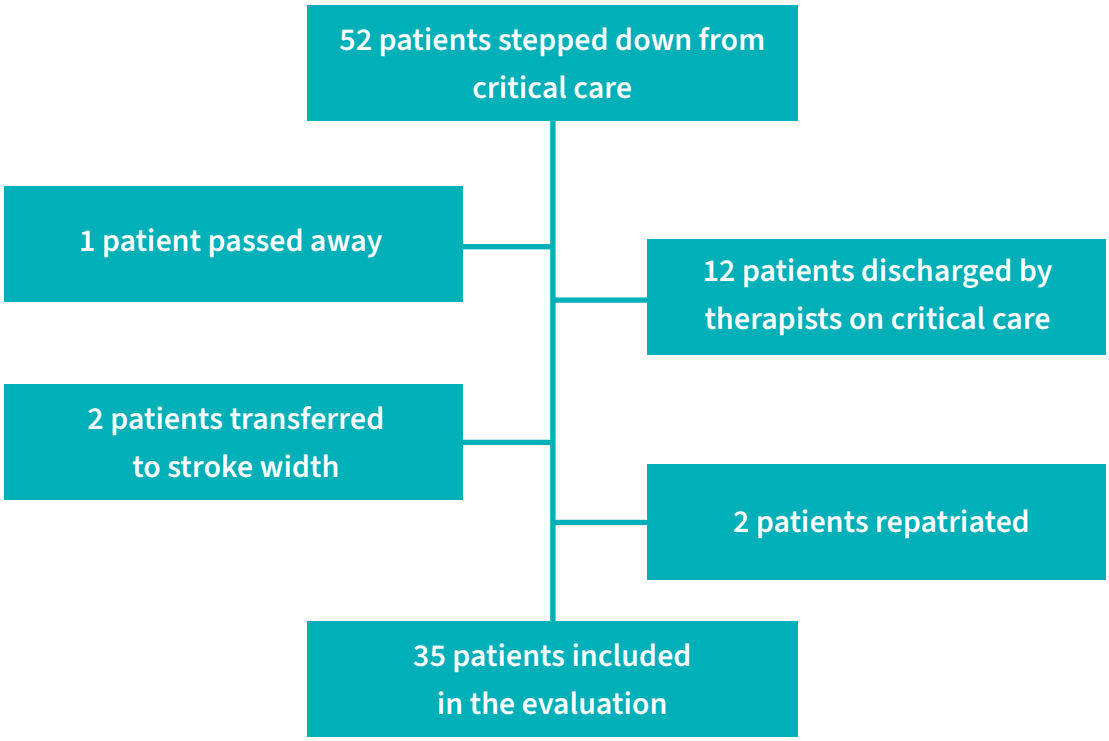

Figure 1: Cohort inclusion and exclusion.

We provided a new seven-day service during the data collection period due to the redeployment of staff from community and outpatient teams. This resulted in a 12% increase in occupational therapist's (three additional members of staff) and a 93% increase in physiotherapists (14 additional members of staff). The resultant therapist to patient ratio on a Wednesday to Saturday shift was 1:9 for physiotherapists and 1:8 for occupational therapists. While the Sunday to Wednesday shift resulted in a 1:7 patient to therapist ratio for physiotherapists and 1:9 for occupational therapists.

This workforce delivered a service to all acute inpatients irrespective of COVID-19 status guided by a standard operating procedure which included a tool for the prioritisation of services for patients with urgent needs. Consequently, all patients on the therapy caseload received an intervention frequency and intensity according to their perceived need, rather than diagnosis. All redeployed therapy staff completed an induction covering personal protective equipment (PPE), manual handling, national early warning scores (NEWS),

braces and orthotics, respiratory competencies, proning, prioritisation, discharge planning, note writing and transdisciplinary working.

Experienced acute inpatient ward occupational therapists and physiotherapists designed the data collection tool (*apriori*) which included 21 coded therapy interventions as our primary outcome measure. Our secondary outcomes were the critical care background and demographics. Table 1 shows the data we collected.

Table 1: A summary of the data collected (including the primary outcome which was the 21 coded therapy intervention that made up the data collection tool).

Demographics	ICU background	Therapy interventions	Rehabilitation and discharge
• Ward. • Age. • Gender. • Ethnicity. • Date of hospital admission. • Date of critical care stepdown. • Date of hospital discharge. • Comorbidities.	• Number of days intubated. • Presence of delirium. • Oxygen therapy on critical care stepdown. • CPAx score on discharge from critical care.	1 Bed based assessment. 2 Sitting on the edge of the bed. 3 Sitting out of bed. 4 Mobility. 5 Mobility with oxygen. 6 Mobilisation with low saturations. 7 Exercises. 8 Activity of daily living review. 9 Personal activity of daily living review. 10 Suctioning. 11 Nasopharyngeal airway insertion. 12 Reposition. 13 Oxygen titration. 14 Self proning. 15 Breathing exercises. 16 Nil treatment – stable. 17 Behavioural management. 18 Re-orientation. 19 Nil treatment – unstable. 20 Discharge planning (face-to-face). 21 Discharge planning (non-face-to-face).	• Date of initial assessment. • Number of delivered interventions. • Functional level achieved on discharge. • Impairments on discharge. • Package of care requirements. • Discharge destination. • Community support. • CPAx score on hospital discharge.

Data was extracted from the electronic patient record and entered onto a password protected excel spreadsheet, anonymised and stored locally in compliance with *General Data Protection Regulation* (GDPR 2018). Only three therapists accessed this spreadsheet throughout the course of the evaluation. Prior to data extraction and analysis, the spreadsheets were scrutinised for consistency of format and coding, and corrections were made as required. Data was subsequently collated via coding and tabbed spreadsheets to extract descriptive information regarding number and frequency of contacts, including which specific interventions were most used.

Ethical approval and patient consent were not required as the project was deemed a service evaluation by the clinical effectiveness unit at The Royal London Hospital. There was no deviation from usual care for any patient, therefore consent was not required. The service evaluation was registered within Barts Health NHS trust according to local policy (registration number 11171).

Results

Therapy interventions

The cohort received a total of 170 therapy sessions over the nine-week period representing a mean of 4.85 (±5) sessions per patient. There was a large range (1–22 sessions) of therapy sessions delivered to patients. All patients were assessed within 48 hours of being transferred from critical care to the wards (Table 2).

Table 2: Mean ± standard deviation (*SD*) for descriptive data; CPAx: The Chelsea critical care physical assessment tool, (Corner et al. 2012) is a measurement tool used to assess physical function in the ICU.

	Mean	*SD*
Age (years)	53	13.7
Hospital length of stay (LOS, days)	23	16.3
Number of days intubated	13.6	6.4
Therapy sessions per patient	4.9	5
Critical care stepdown to initial therapy assessment (days)	1.34	1.8
Critical care stepdown to hospital discharge (days)	9.7	9.4
CPAx on discharge from ACCU	30	11.3
CPAx on hospital discharge	41.3	5.4
Change in CPAx between critical care stepdown and hospital discharge	9.7	8.7

Initially the most common therapy interventions included mobility, sitting on the edge of the bed, sitting in a chair and discharge planning. During the last four weeks there was

an increased frequency of most interventions with peaks in exercise training and mobility practice.

Multidisciplinary interventions delivered at the bed space were highest during the middle of the data collection period and exercise training interventions peaked towards the end of the data collection. Mobility interventions including mobilising with and without oxygen peaked in the fourth and fifth week. Therapy interventions to improve performance in activities of daily living increased from the third week of data collection. More patients were requiring respiratory interventions towards the later part of the evaluation by the physiotherapists including oxygen titration, breathing exercises, self proning, positioning and suctioning. There was a steady increase in the frequency of reorientation and behavioural management interventions which peaked in the seventh week while discharge planning interventions were weighted in the latter half of the period. Figure 2 demonstrates these temporal changes in combined intervention categories across the time.

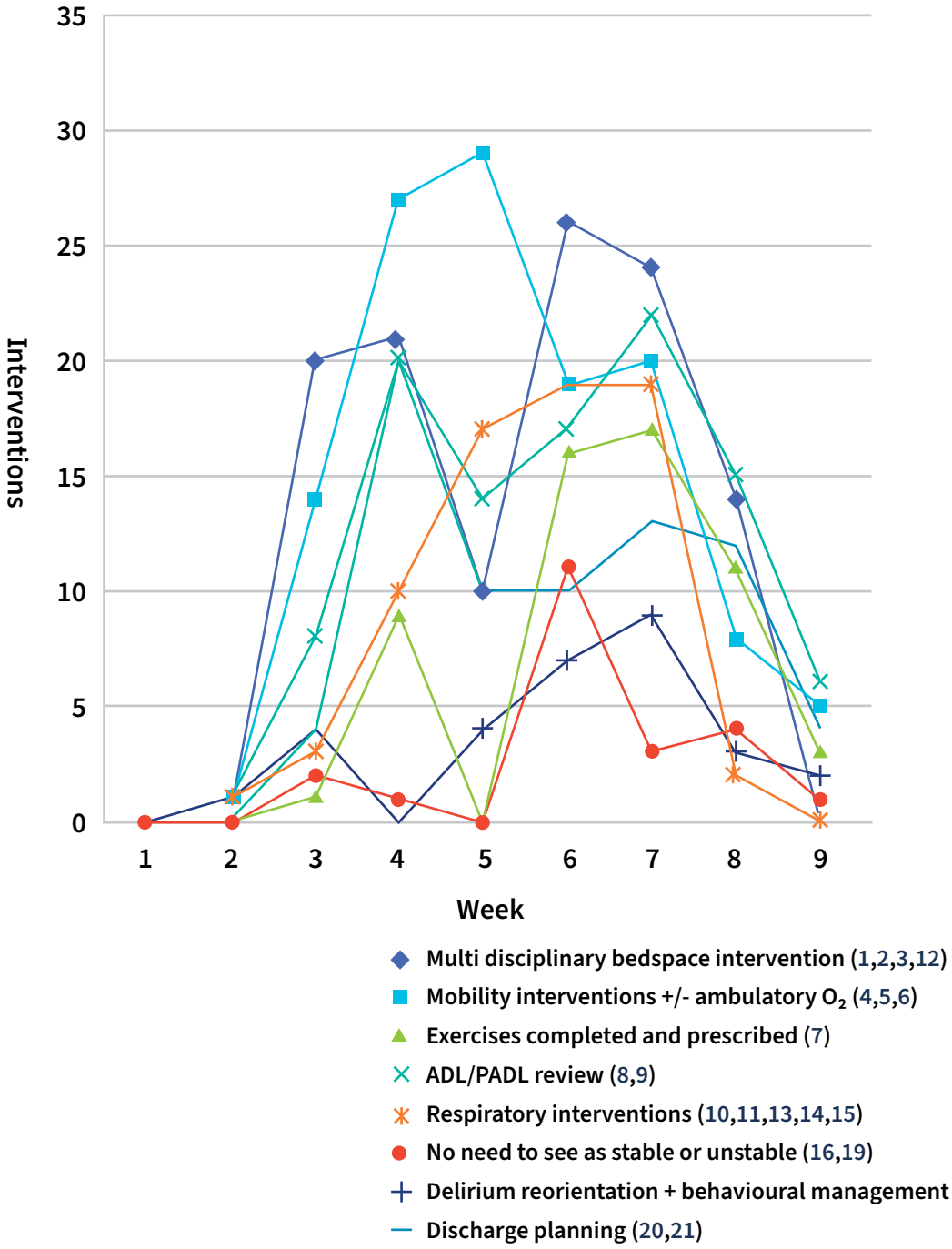

Figure 2: Temporal change in combined intervention categories.

The mean time from critical care step down to hospital discharge was 9.74 ± 9.4 days (Table 1). At hospital discharge, 57% of the cohort had returned to complete independence; 17% were independent but required a walking aid; 14% needed the assistance of one person to mobilise and the remaining 12% needed the assistance of two. 29% remained deconditioned as documented by treating therapists and 17% were experiencing fatigue which was also documented on community rehabilitation referrals by therapists. 9% were desaturating when mobilising and an equal percentage had ongoing confusion. 85% were discharged to their own home and 8.5% required a package of care to do so. 6% were repatriated for in-patient rehabilitation and 9% remained in the hospital at the end of the data

collection period. 34% were referred for community therapy support at hospital discharge. Only 26% did not require a referral to community services. The mean CPAx score at hospital discharge had improved to 41.3 (±5.4 points) representing a mean improvement of 9.7 (±8.7) points. Although it is currently difficult to generalise these findings to other critical care survivors due to the unpredictability of COVID-19, this would be a clinically meaningful change based on the work of Corner et al. (2015).

Demographics

Thirty-five patients experiencing a COVID-19 related admission were included in the evaluation (71% male: 29% female), with a mean age of 53 years (±13.7 years; Table 2). 55% of the sample identified as Black, Asian or Minority Ethnic (BAME), 30% identified as White/White-Other and 15% were not stated. The mean length of hospital admission was 23 days (±16.3days). There were 25 separate comorbidities represented within the sample and demonstrated in Figure 3. Hypertension, type 2 diabetes, end stage renal failure and high body mass index occurred with the greatest frequency. Many patients presented with three co-morbidities (40%), followed by 4 comorbidities (20%) and 2 comorbidities (14%), however four patients (11%) had no previous past medical history prior to contracting COVID-19 (Figure 3).

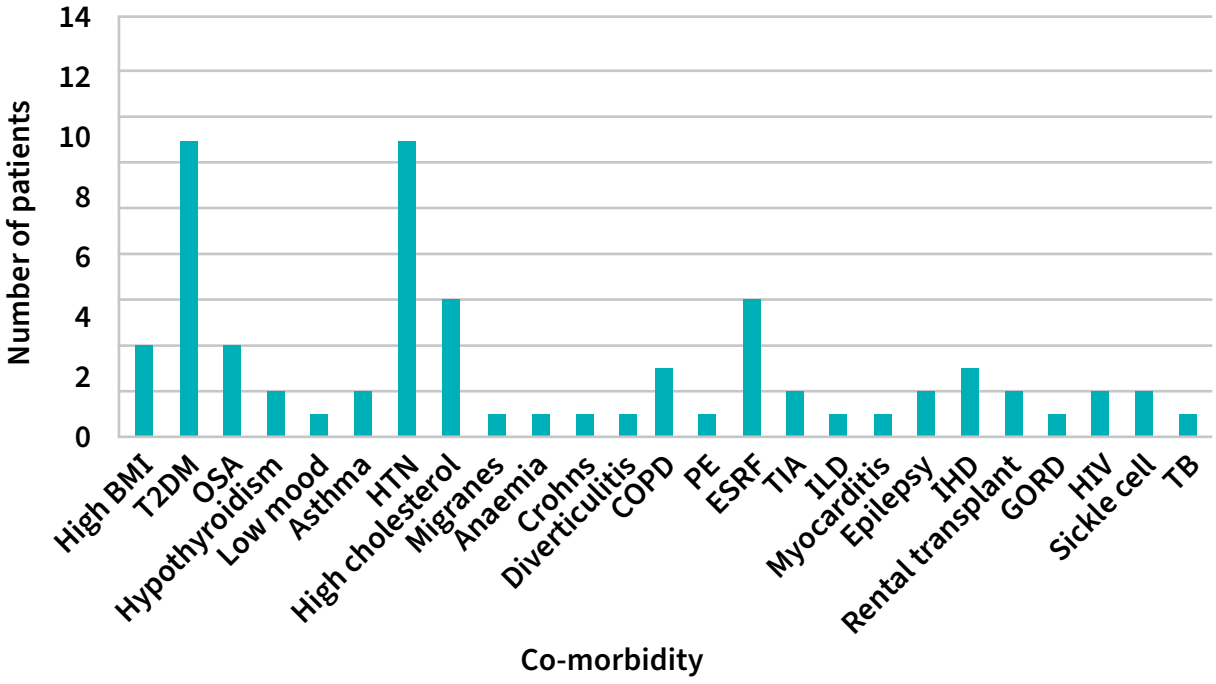

Figure 3: Frequency of co-morbidities within the sample.

BMI = body mass index; T2DM = type 2 diabetes mellitus; OSA = obstructive sleep apnoea; HTN = hypertension; COPD = chronic obstructive respiratory disease; PE = pulmonary embolism; ESRF = end stage renal failure; TIA = transient ischaemic attack; ILD = interstitial lung disease; IHD = ischaemic heart disease; GORD = gastro oesophageal reflux disorder; HIV = human immunodeficiency virus; TB = tuberculosis.

Critical care background

The cohort had a mean intubation time of 13.6 (±6.4) days. 51% of the samples (18 patients) were delirious in the post critical care period. Patients were identified as being delirious by the treating medical teams. 71% of the sample required oxygen therapy post critical care ranging from a range of interfaces including nasal cannula, venturi masks, humidified oxygen and nasal high flow oxygen. Three patients required tracheostomies to help wean from ventilation in critical care, these patients were all weaned off their tracheostomies on the wards. The mean Chelsea Critical care physical assessment (CPAX) score was 30 ± 11.3 points immediately following critical care discharge. This will be patient specific however indicates improvements in respiratory function, mobility, transfers and grip strength. (Table 1).

Discussion

This analysis further strengthens the work completed by McWilliams et al. (2021) in looking into the therapy needs of COVID-19 survivors post critical care step down. This analysis is unique since it was completed during the first peak of the COVID-19 pandemic in the United Kingdom during a period of enhanced staffing. In 2018, the National Institute for Health and Care Excellence (NICE) produced *Guideline 94: Enhanced inpatient access to physiotherapy and occupational therapy* which recommended extended access to physiotherapy and occupational therapy for people admitted to hospital with a medical emergency. In reaching this recommendation, randomised control trials were identified that compared the benefits of enhanced therapy access (across seven days) to standard access (across five days) in stroke patients (English et al. 2015) and older people (Said et al. 2012; Said et al. 2018). These trials suggest additional therapy provision increases the frequency and intensity of therapy delivery, but there are rare accounts or descriptions of the inpatient therapy service or the staff to patient ratio's which enable these outcomes to be achieved.

Irrespective of our increase in service provision, we were able to identify COVID-19 related impairments that needed to be addressed by therapists at different time points during their recovery.

A high number of patients required oxygen therapy and other respiratory interventions persisting into the latter half of the evaluation. 14% of the cohort experienced significant desaturation events with minimal active movement, limiting the intensity of mobility interventions which could be delivered safely. Future staff training in oxygen delivery devices, weaning and titrating oxygen, mobilising with oxygen, general respiratory and pacing techniques may support staff (especially occupational therapists and therapy support workers as appropriate) to manage these impairments more effectively.

The reports of deconditioning (29%) and severe fatigue (17%) were high however we noticed there was no standardised measure being used to assess these impairments. It could be proposed that these numbers may not actually be a true reflection of the patients who

were experiencing these symptoms due to lack of screening tools being used by the team. A meta-analysis of 15 studies including 47,910 patients by Lopez-Leon et al. (2021) found the most common symptom of COVID-19 survivors was fatigue with 58% of these patients experiencing this to some extent.

All these impairments may have the potential to limit the overall intensity and frequency of therapy interventions during the inpatient period and therefore we need an accurate screening tool/assessment and management plan for these specific impairments.

One of the main limitations to our service delivery was the number, range and skill mix of re-deployed therapists who required team induction. Although our team induction covered a range of diagnoses and clinical areas, our initial training focus was on patient safety and essential information to prevent harm given the number of inexperienced staff responsible for intervention delivery (some redeployed team members had not delivered acute ward therapy in over 10 years). Subsequent training was delivered as the pandemic progressed and common clinical presentations were emerging to guide the training content. It is possible that the incidence and frequency of intervention delivery was affected by staff confidence, exposure and expertise. In hindsight, an in-service training schedule that incorporated patient safety and intervention competency, for the commonly expected impairments may have influenced our outcomes however this was a real challenge at the time due to case-load numbers.

We also recognise that the PPE provision and infection prevention restrictions presented a unique challenge during the pandemic. For example, stair and kitchen assessments and other off ward activities which would usually inform ongoing interventions, assist in assessing cognition in a functional way and support discharge planning were ceased. We completed bed side stair assessment if required or set patients a single level to optimise their safety on discharge. The role of the ward therapist changed significantly, with more therapists completing basic care interventions to support nursing activity, especially in COVID-19 designated areas where full PPE was required. Ward culture shifted during the pandemic as patients were nursed predominantly in their beds, due both to the severity of the virus and the risks associated with patients sitting out or mobilising in unobserved clinical areas. These issues may have affected the intensity of therapy services being delivered.

Lastly, we recognise that decisions relating to therapy intervention during the data collection period were based on individual therapist assessment and reasoning alone. Impairments following a COVID-19 related critical care admission were a novel presentation. Therapists may have had difficulty determining the intensity and frequency of rehabilitation sessions in the absence of a clear critical care step down pathway and experience in treating COVID-19 survivors. The absence of measures predicting rehabilitation needs may have left therapists unable to fully appreciate the complexity of these patients and the intensity of rehabilitation they required. Consequently, the assessment and intervention the sample received may have been influenced by staff capacity rather than known

(or measured) rehabilitation needs. Understanding the rehabilitation and recovery needs of the post critical care population in future quality activities may help to inform staffing ratios and the recommended intensity of therapy services. We need to be able to objectively identify rehabilitation/recovery needs, provide a therapy service that is sufficient to meet this need, while still focussing on patient flow and safe patient discharge.

Conclusion

This is the first service evaluation looking into the therapy needs of COVID-19 survivors in detail following their critical care admission. We were able to describe in detail the type, incidence and frequency of therapy interventions delivered during the first peak of the pandemic. It has enabled the team to gain a greater understanding of the impact of COVID-19 from an impairment level and helped us to address gaps in knowledge regarding interdisciplinary management of delirium, oxygen desaturations during routine therapy and fatigue management. This analysis has also demonstrated the resilience and responsiveness of the inpatient therapy team and what can be achieved over short period of time. Future work will explore the establishment of a pathway for patients who are transferred from critical care to the acute wards at The Royal London Hospital to ensure patients receive a comprehensive assessment to help establish their individual rehabilitation complexity and therapy needs.

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Rehabilitation after critical illness (RaCI) enhanced physiotherapy input following critical care discharge: A quality improvement project

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Keywords | Rehabilitation, critical care, quality improvement, physiotherapy.

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Abstract

Background

Early rehabilitation within the critical care setting is proven to have significant impact on functional ability, however the optimum model of care following critical care is unknown. Generally, a decrease in intensity of therapy seen on wards is linked with an initial plateau in a patient's functional ability.

Objective

The primary objective of this study was to determine whether enhanced rehabilitation after discharge from critical care reduces patients' hospital length of stay within a tertiary university hospital. The secondary outcomes include the effect on patient's functional ability, frequency of physiotherapy activity and the need for support on discharge.

Methodology

Forty-four critical care participants were involved, over a four-month period, to receive daily physiotherapy provided by the critical care physiotherapy team in addition to existing ward-based therapy. Data was compared to a matched sample (based on risk of developing physical morbidity) from the previous year.

Results

Compared to before the quality improvement project, clinically significant reductions in patients' hospital length of stay following critical care discharge were observed with a median saving of 11 hospital bed days.

Conclusion

In this small, local project, this quality improvement work has demonstrated potential reductions in length of stay because of enhanced physiotherapy input following discharge from critical care.

Introduction

Patients surviving critical care often suffer physical and psychological morbidity following critical illness (Salisbury et al. 2010). Multi-organ failure, prolonged mechanical ventilation, and neuromuscular dysfunction are all factors associated with both increased critical care and hospital length of stay (McWilliams et al. 2015, 2019). These patients often experience short and long-term reduction in health-related quality of life which has profound consequences for the individual and their families (McWilliams et al. 2015; McWilliams et al. 2019).

The National Institute for Clinical Excellence outlined the key principles of care in the recovery of critically ill patients in their clinical guideline entitled 'Rehabilitation after critical illness' (NICE 2009). Structured rehabilitation within intensive care is recommended and increasingly recognised (NICE 2009, 2017; FICM 2019, 2020); with early, daily physiotherapy reported to be safe, feasible and established as standard care in many units (McWilliams et al. 2015).

A substantial body of research has explored the benefits of rehabilitation after critical care discharge; however, there is currently no evidence to conclude benefit from such interventions (Connolly 2016). The 'RECOVER' study (Walsh et al. 2015) attempted to evaluate the effect of increasing physical and nutritional rehabilitation post critical care discharge using rehabilitation practitioners. The intervention group received a two to three-fold increase in the frequency of mobilisation, increased dietetic involvement, and individualised goal setting. However, there was no improvement in physical recovery or health related quality of life.

Patients discharged from critical care often have multi-factorial rehabilitation needs which require input from allied health professionals and nursing staff (Salisbury 2010; van der Schaaf 2008; Vollam 2021; Silveira 2019). Those discharged to specialities dispersed across the hospital (for example, respiratory medicine, gastrointestinal surgery) commonly experience uncoordinated journeys, where critical care associated problems are poorly understood (Salisbury 2010; FICM 2020). Furthermore, the optimum timing, frequency, duration and components of rehabilitation post critical care is uncertain (Walsh 2015). Conversely, studies completed on already established rehabilitation pathways for example, stroke and ortho-geriatric services suggest that a co-ordinated approach to physical rehabilitation improves outcome for patients and can reduce hospital length of stay (Wu 2019; Stucki 2005).

These findings suggest that there may be potential for improving outcomes within the critical care population through a pathway approach, although this is yet to be demonstrated within the literature.

A recent evaluation within our hospital has shown that the phase immediately following critical care often presents with a plateau or reduction in functional ability. This deterioration is often linked with an increase to patients' length of stay, which can have significant cost implications to the health service (Cuthbertson 2007).

In summary, despite recent interest in rehabilitation during and after critical care, there remains a clear lack of clarity on its effectiveness and cost. Whilst intervention during critical care appears to have some short-term benefit, there is very little evidence for its effectiveness post critical care discharge.

Based on the above, this quality improvement project aimed to improve patient's functional recovery and reduce post-critical care length of stay through the provision of enhanced physiotherapy input. This enhanced physiotherapy input was provided in addition to existing services and was delivered by the critical care physiotherapy team for the first 14 days post-critical care discharge.

Methodology

Context

This quality improvement project was completed in a 1000-bed University Teaching Hospital within South Wales (U.K.). The hospital has a 32-bed, mixed-dependency critical care unit, admitting more than 1500 patients per year from all major specialities including general medicine, liver, trauma, neuro-critical care, and complex upper gastrointestinal surgery. On discharge from critical care patients are transferred to the most appropriate ward for their clinical presentation and medical speciality.

Prior to this quality improvement project, all patients discharged from critical care would be transferred to the ward-based physiotherapy team. The frequency of physiotherapy intervention received was dependent on the demand and prioritisation of physiotherapy case-load. Patients often only received two to three physiotherapy treatments per week of varying durations (on average between 20 and 30 minutes). No weekend or public holiday physiotherapy input was provided unless the patient required urgent 'respiratory' physiotherapy intervention.

Patient selection

Patients deemed 'at risk of physical morbidity' (patients scoring >3 of the following on first assessment) were included in the quality improvement project during December 2019 and March 2020.

1 Unable to get out of bed independently.
2 Anticipated invasive ventilation >72 hours.

3 Obvious physical/neurological injury.
4 Lack of cognitive function to exercise independently.
5 Unable to mobilise short distances independently.
6 Unable to ventilate with <35% oxygen.
6 Pre-morbid respiratory disease.
7 Pre-morbid mobility problems.

Patients were not eligible if they had: a contraindication to mobilisation (for example, unstable fractures), an already established rehabilitation pathway, or a profound acquired neurological deficit, where it was thought a short-term enhancement in therapy input was unlikely to influence recovery time.

Comparator group

To assess the impact of the QI project, data from a comparator group was also collected, and was based on the same four-month period from the previous year. The same eligibility criteria were utilised, specifically only considering patients at 'risk of physical morbidity', and the exclusion of those on pre-existing rehabilitation pathways and patients with profound neurological deficit. The data collated only routinely collected data that was readily available.

Interventions

For the four-month quality improvement project, funding was gained to support an additional physiotherapist within the critical care physiotherapy team with the purpose of providing enhanced physiotherapy input to eligible patients discharged from critical care. The aim was for all patients to receive daily physiotherapy input (from the critical care physiotherapy team) in addition to existing ward-based physiotherapy services. This additional input was provided on weekdays for the first two weeks post critical care discharge (unless discharged from hospital within two weeks). There were no limitations on the duration of individual physiotherapy sessions and no guidance was provided as to the content of the physiotherapy intervention other that it should be targeted at the patient's maximum functional ability. The patients' general management remained the responsibility of the ward-based physiotherapy team and regular liaison between teams was encouraged.

Study of interventions

The quality improvement project was designed to reduce post critical care length of stay and increase patient's functional recovery. A thorough review of the existing physiotherapy model of care was completed (including the physiotherapy records of a the comparator group), which suggested a patient's recovery either slowed or plateaued in the early post critical care period. Based on this review, and discussion with the ward based physiotherapy teams, the quality improvement project focused on increasing physiotherapy involvement for the two-week period post critical care discharge. Once designed, the improvement programme was re-discussed with all in-patient physiotherapy teams to ensure awareness of the project and to answer any queries or concerns. Following the two-week post critical

care discharge period, all physiotherapy services returned to baseline with no involvement from the critical care physiotherapy team.

Measures

The primary outcome was post critical care length of stay (LOS) compared to the comparator group. Secondary outcomes explored patients' functional ability, the frequency and duration of physiotherapy intervention provided, the frequency of 'unmet need' (non-completion of planned physiotherapy sessions, for example, identified as requiring physiotherapy input but no received due to prioritisation of case-load) and physiotherapy/community resource team (care and therapy input) requirements on hospital discharge. Functional ability was measured using the Chelsea critical care assessment tool (CPAx) (which consists of 10 commonly assessed components of physical ability) and, the ICU mobility scale (IMS) (which is a 11-point scale used to record a patient's level of mobilisation); the higher the score the greater the mobility and functional ability. These outcome measures were already in use within critical care unit and familiar to the staff involved. Comparator data was only available for length of stay and physiotherapy/community resource requirements required on discharge.

Analysis

A customised data collection tool was used to aid analysis of this project. Data were analysed using Microsoft Excel. Simple descriptive data are presented using means (standard deviation) or median (inter-quartile range) depending on the nature of the data. No statistical testing was completed.

Ethical considerations

This project constituted an improvement in the standard care delivery with no randomisation and thus met the definition of a quality improvement project under the NHS Health research authority guidelines. This was confirmed with Health and Care Research Wales and as such ethical approval was not required. The project was registered as a quality improvement project (QI project 48) within the host organisation and underwent local peer review as per standard and complied with local governance processes. All data was stored electronically on password protected NHS computers in accordance with data protection requirements.

Results

Demographics

Between December 2019 and March 2020, all eligible patients ($n = 44$) were involved in this single-site service improvement project which looked at enhanced therapy after critical illness. Participants comprised of 34 males and 10 females with an average (*SD*) age of 61.9 (15.6) years. Patients median (IQR) critical care length of stay was 20 (12.0–25.5). The comparator group consisted of 38 patients who were slightly younger with an average age of

56.3 (17.6) years, and a shorter length of stay (17.7 days (IQR 8.5–26.1)). Further demographic information is shown in Table 2.

Post critical care length of stay

A median 11-day reduction in LOS between the project group and comparator group was observed, which must be considered as highly clinically significant. Further comparison details are shown in Table 1.

Table 1: Comparison of project and comparator group.

	Project Group (2019–2020) (*n* = 44)	Comparator Group (2018–2019) (*n* = 38)
Age (Mean, *SD*)	61.9 (15.6)	56.3 (17.6)
Male:female	34:10	21:17
Speciality		
Cardiology	3	2
Cardiothoracic surgery	1	1
General surgery	18	7
General medicine	6	10
Haematology	1	0
Neurology	3	1
Neurosurgery	2	1
Oro-maxillofacial	2	1
Renal	1	0
Spinal	1	4
Thoracic medicine	6	7
Trauma	0	4
Critical care LOS (Median, IQR)	20 (9.0–32.3)	17.7 (8.5–26.1)
Post Critical Care LOS (Median, IQR)	15 (8.3–31.5)	26 (8.0–44.5)

Physical function

An improvement in physical function and mobility (measured using the IMS and CPAx) between critical care discharge and hospital discharge was demonstrated in all but one participant, with the rate of improvement most noticeable within the first 14 days (see Figure 1). Most patients leaving critical care had stood but not stepped (IMS 4 (IQR 4–5)) whereas by day 14 most patients were mobilising with assistance of one person (IMS 8 (IQR 7–9)). The comparator group had a similar mobility status at critical care discharge (IMS 4 (IQR 3–5)), however, no comparison data is available for physical function at either 14-days post

critical care discharge or at discharge home from hospital as this was not routinely collected data, nor was it possible to complete these outcome measures retrospectively.

Demonstrates median changes in outcome measures at each time point.

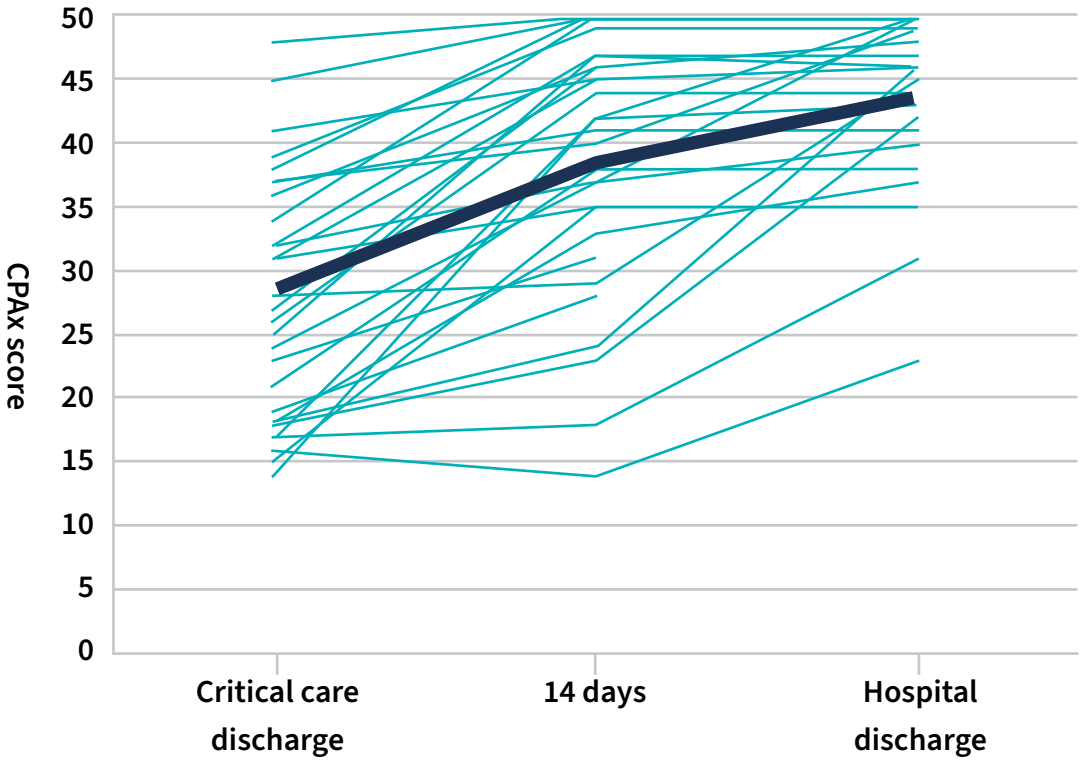

Figure 1: Displays improvements in CPAx score in the intervention group at each time point with superimposed median scores (black line).

Table 2: Demonstrates median changes in outcome measures at each time point.

	Critical care discharge	14-days post critical care discharge	Hospital discharge
CPAx	28 (23–32)	42 (37–45)	45 (42–46)
IMS	4 (4–5)	8 (7–9)	9 (9–9)

Data shown as median (inter-quartile range).

Support required on hospital discharge

79.5% (n = 35) patients were discharged home, with nine being discharged prior to day 14. This is compared to 71.1% (n = 27) in the comparison group. Those in the QI group not discharged home were transferred for either specialist rehabilitation or repatriation to their local hospital (20.4% and 18.4% respectively), with no onward data available. Table 3 outlines differences in physiotherapy/community resource requirements.

Table 3: Physiotherapy and community resource requirements on hospital discharge.

	Project group (2019–2020) (*n* = 35)	Comparator group (2018–2019) (*n* = 27)
No support	37.1% (*n* = 13)	37% (*n* = 10)
Community resource team (care and therapy input)	34.2% (*n* = 12)	18.4% (*n* = 5)
Community physiotherapy	20.0% (*n* = 7)	25.9% (*n* = 7)
Musculo-skeletal physiotherapy	9.0% (*n* = 3)	18.5% (*n* = 5)

Physiotherapy activity

The quality improvement project aimed to enhance physiotherapy input for the first 14 days post critical care discharge. Patients included in the QI programme (*n* = 44) received a mean (*SD*) of 8.6 (4.4) physiotherapy sessions in those 14 days. A mean of 5.9 (3.2) sessions were delivered by the critical care physiotherapy team, and 2.6 (2.0) delivered by ward team. However, this included patients who were discharged within the 14 days. When these were removed from the analysis, the remaining (*n* = 30) received an average of 10.6 (3.3) physiotherapy sessions (average 7.4 [2.3] and 3.6 [1.9] from the critical care and ward-based physiotherapy teams respectively). During the first 14 days, only 2% of planned sessions (for example, 2% 'unmet need') by the critical care physiotherapy team were not completed compared to 42% of the sessions planned by the ward physiotherapy team (for example, identified by ward team as requiring input on a specific day and recorded on a register but intervention not delivered). There was little variation in the duration of physiotherapy sessions with both the critical care and ward-based physiotherapy team sessions lasting an average of 26 minutes.

No comparison data is available for physiotherapy sessions delivered in the 14-days post critical care discharge prior to the initiation of the quality improvement project, nor was it possible to collect this retrospectively.

Discussion

In this quality improvement project, the critical care physiotherapy team continued to provide input to patients, in additional to ward-based physiotherapy input for the first 14-days post critical care discharge. The project included 44 patients deemed at high risk of developing physical morbidity post critical illness with our results demonstrating a 11-day reduction in median hospital LOS compared to a similar group from a year prior. Whilst the results were statistically non-significant, clinically this reduction implies significant health and cost implications to the health service.

Previous research exploring rehabilitation after critical care has failed to consistently show significant difference in outcomes (Connolly et al. 2016), with suggestions that therapy provision three times higher than standard practise may be needed to have significant benefits (Wu et al. 2019). In a different sample population, Atkins et al. (2019) reported similar results to the current QI project, with a 14-day reduction in hospital LOS following the introduction of more consistent rehabilitation on an acute medical ward. Despite acknowledgement of further research warranted to confirm findings in other clinical areas, it suggests that enhanced therapy may influence patient outcome and patient flow.

Patients included in this project demonstrated improvements in physical function at each time-point and was most notable within the first 14-days following critical care discharge. The speed of improvement may have been a reflection on the additional input received by the critical care physiotherapy team, but the absence of comparator data makes this only a suggestion. What remains unclear is the speed in which natural recovery may have occurred, for example, these patients would have continued to improve with or without input. However, our previous unpublished service evaluations have suggested a plateau in physical recovery in the immediate post-critical care period.

Usual standards of rehabilitation are important to consider when analysing and comparing project results (Wu et al. 2019); our unit aims to complete therapy twice a day for those at 'high risk at risk of physical morbidity', whilst resources for rehabilitation on acute wards are limited, and as research suggests, can be as little as two to three times per week (Cuthbertson et al. 2007; Salisbury et al. 2010; Wu et al. 2019). This is highlighted in the current QI project by the significant difference in percentage of intended sessions completed by the therapists; 42% of the intended physiotherapy sessions were not completed by the ward team in comparison to 2% by the critical care physiotherapy team. This 'unmet need' reflects local prioritisation tools and clinical case-load affecting the ability to provide physiotherapy intervention as frequently as planned.

Additionally, within our project, the number of treatment sessions provided (not in relation to unmet sessions) were less than expected over 14-days (average 7.4 [2.3] and 3.6 [1.9] for critical care physiotherapy team and ward-based physiotherapy teams respectively). Reasons for this include the lack of physiotherapy input at the weekend within the host organisation. Additional reasons include patients being unable to tolerate two treatment sessions a day, that they were otherwise engaged or down to individual opinion resulting in re-prioritisation of ward case-load to meet the demand of those patients not seen.

Within this limited QI project, a higher percentage of patients were discharged directly home following when compared to comparison group. This is reflected in a study by Denehy et al. (2017) that showed a significantly higher number of patients being discharged home in their control group compared to usual care. However, in our QI project, whilst more patients were discharged home, there was an increase in requirement for community support. The reasons for this are not clear especially as physical function data from the comparator

group was not available. Potentially, the ability to discharge home more frequently, and in a timelier manner, was only achieved through greater reliance on community services. This cannot be confirmed based on this QI project however would need consideration in future studies.

This study aimed to improve patient's functional recovery and reduce post-critical care length of stay through the provision of enhanced physiotherapy input. However, based on our findings it is difficult to interpret what elements of 'enhanced' input the patients received. Due to clear differences in the number of treatments delivered by the ward and critical care physiotherapy team, and the lack of baseline data, it is unclear whether any improvements were a result of the amount of physiotherapy input delivered, or the continuity of physiotherapy staff involved from critical care into the wards, or a combination of both. However, despite that lack of clarity, the results are suggestive of a clinically significant reduction in length of stay and therefore require further exploration and research.

Limitations

As expected for a small, local quality improvement project there are several limitations affecting the ability to generalise our findings to the wider critical care population. Firstly, the limited sample size of both the QI and comparator groups is insufficiently powered for reliable statistical analysis. However, it should be noted that all patients that were eligible were included in the QI project and therefore the sample is an accurate reflection of the critical care discharges during those 4-months. The single-site nature of the study also limits the generalisation of the results and recognition of limitations and exclusion criteria must be considered when applying to all patients within a critical care population.

The use of a historical comparison group for data is also a significant limitation. Whilst the two groups were matched in terms of both being patients 'at risk of physical morbidity', it was based on local models of risk assessment. There were no significant differences between the groups in terms of age or length of critical care, but there was no assessment of severity of illness and so on. Furthermore, the absence of routinely collected data regarding patients' functional abilities reduced comparisons. Based on these, the results of this project should be considered with caution and likely only a suggestion for future research and discussion.

The potential ceiling effect of the outcome measures also requires discussion. Figure 1 suggests a plateau in patient recovery after day 14. The exact reasons for this are unknown. A plausible explanation is that the patients were at, or close to pre-morbid level of function. It is given that many critical care survivors have chronic diseases in addition to their presenting diagnoses therefore have a lower pre-morbid function Denehy (2013). However, without baseline mobility data it is impossible to state for certain. The sensitivity of the outcome measures used need to be considered. Despite both being validated and shown to be reliable in measuring functional ability they are designed as tools to be used within the critical care setting and not for higher functioning patients (Corner 2013; Tipping 2016).

It must also be highlighted that the end of the project coincided with the start of the COVID-19 pandemic which brought significant changes to the NHS. It is unclear whether patients within the QI group experienced shorter lengths of stay directly because of bed-capacity pressures. This is unlikely to be the case given most patients were discharged prior to the 1st wave of the pandemic but must be considered as a potential factor.

Further research

The importance of early rehabilitation on critical care step down on influencing patients' hospital stay clearly warrants further investigation. Previous research has failed to show significant improvements in outcomes through post-critical care rehabilitation although quality improvement projects have shown potential. Prospective projects need to continue to explore the most suitable methods of delivery of rehabilitation, whilst also considering which professions must be involved, the timing of the intervention and the most appropriate outcomes for use.

Conclusion

In this single site quality improvement project, the provision of 14-days input from the critical care physiotherapy team following discharge from critical care was associated with a median 11-day reduction in hospital length of stay for patients at high risk of morbidity following critical care. Given the significant limitations to this study, and the findings of larger randomised control trials, further research is required into the most appropriate structure, timing, and frequency of rehabilitation in the early post critical care period.

Data availability

Raw data available by direct request to the corresponding author.

Ethics approval

This project constituted an improvement in the standard care delivery with no randomisation and thus met the definition of a quality improvement project under the NHS Health research authority guidelines. As such ethical approval was not required. Consent for involvement was gained as would be for normal therapy treatment sessions.

Declarations

The authors declare no declarations of interest. No material has been used from other sources.

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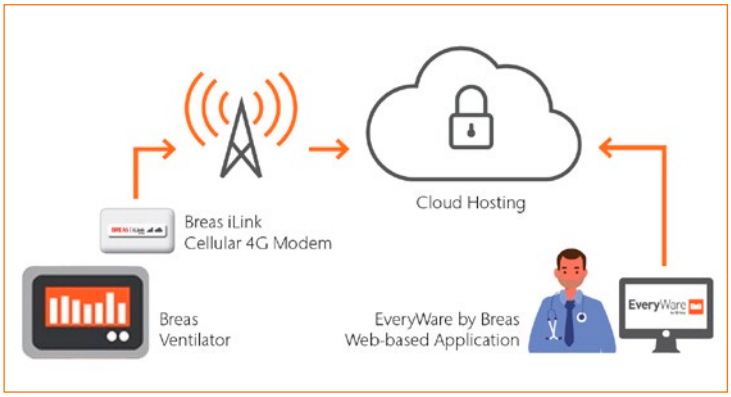

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A service evaluation of the accuracy of electronic prescriptions used to calculate nebulised medication adherence in adult with cystic fibrosis

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Keywords | Cystic fibrosis, service evaluation, electronic prescriptions, nebulised medication, adherence.

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Abstract

Introduction

Adherence to nebulised medications in people with cystic fibrosis (CF) is known to be suboptimal. CFHealthHub uses an electronic prescription (e-prescription) as a denominator and chipped nebuliser devices which capture the frequency of nebulised medications inhaled by the patient. This enables a calculation of nebulised medication adherence to be made. However, e-prescriptions may contain errors which can affect the adherence calculation. This service evaluation sought to review the accuracy of CFHealthHub e-prescriptions at a single adult CF centre, to understand the nature and causes of any inaccuracies and to evaluate the effect of prescription complexity on prescription accuracy.

A total of thirty e-prescriptions from CFHealthHub were compared to 'gold standard' prescriptions. Inaccuracies and types of error in the e-prescriptions were recorded and analysis was conducted to understand the effect of prescription complexity on this. The two prescriptions were discussed with participants to determine the causes of inaccuracies.

Inaccuracies were found in 43% (13/30) of e-prescriptions and were significantly associated with alternating medication regimens ($p = 0.025$). There were four error types found within the e-prescriptions: inaccurate medication list, incorrect medication duration, incorrect medication frequency and prescription duplication errors.

Medication list errors were significantly associated with alternating medication regimens ($p = 0.007$). Causes of e-prescription inaccuracy were due to failure to update the prescription following a change, errors in prescription entry and inaccuracies caused by using two different nebuliser devices.

CFHealthHub e-prescriptions contain inaccuracies and prescription complexity can increase the risk of prescription inaccuracy, although the small sample size limits the ability of the service evaluation to draw strong conclusions. Causes of e-prescription accuracy should be addressed by the local CF team.

Introduction

Adherence to nebulised medications in people with cystic fibrosis (CF) is known to be less than 50% (Daniels et al. 2011; Quittner et al. 2014). Suboptimal adherence leads to increased pulmonary exacerbations and CF-related hospitalisations (Eakin et al. 2011; Quittner et al. 2014). Monitoring adherence to nebulised medications is necessary for '*effective and efficient treatment planning*' (Sabaté 2003). It enables clinicians to determine whether a poor response to treatment is genuine, requiring a change in medication and a possible increase in treatment costs or treatment burden, or whether the poor response is due to suboptimal adherence.

Accurately measuring medication adherence can be challenging, particularly for people with CF whose nebulised medication regimens can be complex (Sawicki et al. 2013). For example, nebulised antibiotics are often prescribed on an alternate month basis for people with chronic *pseudomonas aeruginosa* infection. During the 'month off' a different nebulised antibiotic may be prescribed or no antibiotic at all (NHS England 2014). Some nebulised antibiotic medications are prescribed twice a day whilst others are prescribed three times a day; nebulised medications may also be stopped for a few days if haemoptysis occurs (Cystic Fibrosis Trust 2017).

Electronic prescriptions (e-prescriptions) can be used to provide a denominator from which medication adherence can be calculated. This objective measure is not subject to recall or report biases, unlike adherence measures more commonly used in clinical practice such as patient recall, and can provide real-time data (Forbes et al. 2018). Electronic measuring devices, such as the iNeb (Philips Respironics, Chichester, U.K.) or eTrack (Pari GmBH, Germany), which record when a nebuliser device is used to take a nebulised medication, provide objective data that can be compared to the e-prescription to calculate medication adherence.

The CFHealthHub data observatory study is a multi-centre study measuring nebulised medication adherence, in people with CF, using the iNeb and eTrack chipped nebuliser devices. The devices record each time a nebuliser is completed and compare this to the total doses

on the e-prescription, calculating an adherence percentage of the patients' daily target. At the Wessex Adult CF Centre, the e-prescription is entered into the CFHealthHub website by the research interventionist and must be updated when any changes are made to the nebulised medication prescription by the CF team. Therefore, inaccurate e-prescriptions will affect the accuracy of adherence calculations. Clinicians and patients use the adherence calculations to assess nebulised medication efficacy. Therefore, it is important that e-prescriptions in CFHealthHub remain accurate in order to accurately calculate medication adherence and provide clinicians with a useful tool to guide decision making.

Prescription complexity is known to increase the inaccuracy of e-prescriptions (Ryan et al. 2014). However, to date the accuracy of CFHealthHub e-prescriptions remains unknown. This service evaluation sought to review the accuracy of e-prescriptions in CFHealthHub at the Wessex Adult CF Service, where the author had access to the e-prescriptions of the participants. It aimed to understand the nature and causes of any inaccuracies found and, furthermore, to assess the effect of prescription complexity on prescription inaccuracy as well as types of error.

Methods

Eligibility

Participants were included in the service evaluation if they were using a chipped nebuliser device as part of the CFHealthHub study and they either attended an outpatient clinic appointment or were admitted for inpatient treatment between March and May 2018 inclusively. Participants were excluded from the service evaluation if they were unable to stay to discuss their two prescriptions at the end of their clinic appointment, or if they were unavailable on at least two separate occasions during their inpatient stay.

Procedure

Usual procedure for any participant enrolled in the CFHealthHub study was for the research interventionist to check the CFHealthHub e-prescription with the participant during a clinic visit or whilst they were receiving inpatient care. The e-prescription was checked against documentation in the electronic health record (EHR), for example, in clinic letters or home delivery prescriptions, as it is considered by the Wessex Adult CF Service to be the most accurate and up-to-date record of a patient's current prescription. Therefore, in the service evaluation the EHR record was considered the 'gold standard' prescription. The CFHealthHub e-prescription was identified from the CFHealthHub online platform. Figure 1 shows the process for comparing the two prescriptions.

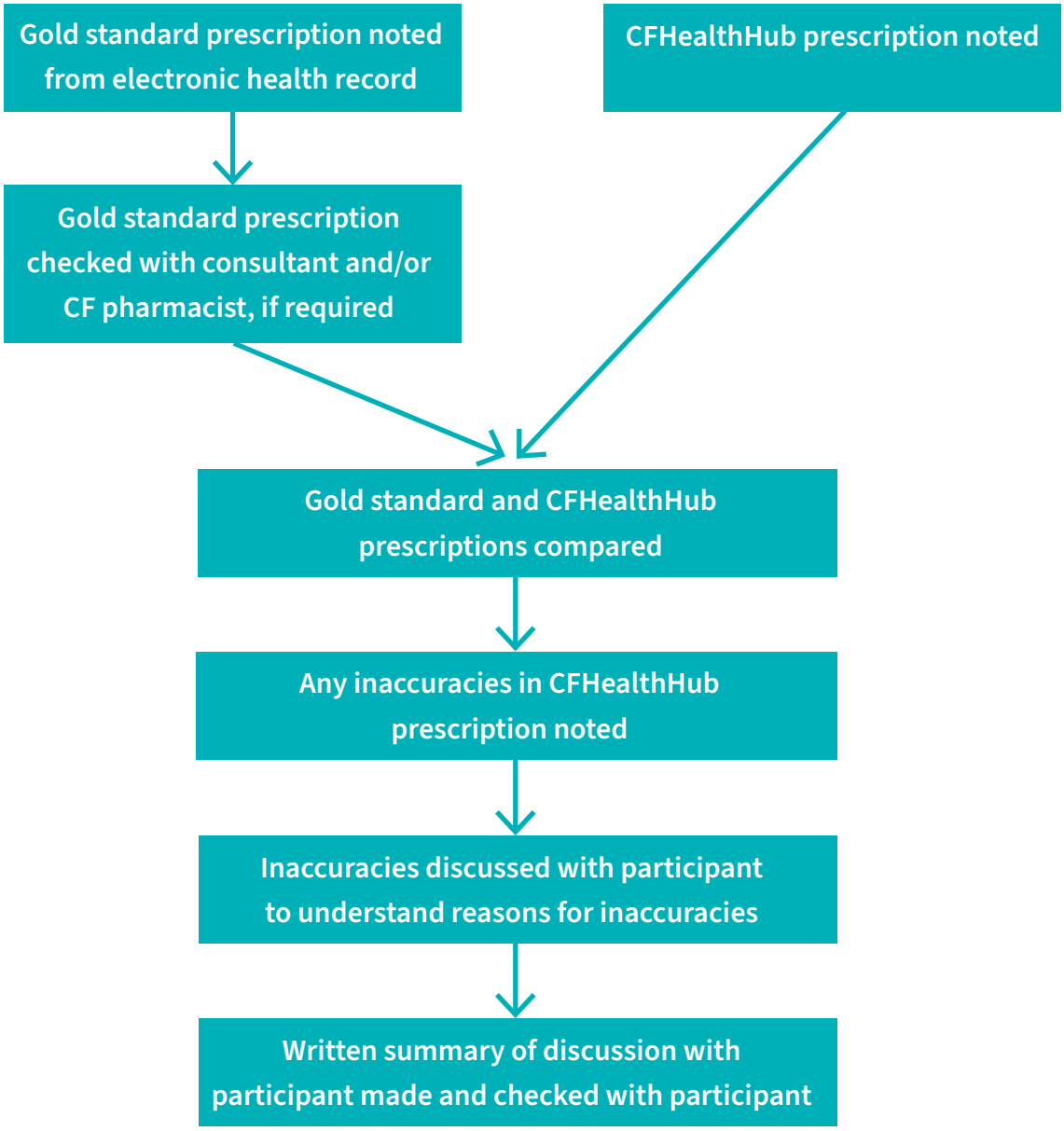

Figure 1: Flow diagram demonstrating the protocol used to compare gold standard and CFHealthHub prescriptions during the service evaluation.

Participant and prescription characteristics were also captured from the EHR for each participant in the service evaluation. All data were stored in password protected electronic files.

In line with guidance from the Health Research Authority and from the research and development department at University Hospital Southampton, this was not considered to be a research study since participants in the service evaluation continued to receive usual care, were not randomised to different groups and the project did not seek to generalise results. Therefore, ethics and approvals were not required. However, the service evaluation was approved and registered at University Hospital Southampton (SEV/0066). The CFHealthHub data observatory study has received ethics and approvals from the London-Brent Research Ethics Committee (17/LO/0032).

Data analysis

A mixed methods approach was used to analyse data from the service evaluation. Quantitative data were used to identify where e-prescription inaccuracies existed and to identify any associations between e-prescription inaccuracies and prescription complexities. Qualitative data were then used to further understand how the inaccuracies may have occurred.

Quantitative data analysis was carried out to analyse the following:

1. The proportion of CFHealthHub prescriptions containing an inaccuracy when compared to the 'gold standard' prescription.
2. The types of prescription error found.
3. The association between prescription accuracy/prescription error types and prescription complexity, as defined in Table 1.

Table 1: Prescription complexity variables analysed in the service evaluation.

Variables
Alternating medication regimen
> 2 medications
Pseudomonas aeruginosa status (chronic, intermittent, not colonised)
Two nebuliser devices

Due to the categorical nature of the data and small sample size, Fisher's Exact test was used to assess the association between prescription accuracy and prescription variables. Additionally, the difference in proportions of inaccurate and accurate prescriptions for different prescription variables was analysed to demonstrate the size of any observed associations.

A qualitative approach, using thematic analysis (Braun & Clarke 2006), was used to analyse written summaries of discussions with participants to elucidate themes relating to the causes of prescription inaccuracies. Braun and Clarke (2006) use a reflexive approach to thematic analysis and this was chosen for its flexibility, including the ability to use it with many different types of data, including summaries of discussions.

Results

A total of 35 eligible participants were identified. However, three were excluded as they were unable to stay to discuss their prescriptions at the end of their clinic appointment and two participants were unavailable on the ward to discuss their prescription during their inpatient stay. Characteristics of the 30 participants included in the service evaluation and their prescriptions have been summarised (Table 2).

Table 2: Demographics of participants and their prescriptions included in the service evaluation.

Variable	*n* = 30
Age (yrs)	
Median (IQR)	28 (22.75 to 33.75)
Range	18 to 49
Gender	
Female (%)	14 (47%)
Male (%)	16 (53%)
Recruitment	
From clinic	26 (87%)
From inpatient ward	4 (13%)
FEV_1 Litres (% predicted)	
Median	2.16 (54%)
IQR	1.33 to 2.95 (39.5% to 75%)
Range	0.52 to 4.14 (15% to 119%)
Pseudomonas aeruginosa status	
Chronically colonised (%)	22 (73%)
Intermittently colonised (%)	5 (17%)
Not colonised (%)	3 (10%)
Nebuliser device used for CFHealthHub data	
eTrack (%)	22 (73%)
Bineb (%)	8 (27%)
Participant using two nebuliser devices	
Yes (%)	4 (13%)
No (%)	26 (87%)
Number of prescribed nebulised medications	
≤2 (%)	18 (60%)
>2 (%)	12 (40%)
Alternating nebulised medication regimen (%)	
Yes (%)	13 (43%)
No (%)	17 (57%)

IQR = interquartile range.

1. Prescription accuracy

A total of 13 (43%) CFHealthHub e-prescriptions were found to contain at least one error leading to inaccuracy when compared to the gold standard prescription. Four CFHealthHub

e-prescriptions contained two errors and one e-prescription contained four errors. In total, this caused adherence to be underestimated for five participants and overestimated for four participants, whilst two prescriptions contained on e-prescription so no adherence calculation could be made. Further analysis showed a significant association between prescription inaccuracy and prescriptions containing an alternating medication regimen ($p = 0.025$), although there is a wide confidence interval for the differences in proportions and a relatively small sample size, Table 3.

Table 3: Association between CFHealthHub inaccuracies and prescription complexities.

Prescription or participant characteristic	*n*% inaccurate prescription (*n* = 13)	*n*% accurate prescription (*n* = 17)	Difference in proportions	95% confidence interval	Fisher's Exact *p* value
Alternating prescription	9 (69.2%)	4 (23.5%)	45.7%	9.9 to 68.6%	0.025*
>2 medications in prescription	8 (61.5%)	4 (23.5%)	38.0%	2.8% to 63%	0.061
Pseudomonas status (chronic)	8 (61.5%)	14 (82.4%)	-20.8%	-49.2% to 10.4%	0.242
Two nebuliser devices	3 (23.1%)	1 (5.9%)	17.2%	-8.6% to 44.8%	0.290

*Significant at <0.05.

2. Prescription error types

There were four types of prescription error found (Table 4). Medication list errors were shown to be significantly associated with prescriptions containing an alternating medication regimen ($p = 0.007$), Table 5.

Table 4: Errors identified in CFHealthHub e-prescriptions.

Error type	Description of CFHealthHub error	Total errors (%)
Medication list	List of nebulised medications within e-prescription incorrect	15 (75%)
Duration	Dates of nebulised medication incorrect	3 (15%)
Frequency	Frequency of nebulised medication incorrect	1 (5%)
Duplication	Nebulised medication entered on e-prescription twice	1 (5%)

Table 5: Association between 'medication list' errors and prescription complexities.

Prescription or participant characteristic	*n*(%) 'medication list' error present (*n* = 10)	*n*(%) 'medication list' error absent (*n* = 20)	Difference in proportions	95% confidence interval	Fisher's Exact *p* value
Alternating prescription	8 (80%)	5 (25%)	55%	17.1% to 74.9%	0.007*
>2 medications in prescription	6 (60%)	6 (30%)	30%	-6.1% to 57.9%	0.139
Pseudomonas aeruginosa status (chronic)	6 (60%)	16 (80%)	-20%	-51.1% to 11.7%	0.396
Two nebuliser devices	3 (30%)	1 (5)%	25%	-1.8% to 55.6%	0.095

*Significant at <0.05.

3. Causes of prescription inaccuracy

There were three causes of prescription error found through analysis of the EHR and thematic analysis of discussions with participants about their prescriptions (Figure 2). Prescription changes were the most frequent cause of prescription inaccuracy. This occurred when a change was made to the gold standard prescription but the CFHealthHub e-prescription was not updated; for example, the prescription may have been changed following an outpatient appointment.

> '…found that dornase made him tight chested so it was agreed at his last clinic appointment… that he should alternate between dornase one month and hypertonic saline one month' – *participant 24.*

The second cause of prescription inaccuracy occurred when the e-prescription was entered incorrectly. Errors could persist for several months.

> '… reports that… she stopped Colomycin just before May 2018' – *participant 1*.

The final cause of prescription inaccuracy was found to be linked to the use of two different nebuliser devices by the same participant. Typically, one device was used to take one or two nebulised medications and the other device was used for other nebulised medications. However, only one of the devices was linked to the participants' CFHealthHub account. Errors occurred when the participant switched which device they used to take their different medications but did not alert the clinical team.

'… iNeb was broken recently so she took her Dornase via her eTrack during April/May' – *participant 26*.

Discussion and conclusion

This service evaluation has highlighted that 43% (13/30) e-prescriptions in an online platform, CFHealthHub, measuring adherence to nebulised medications, were inaccurate. Consequently, nine participants' nebulised medication adherence was overestimated or underestimated. Although the service evaluation did not seek to determine the effect of inaccurate e-prescriptions, it does highlight the need to maintain an accurate e-prescription, particularly when using adherence data to inform treatment effectiveness and MDT decision making.

Evidence of e-prescription inaccuracy rates varies considerably in the literature from <1% to >80%. This is largely due to the different criteria used to define a prescription error making it difficult to compare the error rate found in this service evaluation with those observed in other studies (Jayawardena et al. 2007; Velo & Minuz 2009; Kaushal et al. 2010). Studies often include 'prescribing errors', that is errors that occur when making a clinical decision about a prescription but CFHealthHub e-prescriptions are not used to dispense medications and therefore do not contain prescribing errors.

Only one prescription complexity, alternating medication regimen, was found to be significantly associated with prescription inaccuracy. Unlike medications prescribed on a continuous basis which can be entered into the e-prescription once, alternating medications must be entered on each alternate month, increasing the chance for an error to occur. More frequent quality checks and/or an alert system may help address this. Although there was not a statistically significant association between prescription inaccuracy and prescriptions containing >2 medications, there was a 30% difference in the proportion of inaccurate prescriptions with >2 medications. This suggests a trend towards e-prescription inaccuracy with a greater number of medications in the prescription. Clinicians at the Wessex Adult CF service should consider whether e-prescriptions with alternating regimens or >2 medications should be checked on a more frequent basis to improve accuracy.

There were three causes of prescription inaccuracy found. However, due to the small sample size it is unlikely data saturation was reached and further causes of e-prescription inaccuracy may exist. Inaccuracies caused by a failure to update the e-prescription after a change was made to the gold standard prescription suggest communication deficiencies within the CF team that need to be addressed.

Although no statistically significant association was found between e-prescription inaccuracy and using two different nebuliser devices, the use of two devices emerged as one of the themes leading to prescription inaccuracy. Since only four participants (13%) were found to be using two different nebuliser devices and given the small sample size in the service evaluation there is an increased risk of a type 2 error, which may explain these apparently

conflicting results. Further analysis with a larger sample size is needed to understand the effect of using two different nebuliser devices on e-prescription accuracy.

This service evaluation has several limitations. Firstly, although 43% of e-prescriptions in the service evaluation contained an alternating regimen, only 22% of all CFHealthHub e-prescriptions at the Wessex Adult CF Service contain an alternating prescription. Therefore, it may have overestimated the percentage of inaccurate e-prescriptions. Secondly, the service evaluation is context-specific and may have limited generalisability to other CF centres.

Strengths of the service evaluation include the use of a mixed-methods design which allowed the service evaluation to reveal the issues in greater depth than a purely qualitative or quantitative approach would have allowed. Finally, this service evaluation is the first within the Wessex Adult CF Service to look at the accuracy of e-prescriptions which are used to measure nebulised medication adherence in people with CF. It highlights the wider challenges of measuring adherence in this patient group, the types of prescription that are more prone to inaccuracy and suggests areas for improving e-prescriptions accuracy.

In conclusion, this service evaluation has underlined the difficulties of maintaining accurate e-prescriptions for people with CF, and it has highlighted the causes of e-prescription inaccuracy at the Wessex Adult CF Service, although the full extent of e-prescription inaccuracy may not have been identified in this sample size. There is a need to introduce strategies to improve the accuracy of these e-prescriptions to ensure that the adherence data obtained from them remains reliable and can be used to optimise patient care.

Key points

1. Measuring adherence to nebulised medications requires attention to the prescription to ensure adherence calculations are accurate. This is particularly challenging in CF due to prescription complexity.
2. Prescriptions that contain an alternating medication regimen and more than two medications may be at increased risk of prescription inaccuracy.
3. Effective communication between different members of the CF MDT is key to ensuring e-prescription accuracy when changes are made to the nebulised medication prescription.

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Ethical and R&D approval

This service evaluation did not require ethical approval and was approved and supported by the clinical and management teams.

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A systematic review to determine the presence and effectiveness of shared decision making interventions for airway clearance techniques in adults with bronchiectasis

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Keywords | Bronchiectasis, airway clearance techniques, shared decision making.

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Abstract

Background

Bronchiectasis is a chronic lung disorder, impaired muco-ciliary clearance and sputum retention are core elements in bronchiectasis pathophysiology. Airway clearance is regarded as the cornerstone of therapy in bronchiectasis. There is currently a lack of randomised controlled trials (RCTs) proving the efficacy of one specific airway clearance technique (ACT) over another. Shared decision-making (SDM) interventions are usually designed for situations where there is some uncertainty about the best treatment option and provide information about the advantages and disadvantages in as balanced a way as possible.

Aims

To determine if and how SDM is used when choosing ACTs for adults with bronchiectasis. To determine the effectiveness of SDM when choosing ACTs for adults with bronchiectasis. Effectiveness will be measured using clinical and patient outcomes including: exacerbation frequency, hospitalisation, adverse events and mortality, patient adherence, health related quality of life, patient preference and acceptance.

Objectives

To systematically search and identify all studies that include the use of SDM in ACTs in adults with bronchiectasis. To critically appraise and synthesise studies to provide a summary of the effectiveness on the use of SDM in ACTs in adults with bronchiectasis.

Search criteria

The following electronic databases were searched: CINAHL, EMBASE, Medline, PsycINFO, Google Scholar, Web of Science and the Cochrane Library. No limit was set for publication date. The review was limited to English language publications only.

Results

No studies were identified for inclusion in the review.

Limitations

With no studies meeting criteria for inclusion, it may appear to offer no conclusions or offer conclusions not based on evidence and may seem disappointing among some clinicians and policymakers. We argue that this empty review remains important and highlights a major research gap and has identified the state of the evidence at this point in time in SDM for ACTs in bronchiectasis.

Conclusions

Bronchiectasis is an increasingly prevalent disease. ACTs are the cornerstone of bronchiectasis management. We have presented clear justification for further research for development of a SDM intervention for ACTs in adults with bronchiectasis.

Introduction

Bronchiectasis is a chronic lung disorder associated with poor quality of life and frequent exacerbations (Polverino et al. 2017). It is characterised radiologically by permanent dilation of the bronchi, and clinically by a combination of physical symptoms including cough, sputum production and recurrent respiratory infections (Chalmers & Hill 2013).

People with bronchiectasis experience chronic productive cough and acute exacerbations, which are linked to poorer quality of life and a higher rate of disease progression (Lee et al. 2021). Higher disease progression carries an increased risk of hospitalisation (Chalmers et al. 2014; Costa et al. 2018) where currently over £30 million is spent per year in the U.K. (Goeminne et al. 2019). There is an estimated 25% mortality rate for patients with severe disease within 4 years (Menéndez et al. 2017).

Impaired muco-ciliary clearance and sputum retention are core elements in the pathophysiology of bronchiectasis. Consensus guidelines recommend that all patients with bronchiectasis receive airway clearance techniques (ACTs) (Polverino et al. 2017). Despite these recommendations, reported use of ACTs vary significantly throughout the world. Data from

the *European Bronchiectasis Registry* (*n* = 13,512) show only around 50% of patients perform regular ACTs, ranging from 10% in Sweden to 92% in Denmark (Spinou et al. 2020); whereas an analysis from the United States by Basavaraj et al. (2020) showed slightly higher average reported use of daily ACTs, 59% (*n* = 905).

Airway clearance techniques

ACTs are non-pharmacological interventions that facilitate removal of secretions from the lungs (Bradley et al. 2018). A myriad of ACTs are applied in clinical practice, including positioning, gravity-assisted drainage, manual techniques, various breathing strategies, positive expiratory pressure (PEP) devices, oscillating positive expiratory (OPEP) devices and mechanical tools that are applied to the external chest wall (Lee et al. 2017). Many of these ACTs may be used in isolation or in combination with one another.

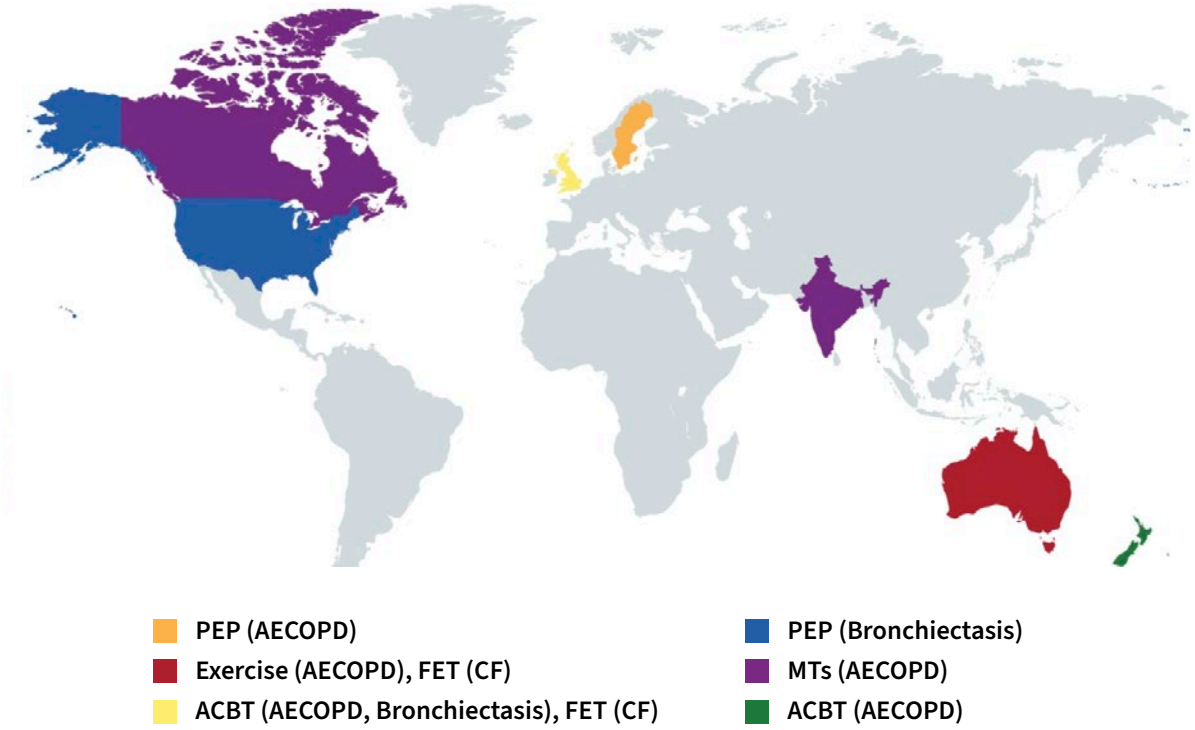

Figure 1: Most commonly used airway clearance technique in each country (Spinou et al. 2020)

PEP = positive expiratory pressure; AECOPD = acute exacerbation of chronic obstructive pulmonary disease; ACBT = active cycle of breathing technique; MTs = manual techniques; FET = forced expiratory technique; CF = cystic fibrosis.

The current prescription of ACTs by respiratory physiotherapists and other appropriate health care professionals (HCPs) varies globally. Figure 1 shows the most commonly prescribed ACTs across the world. Factors influencing regional trends in ACT are complex including clinician familiarity and training, reimbursement approvals particular to each healthcare system, clinical care pathways and patient preferences (Hoo et al. 2015).

For example, an online survey conducted by the Association of Chartered Physiotherapists in Respiratory Care (ACPRC) found that 44% of U.K. physiotherapists ($n = 63$) struggled with funding of PEP/OPEP devices in their respective healthcare environment which affected their decision on the type of ACT they could prescribe (ACPRC 2020).

Guidance of ACT prescription has emerged in the past two years with the publication of the British Thoracic Society (BTS) guidelines for bronchiectasis in adults (Hill et al. 2019a). These guidelines include a flow chart recommending which ACTs to prescribe and when (for example, patients in a stable state and those with acute inpatient exacerbation), Figures 2 and 3 respectively. The availability of this flow chart may be viewed as both a positive and negative step in ACT prescription. It provides clear instructions to respiratory physiotherapists on initial ACT prescription (ACBT +/- postural drainage) and considerations of adjuncts when this is not effective (for example, OPEP). Alternatively, the flow chart could be simply followed to the letter, with little or no consideration for a more personalised approach as previously mentioned, including patient preference or adherence.

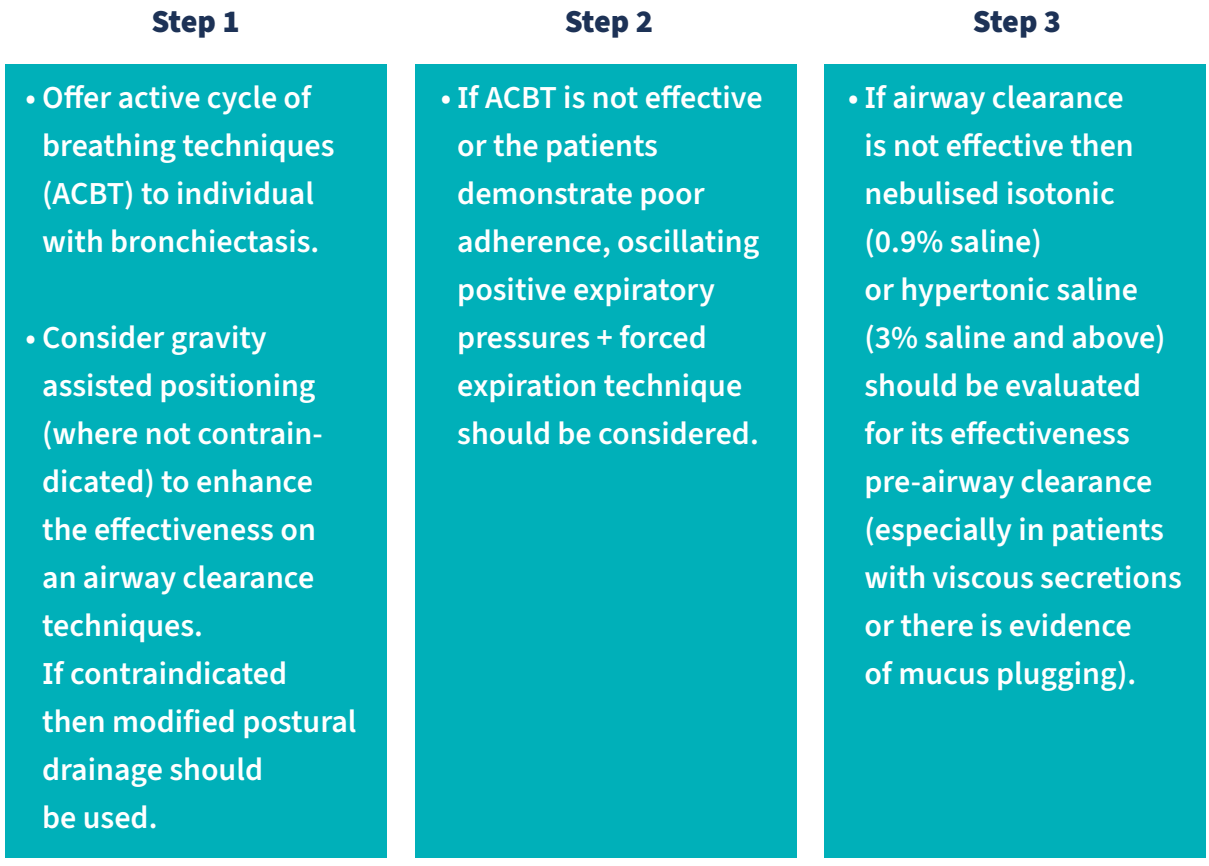

Figure 2: Physiotherapy management – stepwise airway clearance techniques during a stable state. Adapted from *The British Thoracic Society guideline for bronchiectasis in adults* (T Hill et al. 2019)

ACBT = active cycle of breathing techniques.

Step 1	Step 2	Step 3
• Increase airway clearance frequency. For example, from twice daily to three/four times daily.	• Commence the use of mPD or PD if tolerated. • For individuals with radiological changes, PD or mPD should be targeted appropriately.	• Individuals with ongoing difficulty with airway clearance may benefit from the addition of other techniques. It is recommended that these should be commenced and evaluated in the following order (unless contraindicated). • Enhance humidifcation/ hydration of airways if secretions viscous (isotonic (0.9% saline) or hypertonic saline (3% saline and above)/ humidifcation/increase fluid intake). • Manual techniques. • Positive pressure devices including intermittent positive pressure breathing (IPPB) or non-invasive ventilation (NIV) to be used during airway clearance.

Figure 3: Physiotherapy management – stepwise airway clearance techniques during an exacerbation. Adapted from *The British Thoracic Society guideline for bronchiectasis in adults* (T Hill et al. 2019)

PD = postural drainage; mPD = modified postural drainage.

Shared decision making as an intervention

SDM is an approach where clinicians and patients are expected to make decisions together, using the best available evidence (Elwyn et al. 2010b). Patients and service users should be able to understand the care, treatment and support options available to them, including the benefits and risks associated with those options (NHS England 2019).

SDM interventions such as 'decision aids' have already been designed for a range of clinical specialities including cancer and diabetes (Elwyn et al. 2010a; Trikalinos et al. 2015). As there is only low-grade evidence for ACTs in bronchiectasis and little evidence that one technique is superior to others; SDM may be a feasible intervention to improve patient choice of, and adherence to ACT's.

Interventions may include but are not limited to; option grids during consultations listing the range of ACTs available based on current evidence and the pros and cons of each; paper or electronic based decision aids with comprehensive or up to date and evidenced based information on all types of ACTs that patients can bring home and independently decide on what type of, if any, ACT they wish to use. Additionally, specific behavioural change techniques (BCTs) for example, behavioural regulation, beliefs about benefits and motivation, could be used to facilitate SDM within the consultation.

Why is it important to do this review?

There is currently a lack of RCTs proving the efficacy of one specific airway clearance technique over another in bronchiectasis (Hill et al. 2019b). SDM tools are usually designed for situations where there is uncertainty about the best treatment option and provide information about the advantages and disadvantages in as balanced a way as possible (Elwyn et al. 2010b); lending them well to a patient preference situation where the clinician is in clinical equipoise.

The integration of SDM in clinical practice can help indicate to the patient that their opinions and preferences are valued and that patient-centred care has been achieved (Carmona et al. 2021). National bronchiectasis guidelines state that patient preference and adherence should be considered when recommending ACTs (Hill et al. 2019a) but provides no indication on how this should be performed.

This systematic review seeks to establish if SDM is used when choosing ACTs for adult patients with bronchiectasis and if possible, determine the effectiveness of this intervention. The review aims to identify, appraise and summarise the literature from which a specific SDM framework could be established or a decision tool developed, trialled and adopted in national guidelines.

Aims

This systematic review aims:

- To determine if and how SDM is used when choosing ACTs for adults with bronchiectasis.
- To determine the effectiveness of SDM when choosing ACTs for adults with bronchiectasis.

Effectiveness in this review will be measured using clinical and patient outcomes. Clinical outcomes will include: exacerbation frequency, hospitalisation, adverse events and mortality. Patient outcomes will include: patient adherence, health related quality of life, patient preference and acceptance.

Methods

The protocol was registered on the international *Prospective Register of Systematic Reviews (PROSPERO)* database on 17th June 2021 (registration number: CRD42021261640). We have conformed to the *Preferred reporting items for systematic reviews and meta-analyses (PRISMA)* (Moher et al. 2010) herein.

Eligibility criteria

The following inclusion and exclusion criteria were used to guide the screening and selection of studies in the systematic review.

Inclusion criteria

- Adults ≥18. Confirmed clinical and radiological diagnosis of bronchiectasis. Co-morbid respiratory disease such as asthma and COPD will be included.
- Any intervention using shared decision making for example, one-to-one basis, a group basis, discussion sessions, role play sessions, blended learning sessions, online learning sessions and the use of hard-copy information resources such as leaflets or workbooks or option grids. This includes all interventions named as promoting, improving, enabling or facilitating shared decision making.
- The use of any ACTs by patients.
- Presence of shared decision-making measured by any validated tool including but not limited to:
    - The *Observing patient involvement 12-item (OPTION) scale* (Elwyn et al. 2003).
    - The *Observer-based measure observer 5-item (OPTION) scale* (Elwyn et al. 2013).
    - Decision-making instrument facilitation antecedents (for example, the *Preparation for decision-making scale*) (Bennett et al. 2010).
    - Decision process (for example, the *Rochester participatory decision-making scale*) (Shields et al. 2005).
- Clinical outcomes including: exacerbation frequency, lung function, hospitalisation, sputum characteristics, adverse events and mortality.
- Patient outcomes including: patient adherence, health related quality of life, patient satisfaction, decision regret and patient preference and acceptance.
- All study types except case reports, expert opinion and editorials will be included.

Exclusion criteria

- Children <18 years old.
- CF as a co-morbidity.
- Other isolated respiratory diseases for example, Asthma, COPD, CF.
- Non-English publications.

Publication date

No limit was set for publication date. These varied between databases.

Search criteria

The search strategy was developed by PM with support from FB, and then piloted on 28th June 2021 to ensure it was comprehensive enough to identify as many appropriate studies as possible. The electronic searches took place between June and July 2021.

Electronic searches

A systematic literature review was conducted using the following electronic databases: CINAHL, EMBASE, Medline, PsycINFO, Google Scholar, Web of Science and the Cochrane Library (Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Health Technology Assessments Database, Cochrane Airways Group).

Additionally a search of the clinical trials registries, ClinicalTrials.gov (www.ClinicalTrials.gov) and grey literature through Open Grey (www.opengrey.eu) and grey matters (www.cadth.ca/grey-matters-practical-tool-searching-health-related-grey-literature-0) was completed. All databases were searched from their inception to 29th June 2021. Due to time and financial constraints, a restriction on non-English publications was imposed. A report on any eligible non-English publications will be made, specifically stating any evidence of potential language bias in the review.

Additional searches

The online *Medical Decision-Making* journal was also searched using the terms 'bronchiectasis' and 'airway clearance' on 22nd July 2021.

Search terms

Search terms were developed from the review questions which was derived from the PICO (Population, Intervention, Comparison, Outcome) and PEO (Population, Exposure, Outcome) frameworks (Schardt et al. 2007; Bettany-Saltikov 2016). Table 1 illustrates the key PICO and PEO search terms.

Table 1: 'PICO' and 'PEO' keyword search terms.

Population	Intervention	Exposure	Comparison	Outcome
Adults with bronchiectasis	Shared decision making	Airway clearance*	Usual care	Exacerbation frequency
Adults with non-cystic fibrosis bronchiectasis	Attitude of health personnel	Mucus clearance*		Adherence
Bronchiectasis	Attitude to health	Sputum clearance*		St. Georges quality of life questionnaire
Non-cystic fibrosis bronchiectasis	Choice behavio*	Secretion clearance*		Patient acceptance
	Communication	Active cycle of breathing*		Patient satisfaction
	Decision support technique*	Positive expiratory pressure*		Lung function
	Decision making	Manual technique*		Hospitalisation

* = truncation of terms.

Study selection

All search results including title, author(s) and abstract fields were downloaded and imported to EndNote X9. EndNote was used to identify and remove all duplicates. Once all duplicates were removed all articles were imported to 'Rayyan'. Rayyan is an online platform which allows researchers to conduct initial screening of abstracts and titles for systematic reviews (Ouzzani et al. 2016). All studies uploaded to Rayyan were screened using a template derived from the eligibility criteria of the review.

Data extraction

All data was extracted into pre-defined data extraction form. The data extraction form (Appendix 1) was designed specifically for this review. The data extraction form includes participant demographics, aims and methods of the study, data and author findings and quality assessment.

Quality assessment of included studies

This review used Critical Appraisal Skills Programme (CASP) checklists (Appendix 2). The CASP tool is the most commonly used tool for quality appraisal in health-related

qualitative evidence syntheses, with endorsement from the Cochrane Qualitative and Implementation Methods Group (Long et al. 2020).

Data analysis and synthesis

We planned to use tables with supporting narrative to determine whether the included studies were sufficiently similar in design, participants, interventions and outcomes to be combined in a meta-analysis (Schünemann et al. 2008). We intended to use a random-effects model using standardised mean differences with a 95% confidence interval. Standardised mean difference, with 95% confidence intervals would have been used where outcome measures such as lung function or health related quality of life are the same, but interventions varied in either methods or outcome measure scales. If appropriate, we planned to use forest plots to assess heterogeneity using i2.

To ensure robustness of any summary statistics, we planned to perform sensitivity analysis if there were sufficient comparable studies. This would have involved adding or removing studies where there was high risk of bias in relation to randomisation, allocation concealment, or blinding of the interventions from participants or trial personnel (Deeks et al. 2011).

Due to the anticipated heterogeneity in study design, methods and methodology; a narrative synthesis was planned for the review synthesis. This narrative synthesis used the explicit framework proposed by Popay et al. (2006); developing a theory of change model; developing a preliminary synthesis, exploring relationships within and between studies, and assessing the robustness of the synthesis.

Results

A total of 4414 studies were initially identified from the searches. 864 duplicate studies were removed; resulting in 3550 studies in total for title and abstract screening. All 3550 titles and abstracts underwent double-blind screening by the lead reviewer (PM) and co-authors (JB, SM, JB, ADS). Disagreements for inclusion or exclusion were resolved through discussion.

Seventeen studies were eligible for full text screening. Two studies (Lawton et al. 2019; Ryan & MacLeod, 2020) were removed as no full text were available. The remaining full text studies (n = 15) were screened independently by two reviews, PM and ADS. Any uncertainties were resolved though discussion. A third reviewer (SM) was used as mediator where consensus for studies was not reached.

All references of the 15 full text studies were searched manually by the lead researcher and compared to the list created in EndNote to ensure there were no missing data. Where studies were found that were not in the EndNote library; they were screened with the proforma used in the title and abstract screening in this review. No additional relevant studies were identified.

Description of results

No studies were identified for inclusion in the review. We have presented a study flow diagram illustrating the results (Figure 4) and reasons for exclusion (Table 2).

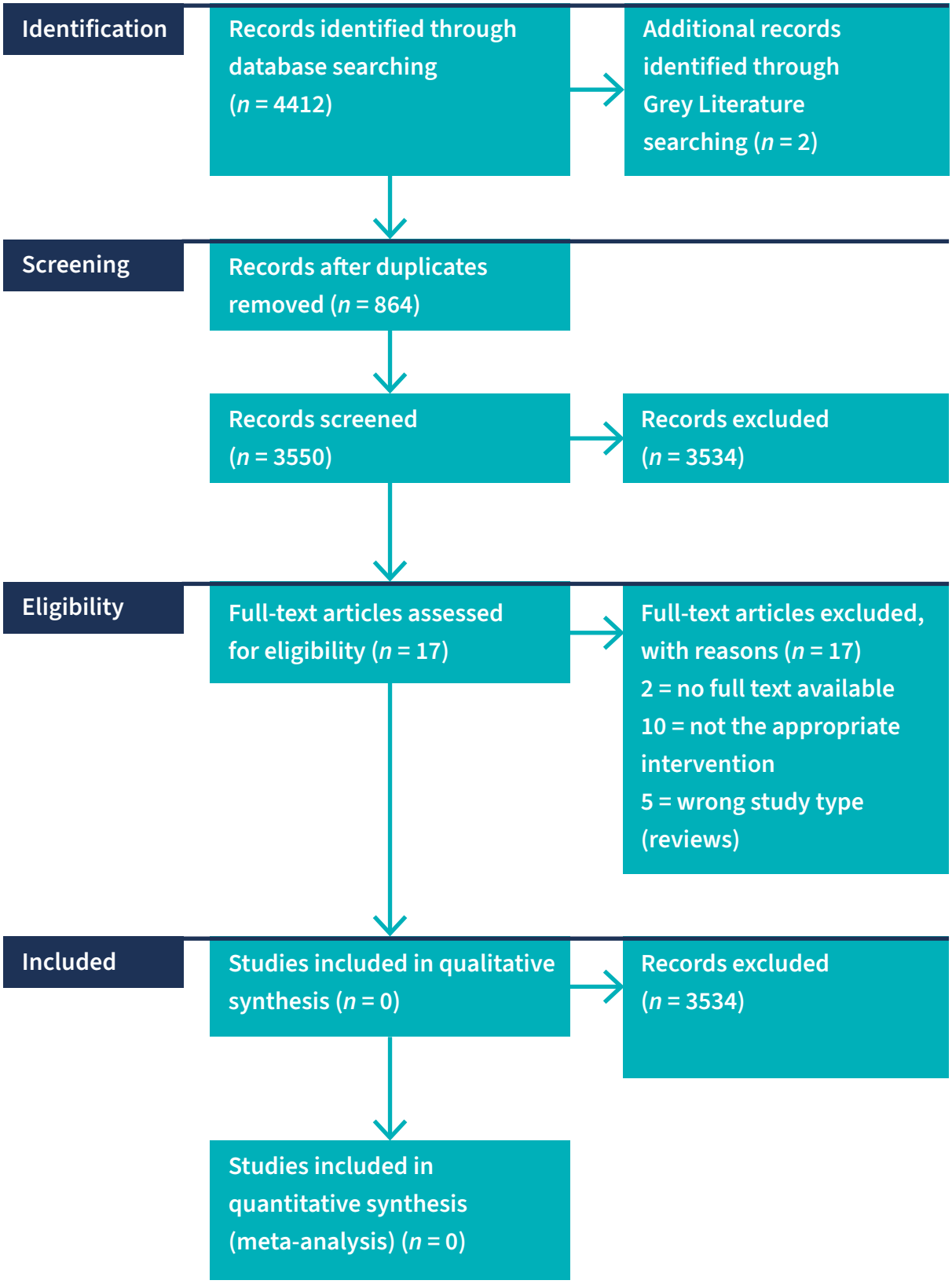

Figure 4: Preferred reporting items for systematic reviews and meta-analysis (PRISMA) flow diagram.

Table 2: Reasons for exclusion

Study	Reason for exclusion
Brockwell et al. (2020)	Not an appropriate intervention. Mentions 'Bronchiectasis Education Tool' as an intervention. States 'decision making' was not taught as part of the intervention
Cecins et al. (1999)	Not an appropriate intervention. Includes COPD patients as well as bronchiectasis
Chalmers et al. (2014)	Not appropriate study design (review article)
Eaton et al. (2007)	Not an appropriate intervention. Various techniques, no SDM but patient preference measured
Farley et al. (2008)	Not appropriate study design (review article)
Flude et al. (2012)	Not appropriate study design (review article)
Guan et al. (2019)	Not an appropriate intervention. Does not mention SDM specific to ACT, only 'self-management techniques'
Kelly et al. (2018)	Not an appropriate intervention. Includes SDM in references but not as focus of work
Kelly et al. (2021)	Not an appropriate intervention. Mentions SDM only in discussion 'making autonomous decision under direction of clinician' in relation to ACTs
Knowles et al. (2021)	Not appropriate study design (review article). In discussion the author mentions 'respiratory physiotherapy should ensure there is SDM regarding patients' preferences'
Lavery et al. (2007)	Not an appropriate intervention. Does not mention SDM
Lavery et al. (2011)	Not an appropriate intervention. Does not mention SDM
Lawton et al. (2019)	No full text available (abstract only)
Lee et al. (2021)	Not an appropriate intervention. Study mentions a mix of ACTs were prescribed which 'aligns' with acceptable methods such as considering patient preference. Does not explicitly state this study used SDM when prescribing ACTs
McIlwaine et al. (2017)	Not appropriate study design (review article)

Herrero-Cortina et al. (2016)	Not an appropriate intervention. Study measures an element of SDM (patient preference) as an outcome, not as part of the intervention
Ryan and MacLeod (2020)	No full text available (abstract only)

Discussion

Patient involvement in decision-making is becoming an essential element of modern medicine. Recent healthcare policy-making and legislation provide guidance on why SDM should be part of everyday care in all healthcare setting (NHS England 2019; Carmona et al. 2021; National Institute for Health and Care Excellence 2021). This systematic review provides a timely contribution by demonstrating the gap in evidence of this in airway clearance techniques for adults with bronchiectasis.

This review identified the lack of evidence that SDM is used when choosing airway clearance techniques for adults with bronchiectasis. The review subsequently concludes insufficient evidence to demonstrate the effectiveness of SDM interventions for choosing airway clearance techniques in adults with bronchiectasis.

Brockwell et al. (2020) found that improved interaction and communication with healthcare professionals on self-management techniques including airway clearance was the primary theme in their analysis of patient focus groups using the Bronchiectasis Education Tool (BET). They concluded patients have a desire to be involved with and assist initiatives to increase their education of ACTs to support their condition.

Similarly in a study by Kelly et al. (2021) exploring views of self-management with respiratory physiotherapists and adult patients with bronchiectasis they found making autonomous decisions under the direction and support of a clinician was recognised as a significant part of self-management by patients. When Kelly et al. (2021) specifically looked at patient influencers on self-management, they concluded there is a need for tools to promote participation in education on ACTs that are acceptable to patients and do not add to their treatment burden.

An unpleasantly familiar, frequently published, yet unchanging statistic over the past 20 years, is the low adherence rates (averaging 30%) of ACTs within many respiratory diseases including bronchiectasis, CF and COPD (White et al. 2007; Flores et al. 2013; Bradley et al. 2018; Low et al. 2020). A recent systematic review into barriers and facilitators for ACTs in bronchiectasis found a lack of time the most common reason for not performing them, with other reasons such as competing priorities and lack of perceived benefit from adherence also frequently cited (Low et al. 2020). Given, longer-term adherence is essential to identifying long-term clinical benefit for ACTs in bronchiectasis; it may be pragmatic to consider some trade-off on efficacy if patients were able to make an informed choice.

An informed choice will only be possible if there is a more personalised approach to the prescription of ACTs in bronchiectasis such as SDM.

Limitations of this review

Due to resource limitation, this review was limited to English language publications only. However, throughout title and abstract screening, the authors did not identify any study that met all the inclusion criteria except publication in English.

With no studies meeting criteria for inclusion, a limitation of this review may be that it appears to offer no conclusions or offer conclusions not based on evidence and may seem disappointing among some clinicians. We argue that this empty review remains important and highlights a major research gap and has identified the state of the evidence at this point in time in SDM for ACTs in bronchiectasis.

Implications for practice

No eligible studies were found for inclusion in this review. We would argue this has serious implications for practice. We were unable to identify the use or effectiveness of any SDM intervention in airway clearance techniques in adults with bronchiectasis. Based on the literature examined during this systematic review, there appears to be a desire from both patients and health professionals to engage with elements of SDM to facilitate a personalised ACT prescription that takes into account the patient's disease state, preference and motivation, together with the physiological knowledge base of each ACT (Flude et al. 2012; Herrero-Cortina et al. 2016; McIlwaine et al. 2017; Hester et al. 2018; Kelly et al. 2018; Knowles et al. 2021). The author acknowledges that this desire and ability to participate in SDM, may differ significantly between patients who have been recruited into research studies to allow such conclusions, and those who have not. This selection or recruitment bias may not reflect a 'real world' demand for and engagement of a potential SDM intervention.

Implications for research

A lack of studies for inclusion in this review has identified a gap in research focusing on SDM interventions for ACTs in adults with bronchiectasis. We hope that having identified this gap in research, we have created a need to design high-quality SDM interventions for ACTs in adults with bronchiectasis amongst clinicians and researchers.

Qualitative studies may play an important role in the development of SDM interventions for ACTs in adults with bronchiectasis. For example, studies looking at patient preferences in the delivery of information, format of the intervention for example, electronic/hard copy decision aids, BCTs or a combination of these, may lay the foundations for identification of interventions that could be tested in feasibility trials up to high-quality RCTs.

Conclusion

Bronchiectasis is an increasingly prevalent disease. ACTs are the cornerstone of bronchiectasis management. We have presented clear justification for further research for

development of a SDM intervention for ACTs in adults with bronchiectasis. This is supported by the recent NICE guideline on SDM, which made specific recommendations for research including: research on differing SDM interventions in different groups and the acceptability of these SDM interventions (National Institute for Health and Care Excellence 2021). We hope to see progress in this field in the near future to assess any impact it may have for this population.

Key points

1. There is a gap in research focusing on SDM interventions for ACTs in adults with bronchiectasis.
2. Patients and healthcare professionals have an enthusiasm to engage with and promote SDM in airway clearance techniques respectively.
3. There is a justification for further research for development of SDM interventions for ACTs in adults with bronchiectasis.

Statement of ethics

An ethics statement is not applicable because this study is based exclusively on published literature.

Conflict of interest statement

None.

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Appendix 1: data extraction template

Data extraction				
Publication details				
Author(s)				
Year				
Title				
Journal				
Population	**Yes**	**No**	**Unclear**	**Page/paragraph/figure #**
Adults with bronchiectasis				
Diagnostic criteria (for example, HRCT chest)				
Demographics				
Age				
Sex				
Co-morbidities				

Study details	Description as stated in the paper/report	Page/ paragraph/ figure #
Study Design: RCT, cohort, case-control, cross-sectional, quasi-experimental, review, editorial		
Aim of study/review		
Duration of study		
Sample size		

Exposure 1	Yes	No	Unclear	Description as stated in the paper/report	Page/paragraph/ figure #
Airway clearance technique provided/ prescribed/used by patient/participant					
Exposure 2/intervention	**Yes**	**No**	**Unclear**	**Description as stated in the paper/report**	**Page/paragraph/ figure #**

Shared decision making: any intervention using shared decision making for example, one-to-one basis, a group basis, discussion sessions, role play sessions, blended learning sessions, online learning sessions and the use of hard-copy information resources such as leaflets or workbooks or option grids.

This includes all interventions named as promoting, improving, enabling or facilitating shared decision making.

Interventions of interest are those delivered by professionals.

	Description as stated in the paper/report	Page/ paragraph/ figure #
Intervention: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities		
Who provided the intervention? Describe their expertise, background or any specific training		
Describe the types(s) of locations(s) where the intervention occurred (virtual, telephone, face-to-face, hospital, community)		
Tailoring: If the intervention was personalised, describe why, when, how		

Outcomes	Yes	No	Unclear	Description as stated in the paper/report	Page/paragraph/ figure #
Outcomes: presence of shared decision-making measured by any validated tool including but not limited to: The *Observing patient involvement 12-item (OPTION) scale* (Elwyn et al. 2003) *Observer-based measure observer 5-item (OPTION) scale* (Elwyn et al. 2013) Decision-making instrument facilitation antecedents (for example, the *Preparation for decision-making scale*) (Bennett et al. 2010)					

Decision process (for example, the *Rochester participatory decision-making scale*) (Shields et al. 2005))
Adherence to Airway Clearance Techniques (measured by patient reported data or electronic monitoring)
Respiratory exacerbation frequency per year and/or time to first exacerbation
Lung function measure as forced expiratory volume in one second (FEV_1) in litres or as a percentage of predicted
Adverse effect such as longer consultation time, increased costs or unanticipated adverse effects as reported by study authors

St. Georges respiratory questionnaire.		
Anxiety (measured by for example, the *Generalised anxiety disorder 7- item (GAD-7) scale* or the *Hospital anxiety and depression scale (HADS)*)		
Decision conflict (as measured by the *Decision conflict scale* or the *SURE scale*)		
Decision regret (as measured by the *Decision Regret scale*)		
Participant satisfaction with decision		
Depression (measured by for example, *Patient health questionnaire (PHQ) (PHQ-9) scale* or the *CES-D scale*, or the *Hospital anxiety and depression scale (HADS)*)		
Mortality		
Conclusion	**Description as stated in the paper/report**	**Page/ paragraph/ figure #**

PRISMA 2020 checklist

Section and topic	Item #	Checklist item	Page #
Title			
Title	1	Identify the report as a systematic review	1
Abstract			
Abstract	2	See Page et al. (2021) for abstracts checklist	1
Introduction			
Rationale	3	Describe the rationale for the review in the context of existing knowledge	7
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses	7
Methods			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses	8
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted	10
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used	10
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process	12–13
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	13
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (for example, for all measures, time points, analyses), and if not, the methods used to decide which results to collect	9 and 11
	10b	List and define all other variables for which data were sought (for example, participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information	11

Section and topic	Item #	Checklist item	Page #
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process	11
Effect measures	12	Specify for each outcome the effect measure(s) (for example, risk ratio, mean difference) used in the synthesis or presentation of results	12
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (for example, tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5))	12
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions	12
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses	12
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used	11–12
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (for example, subgroup analysis, meta-regression)	12
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results	12
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases)	13
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome	12

Section and topic	Item #	Checklist item	Page #
Results			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram	12–13
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded	13
Study characteristics	17	Cite each included study and present its characteristics	13
Risk of bias in studies	18	Present assessments of risk of bias for each included study	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (for example, confidence/credible interval), ideally using structured tables or plots	NA
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies	NA
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (for example, confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect	NA
	20c	Present results of all investigations of possible causes of heterogeneity among study results	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed	NA

Section and topic	Item #	Checklist item	Page #
Discussion			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence	14
	23b	Discuss any limitations of the evidence included in the review	15
	23c	Discuss any limitations of the review processes used	15
	23d	Discuss implications of the results for practice, policy, and future research	15–16
Other information			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered	8
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared	8
	24c	Describe and explain any amendments to information provided at registration or in the protocol	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review	17
Competing interests	26	Declare any competing interests of review authors	17
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review	Not included

From: Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ (Clinical research ed.)*, *372*, n71. https://doi.org/10.1136/bmj.n71.

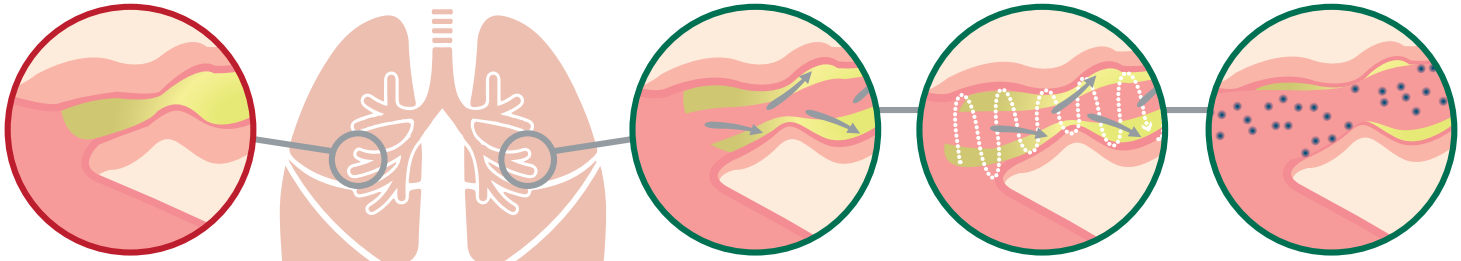
For more information visit www.prisma-statement.org.

Are Your Bronchiectasis Patients Receiving the Care They Need?

There's a *Clear* Choice

BTS guidelines recommend airway clearance techniques, such as OPEP, for the treatment of patients with bronchiectasis.[1]

The ***Aerobika**** Oscillating Positive Expiratory Pressure Device can help open airways and clear excess mucus from the lungs so that patients can breathe better.[2,3]



BEFORE USE:
Airways inflamed, collapsed and plugged with mucus[4]

AFTER AEROBIKA* OPEP USE:
Airways are opened

Vibrations help thin and loosen mucus

This may help inhaled medication work better[5]

Make the *Clear* choice. Prescribe the device that 97% of surveyed Bronchiectasis and COPD patients would continue to use ($n = 812$).[6]

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Oscillating Positive Expiratory Pressure Device

MEDICAL DESIGN EXCELLENCE AWARDS® 2014 GOLD WINNER

Free HCP Demo Kit
Scan the QR Code to Claim

References:
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COPD = Chronic Obstructive Pulmonary Disease HCP = Healthcare Professional

Association of Chartered Physiotherapists in Respiratory Care scoping review: Post-operative physiotherapy management in upper gastrointestinal (GI) surgery

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Keywords | Abdominal surgery, mobilisation, physiotherapy, post-surgical rehabilitation, upper gastrointestinal surgery.

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Abstract

Objective

This scoping review will identify and synthesise the available evidence for post-operative physiotherapy following upper GI surgery, in order to identify gaps in the literature, inform evidence-based practice and contribute towards guidelines and/or policy development.

Introduction

Physiotherapy management following thoracic, cardiac and upper gastrointestinal surgery has been identified as one of the five key priorities for review by the Association of Chartered Physiotherapists in Respiratory Care (ACPRC) editorial board. Previously, systematic reviews have been published with a focus on one type of physiotherapy treatment. The aim of this scoping review was to identify all types of post-operative physiotherapy following upper GI surgery research to provide a comprehensive review of available evidence.

Inclusion criteria

Studies with adult patients undergoing upper GI surgery and published between 2015 and 2020 were included. The surgical procedure included required post-operative physiotherapy intervention as part of the recovery process. The context was in-patient, hospital-based surgery. Physiotherapy intervention prior to admission (such as pre-habilitation), and intervention after hospital discharge, for example, out-patient follow up were excluded. Research from any country of origin and any type of healthcare system was included.

Methods

The search strategy was agreed by the scoping team and searches were undertaken of PEDro, CINAHL, EMBASE, MEDLINE, PubMed, Google Scholar and the Clinical Trials Registry. Exclusion criteria included any articles not written in English.

All identified citations were uploaded into web-based Endnote. Articles were screened against title and abstract by one reviewer, and full text articles were appraised by two reviewers.

Data extraction included the aim of the study, design/methodology, sample details (number of participants, mean age, gender ratio), comparison group details, outcome measures, and key findings relevant to the scoping review questions. Quality was assessed using the relevant Critical Appraisal Skills Programme (CASP) or Joanna Briggs Institute (JBI) tools dependent on study methodology.

Results

Eleven studies were identified for inclusion of which there were three randomised control trials (RCT), four cohort studies, one systematic review, one cross sectional study, one narrative review and one survey. No qualitative studies were found.

Four studies considered the role of adjuncts (incentive spirometry and inspiratory muscle training). Five studies investigated ambulation or early mobilisation post-surgery, one study looked at the role of pre-operative education and one study looked at current practise. 57 physiotherapists were surveyed, 1,384 participants were included in studies and 37 papers were included in reviews.

The studies found that early and intensive mobilisation as part of an ERAS programme showed a statistically significant reduction in length of stay (LOS) and post-operative pulmonary complications (PPCs). Reported physiotherapy interventions are in line with current best practice guidelines. IMT and IS continue to show positive results in the literature in particular in the older and high-risk patient. Pre-operative assessment and education should be considered in patients undergoing upper abdominal GI surgery however screening tools for prioritisation are not yet established. The quality of the research was generally good; however, sample sizes were small and often

underpowered.

Conclusions

This scoping review has demonstrated that current evidence supports post-operative physiotherapy intervention in people who undergo upper GI surgery. Future research should aim to determine the role of pre-operative physiotherapy, clarify the impact of breathing exercise protocols and expand the diversity of methodologies to include more qualitative research.

Introduction

The Association of Chartered Physiotherapists in Respiratory Care (ACPRC) editorial board is comprised of respiratory physiotherapy clinicians and academics who lead scoping of latest evidence, commissioning, co-ordination and delivery of all new ACPRC guidance documents and resources. The aim of this work is to facilitate knowledge sharing and drive improvements in the quality of care for respiratory patients.

The editorial board discussed potential areas for investigation and agreed that the area of physiotherapy and surgery should be prioritised. This was subsequently divided into cardiac, thoracic and upper gastrointestinal (GI) surgery. Members of the editorial board were nominated to be the scoping review leads and other respiratory physiotherapists were approached to be part of each team to conduct the literature searches and reviews. The editorial board aimed to provide an overview of all types of post-operative physiotherapy research.

A scoping review was decided upon by the research team to focus on any new evidence for physiotherapy intervention across the *POST-OPERATIVE UPPER GI SURGERY* population. The last large-scale review of the literature in this field was undertaken by Reeves and Boden (2016), this was a narrative review. It recommended that patients should be screened for risk of developing post pulmonary complications (PPCs); high-risk patients should have prophylactic physiotherapy; patients should have some form of preoperative education; post operative ambulation should be commenced as early as possible and that oscillatory PEP may assist in preventing PPCs. No recommendations were made about the inclusion of post-operative rehabilitation programmes. An exploratory search identified new literature and therefore an updated review is required.

Key terms

Physiotherapy intervention – treatment that is prescribed or carried out by a registered physiotherapist or a member of the physiotherapy team (for example, a rehabilitation or therapies assistant).

Surgical intervention – invasive surgery that requires admission to hospital, not performed as a day case.

Objectives

1 To assess the extent and type of evidence associated with post-operative physiotherapy following upper GI surgery.
2 To review the research to inform appropriate future guidance documents, whilst also highlighting gaps in the research field.

Review questions

- What types and number of studies have been carried out with adults undergoing upper GI surgery and post-operative physiotherapy treatment?
- What is the quality of the research? What are the results of the research?
- Is there sufficient evidence to develop new ACPRC guidance documents and resources, if so, what is the best resource to develop?

Methods

Participant eligibility criteria

Inclusion criteria

- Adult patients undergoing invasive upper GI surgery that requires admission to hospital and routinely receives post-operative physiotherapy.
- Human studies.

Exclusion criteria

- Paediatrics – defined as less than 18 years of age.
- Day case surgery.
- Animal studies.
- Pre-habilitation, and interventions after hospital discharge, for example, out-patient follow up.

Concept

Inclusion

- Procedures that require post-operative physiotherapy intervention as part of the recovery process.

Context

Inclusion

- In-patient, hospital-based surgery.
- Any country, state or privately funded.

Types of sources

Included studies were published in English from March 2015 to December 2020. This scoping review considered both experimental and quasi-experimental study designs including

randomised controlled trials, non-randomised controlled trials, before and after studies and interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies were considered for inclusion. This review also considered descriptive observational study designs including case series, individual case reports and descriptive cross-sectional studies for inclusion. In addition, qualitative studies were included for consideration in this review. Finally, systematic reviews and opinion papers that met inclusion criteria were included.

Review methods

Search strategy

The search strategy was agreed by each scoping team, with input from local hospital and university library services (Appendix 1) Once developed, a full search was undertaken of PEDro, CINAHL, EMBASE, MEDLINE, PubMed, and Google Scholar. The Clinical Trials Registry was also searched for any unpublished literature. A hand search of reference lists and grey literature was also completed to ensure a comprehensive search was undertaken. All articles with search strategy terms contained in the titles and abstracts were shortlisted by the lead researcher and final inclusion was agreed by the search team. The search strategy, including all identified keywords and index terms, was adapted for each included database. The shortlisted references were uploaded to Endnote. Included studies were published over a five-year period, post 2015, this period was chosen as being after the date of the last significant review of relevant literature to capture any new published data.

Study/source of evidence selection

Titles and abstracts were further screened by one reviewer and assessed against the inclusion criteria for the review. Potentially relevant sources were then retrieved in full and reviewed by two reviewers. The full text articles were divided amongst the review team and assessed for quality using the CASP tool. Disputes were discussed and consensus for inclusion reached between reviewers.

Reasons for exclusion of sources of evidence at full text stage that do not meet the inclusion criteria are recorded and reported in the scoping review. Any ambiguity to the relevance of title, abstract or full text was discussed with the topic lead.

Data extraction

Data was extracted and analysed by one reviewer (KG). A data extraction tool was created by the topic leads to collect data from each study based on the JBI extraction tool (2020). Extracted data included: author(s), year of publication, setting, aim/purpose of study, sample size, design/methodology, outcome measures, comparisons and key findings (Table 1).

Table 1: Summary of findings for GI surgery.

Author(s)/year	Setting	Aim/purpose	Sample size	Design/methodology	Outcome measures	Comparison	Key findings
Adjuncts							
Kamble and Vardhan (2019)	India	Effect of threshold IMT Vs IS	*n* = 30	Prospective, cross-sectional comparison	MIP (Pimax)	IMT/IS	MIP increased in both groups. Threshold IMT has more effect than IS over a two week period
Kumar et al. (2016)	India	Comparison of flow and volume IS on pulmonary function and exercise tolerance	*n* = 50	RCT	FVC, FEV_1, PEF, 6MWT	Flow/volume IS	Flow and Volume IS showed significant statistical impvmt in 6MWT. FVC, FEV_1 and PEFR improved by day 4/5 post op in both flow and volume IS groups
Khyati et al. (2020)	India	Effect of IMT on pulmonary function (smoker/non smoker)	N/a	Observational cohort (IMT and conventional PT)	MIP/MEP, FVC, FEV_1, 6MWT, Borg Scale	IMT/conventional PT	N/a
Kendall et al. (2017)	Portugal	Meta-analysis of the effectiveness of IMT to reduce postoperative pulmonary complications (PPC) and length of hospital stay (LOS)	*n* = 853	SR	PPC LOS	N/a	IMT significantly reduces the risk of PPC and reduces LOS. IMT prescription should target at least a two week period

Ambulation/mobility

Asada et al. (2019)	Japan	Associated factors with delayed ambulation after abdominal surgery	*n* = 217	Retrospective cohort study	ASA-PS, patient characteristics, NLR PNI, intraoperative data, surgery duration, POD1 mobility	N/a	31.8% patient unable to ambulate without assistance POD1. Inability to mobilise on POD1 associated with longer LOS
de Almeida et al. (2017)	Brazil	Efficacy, feasibility and safety of supervised post op exercise and mobility programme	*n* = 108	RCT	Independent ambulation, 6MWT, Piper fatigue scale, HRQOL	Standard care v's exercise programme	Early, supervised mobilisation is safe. At POD5 early mobility intervention group had greater 6MWT than standard rehabilitation group
Carmichael (2017)	U.S.A.	Clinical practice guidelines for enhanced recovery after colon and rectal surgery	N/a	Clinical practice guidelines	N/a	N/a	Early and progressive patient mobilisation is associated with shorter length of stay. Grade of recommendation: strong recommendation based on low-quality evidence
Castelino et al. (2016)	Canada	Effect of early mobilisation protocols on post-op outcomes	*n* = 508	SR	Duration of stay, GI function, PPC's, spirometry, 6MWT, PRO's	N/a	Variation in mobility protocols between studies. No difference in post-op complications, functional testing, or PROs Reduced hospital LOS in IG

Hussey et al. (2019)	Ireland	Quantification post op mobility and barriers to mobility in oesophagectomy	*n* = 30	Prospective observational	Actigraph GT3X+, medical status, pain scores, physiotherapy comments	N/a	Haemodynamic instability most common reason for non-mobilisation. 96% of time during POD1–5 is sedentary. Light intensity activity = positive increase in daily step count
Education							
Boden (2018)	Australia	Pre-op physiotherapy for prevention of respiratory complications post UAS	*n* = 441	RCT	PPCs (Melbourne group score) LOS, hospital acquired pneumonia, HRQOL, physical function, post D/C complications	Information booklet v's pre-op physiotherapy	PPC halved in in intervention group. No significant differences in secondary outcomes
Current practice							
Patman et al. (2017)	Australia	Physiotherapy in upper abdominal surgery – what is current practice in Australia?	*n* = 57	Survey	Questions on: treatment milestones, prescribed and used interventions, components of breathing exercises, outcomes measures, perceived barriers to treatment	N/a	Intervention choice is reflective of guidelines. Early mobilisation and respiratory interventions are used despite conflicting literature

Reeve and Boden (2016)	New Zealand	Physiotherapy Management of patients undergoing abdominal surgery	Not stated	Narrative review	PPC's, current physiotherapy interventions	N/a	Limited and equivocal research. Cost analysis studies and good quality research needed

6MWD = 6 minute walk distance, 6MWT = 6 minute walk test, BMI = body mass index, CG = control group, CPAP = continue positive airway pressure, ERAS = enhanced recovery after surgery' FEV_1 = forced expiratory volume in 1 second, HFNO = high flow nasal oxygen, HRQOL = health related quality of life, IG = intervention group, IMT = inspiratory muscle training, IS = incentive spirometry, LOS = length of stay, METs = metabolic equivalent of task, PE_{max} = maximal expiratory mouth pressure, PI_{max} = maximal inspiratory mouth pressure, NLR = Neutrophil to lymphocyte ratio, PEF = Peak Expiratory Flow, PFTs: = pulmonary function testing, PNI = prognostic nutritional index, Post-op = post-operative, POD = post-operative day, PPCs = post-operative pulmonary complications, PROs = patient reported outcomes, PT = physiotherapy, (HR) QOL = quality of life, RCT = randomised control trial, RMT = respiratory muscle training, SR = systematic review, VAS = visual analogue scale.

Results

Types of study

Twelve studies were identified for inclusion of which three were randomised control trials (RCT) three cohort studies, two systematic reviews, one cross sectional, one narrative review, one survey and one guideline. One study was a protocol so limited methodological information could be elicited and was therefore excluded. No qualitative papers were found from either physiotherapist or patient perspectives. The results of the search and the study inclusion process can be seen in 'preferred reporting items for systematic reviews and meta-analyses extension for scoping review' (PRISMA-ScR) flow diagram (Figure 1).

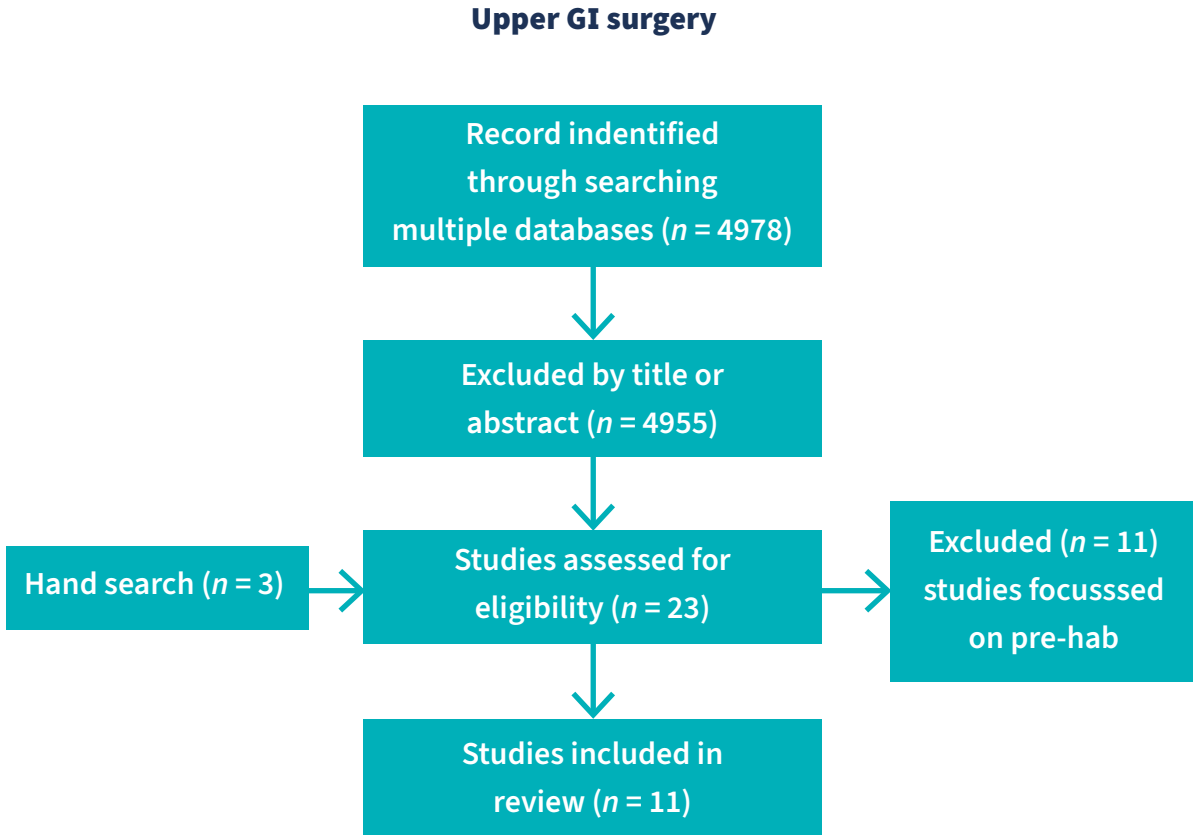

Figure 1: Flow diagram of scoping review process.

Participants

Across the eleven papers 57 physiotherapists were surveyed, 1,384 participants were included in studies and 37 papers were included in reviews. Authors came from a wide variety of countries and of the lead authors eight were listed as physiotherapists and 34 different types of upper abdominal surgical procedures were documented throughout the studies.

Intervention

Four studies explored the use of postoperative physiotherapy adjuncts: One RCT considered the role of incentive spirometry (IS), flow versus volume. One systematic review considered the evidence base for the use of inspiratory muscle training (IMT). One study compared IS

to IMT and one study proposed a protocol specifically considering IMT in the abdominal surgical patient group comparing this intervention to conventional physiotherapy. All studies described the intervention in detail and were conducted by physiotherapists. A wide variety of outcome measures were reported across the adjunct studies the most common being 6MWT, PPC, HRQol measures, MIP and spirometry.

Two studies (RCT and systematic review) reported that IMT should be undertaken for a period of 15–20 minutes to be most effective and ideally for two weeks post procedure (Kamble & Vardhan 2019; Kendall et al. 2018). All studies found IMT has the most impact on reducing post pulmonary complications and length of stay however there is variation across the studies in their definition of PPC's and their chosen measurements of this outcome. Kendall et al. (2018) also goes on to suggest that IMT should be started at the pre-op stage to be optimally effective.

In terms of incentive spirometry Kemble and Vardhan (2019) found that incentive spirometry showed an extremely significant improvement in maximal inspiratory pressure (p <0.0001). Kumar et al. (2016) found that IS better preserved pulmonary function (FVC, FEV_1 and PEFR) and that six minute walk test showed a statistically significant improvement in distance covered (p <0.05).

Five studies considered the effect of ambulation/early mobilisation in the post-operative stage. Three studies undertook exercise or mobilising interventions. One systematic review considered the effect of early mobilisation protocols and there was one, a clinical practice guideline considering enhanced recovery post-operatively.

Most studies were physiotherapy led ambulation/rehabilitation interventions apart from Asada (2019) which was nurse led. All five studies reported common barriers to early mobilising: wound infection, bleeding, anaemia, ileus, cardiovascular instability, and patient reported barriers include catheters and IV drip stand limitations and post- operative pain. Hussey (2019) suggests that specific strategies need to be put in place for those patients with CVS instability in terms of achieving early mobilisation.

All studies state the inclusion of physiotherapy as part of their intervention however the detail of the actual exercise programme or protocol varied significantly. Sit to stand, walking, stretches, balance exercises and ambulation were all described. In terms of outcome measures, use of pain scores, pedometer steps achieved, 6MWT, BORG scales and length of mobilisation achieved were all utilised across the studies. The clinical practice guidelines (Carmichael 2017) state that early and progressive mobilisation is associated with a shorter length of stay and that mobilisation goals should be discussed with the patient, but they also accept that their recommendations are based on low quality evidence.

One study investigated pre-operative education on post- operative pulmonary complications (Boden 2018) this paper was clear in stating that this intervention was not pre-habilitation but education. This was the only study that builds on the previously

suggested priorities by Reeves and Boden (2016). The study found that pre-operative education should be considered as the primary step in PPC prophylaxis (15% absolute risk reduction) and that qualitatively, education that was found to be engaging was most likely to be memorable and impactful.

One study reviewed current practice in post-operative physiotherapy, Patman et al. (2017) surveyed 57 physiotherapists in Australia. Interventions reported by clinicians were in line with current practice guidelines however some practices were still undertaken despite conflicting and limiting literature. Further research is needed around understanding the barriers to accessing physiotherapy, determining valid and appropriate pre-operative screening tools to aid prioritisation and that cost analysis studies were needed to be undertaken.

Quality assessment

The majority of studies have a small sample size and at times studies were underpowered. In terms of the RCT's, although there was blinding of some participants there was an absence of blinding of researchers and assessors. It is clear to see that studies mainly used established and valid outcome measures and assessment tools however some were country or hospital specific tools that may be difficult to replicate in the U.K. NHS health sector. The majority of studies had clear study protocols, and in most studies all participants were accounted for. In most studies the participants in each group had comparable baselines. The reviewers felt that cost-effective analysis would have improved many of the RCTs.

An agreed exclusion by all the leads of the surgical scoping reviews were studies that focussed on pre-habilitation as this was felt to merit a separate review in itself. Eleven studies were found in the time period of this review that related to pre-habilitation and upper abdominal surgery – the reviewers feel that this could be the focus of any further research in this speciality.

Limitations

Papers in other languages were excluded from this review so this may have added bias to the selection process. The lead reviewer had final say on all included papers, any two reviewers out of the review team undertook the quality assessment so this may have led to inconsistencies in approach as both CASP and JBI tools were used.

Conclusion

In conclusion, this scoping review was undertaken as an area of priority for the ACPRC editorial board. The objective was to report the extent and methodological type of evidence associated with post-operative physiotherapy in people who undergo upper abdominal surgery. From an initial search return of 4978 articles and following screening, 11 studies were included in the scoping review. A variety of different research methodologies were included in the review which demonstrates diversity of evidence available.

The literature showed positive outcomes for physiotherapy intervention. Studies reported that early and intensive mobilisation were linked to a reduction in PPCs and LOS. Reported physiotherapy interventions are in line with current best practice guidelines. IMT and IS continue to show positive results in the literature. Pre-operative assessment and education should be considered in patients undergoing upper abdominal GI surgery however screening tools for prioritisation are not yet established. The quality of the research was generally good with consistent positives across methodology types however sample sizes remain small and often underpowered.

The clinical relevance for this scoping review is that physiotherapy as part of an ERAS is beneficial, and intensive mobilisation is linked to improved recovery and reduced length of stay. Cost effectiveness analysis studies need to be undertaken. However, there was also a lack of qualitative studies, so a focus on patient experience and patient reported outcomes should also be prioritised.

In addition to this upper GI scoping review, the editorial board are undertaking independent cardiac and thoracic reviews. Each of these will be published separately, followed by a combined ACPRC surgical position statement on all three surgeries.

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Conflicts of interest

There are no conflicts of interest with the authors listed on this manuscript.

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Appendix 1

Search strategy – upper GI

Search 1

Abdominal.

OR gastrointestinal.

OR upper gi (note: upper gi must be written in lower case or it thinks it's a boolean operator!).

OR upper gastrointestinal.

OR colorectal.

Results = 138,174 studies.

Search 2

operat#.

OR surg#.

OR (preoperative or pre-operative or pre-op or perioperative or peri operative).

OR (postoperative or post operative or post-surgery or post-surgical).

OR (prehabilitation or prehab or pre-operative rehabilitation or peri-operative rehabilitation).

Results = 217,824 studies.

Search 3

(physiotherap# or physical therap#).

OR (mobilisation or mobilisation or mobilise or mobilise).

OR (exercise or physical activity or fitness).

OR ambulat# OR walk#.

Results = 283,080 studies.

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