

NEW ZEALAND JOURNAL OF PHYSIOTHERAPY

- National Science Challenge for New Zealand
- The feasibility of inpatient COPD research
- Allied health service in an Emergency Department
- Positive thinking and physical activity motivation
- Physiotherapy management in abdominal surgery
- Encouraging social interaction in autism spectrum disorder
- Group exercise after severe stroke



PHYSIOTHERAPY NEW ZEALAND
Kōmiri Aotearoa

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MOVEMENT FOR LIFE

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Ageing Well Kia eke kairangi ki te taikaia mātuatanga: a National Science Challenge for New Zealand

The New Zealand National Science Challenges were launched in 2013 as new research funding initiatives to support high quality, mission-led science in the country. One of these Challenges, *Ageing Well*, has particular relevance for physiotherapy and involves physiotherapists in management and science leadership, as well as through its funded research programme.

BACKGROUND: OUR AGING POPULATION

People are living longer, a trend which has continued globally for at least a century. Such ageing is unprecedented historically, and will have profound effects over the coming decades: on countries, on communities, on families and whānau, and on individuals. These changes will affect all areas of our lives.

This global pattern is reflected in the ageing population in New Zealand, where our life expectancy at birth is now 83.2 years for females and 79.5 years for males; this has increased by 1.0 years for females and 1.5 years for males since 2005–07. However, there are disparities across the population. In particular, Māori men live almost 7 years less than other New Zealand men: life expectancy at birth is 73.0 years for Māori males, compared with 80.3 years for non-Māori males (Statistics New Zealand 2015).

THE NEW ZEALAND NATIONAL SCIENCE CHALLENGES

Based upon a nationwide public consultation in 2012–2013 and reports from Peak Panels comprising leading scientists in the country, the National Science Challenges were launched by the government (Ministry of Business, Innovation and Employment) as new restructured research funding agencies, starting in 2012–2013. There are now a total of 11 Challenges including areas as diverse as *New Zealand's biological heritage* (directed at 'protecting and managing our biodiversity, improving our biosecurity, and enhancing our resilience to harmful organisms') and *Science for technological innovation* ('Enhancing the capacity of New Zealand to use physical and engineering sciences for economic growth')(Ministry of Business, Employment and Innovation 2016).

The Challenges also comprise three which are particularly focused on health and wellbeing across the lifespan: *A Better Start* ('Improving the potential of young New Zealanders to have a healthy and successful life'), *Healthier Lives* ('Research to reduce the burden of major New Zealand health problems'), and *Ageing Well* ('Harnessing science to sustain health and wellbeing into the later years of life').

AGEING WELL

The Ageing Well National Science Challenge, *Kia eke kairangi ki te taikaia mātuatanga*, is based upon a nine partner collaboration, with University of Otago acting as the host institution; other institutions include universities such as University of Auckland and AUT University, as well as AgResearch (a Crown Research Institute) and CRESA (Centre for Research Evaluation and Social Assessment). The initial RFP

(Request for Proposals) from the Ministry in February 2014 highlighted three themes for research focus, as outlined below (Table 1) (Ministry of Business, Employment and Innovation 2014).

Table 1: Ageing Well – Research Themes and Impacts

Themes	Outcomes
Maintaining brain health	The number of older people requiring residential care due to cognitive and other neurodegenerative deficits, including those resulting from strokes, is reduced.
Dealing with physical frailty	Older people maintain more independent mobility later in life with reduced osteoarthritis and fracture rates, reduced hospital re-admissions, and increased physical activity.
Enhancing the role of older people in society	Older people have increased engagement and a sense that their roles and contributions are valued and supported within their culture and communities.

Like all Challenges, the fundamental difference between Ageing Well and other research funding agencies such as Health Research Council and Lottery Health, is that the research it funds is mission-led (cf researcher-initiated research). For Ageing Well, the defined mission is: *to push back disability thresholds to enable all New Zealanders to reach their full potential through the life course with particular reference to the latter years of life*. It should be noted that further extending lifespans is not a primary focus for research in this Challenge; rather the focus is on improving health and wellbeing: *'adding life to years, rather than years to life'*.

The Challenge was awarded a total of \$14.6 million in 2015, based upon an agreed Research and Business Plan (Ageing Well Research and Business Plan 2015), to cover a five year funding window ('tranche') until June 2019. The importance of this (and the funds provided for the other 'health' Challenges) is that it represents new research funds and opportunities for research in health and wellbeing. Furthermore, as with other Challenges, it is planned that a second 5 year tranche of funding will be available from 2019–2024. A significant proportion of the first tranche funding has already been allocated to research projects (see Table 2). Furthermore, the Challenge has set aside some \$3.5 million for a contestable project round during 2016, which is currently being pursued in collaboration with Health Research Council, and Ministry of Health. Within this open round it is anticipated that there will be dedicated funds to support Māori researchers and research associated with the Ministry of Health's Mobility Action Programmes.

Table 2: NSC Ageing Well - Core Funded Research Projects (Ageing Well 2015)

Research Project Title	Lead Investigator(s)
Enabling older people's independence, active lives and participation in the face of structural housing tenure changes and reliance on rental housing	K. Saville-Smith (CRESA) and colleagues
Transforming ways of living and reducing frailty*	R. Teh (Auckland) and colleagues
Social isolation and loneliness amongst older people within the multicultural New Zealand context: implications for ageing in place and service delivery	M. Gott (Auckland) and colleagues
Can neurodegenerative end of life care be improved with individualised interventions?	M. Boyd (Auckland) and colleagues
Older people in retirement villages: unidentified need and intervention research	M. Connolly (Waitemata DHB and Auckland) and colleagues
Risk factors for reduced social engagement in older people	H. Jamieson and S. Keeling (Otago, Christchurch)
Evaluation of the Drug Burden Index to predict adverse outcomes in older people	H. Jamieson (Otago, Christchurch)
Health and Wellness Coaching (HWC) for primary stroke and CVD prevention: an RCT	V. Feigin (AUT) and colleagues
Implanted electrical stimulators to augment stroke recovery*	J. Reynolds (Otago) and colleagues

Notes: *, include physiotherapy researchers

RELEVANCE FOR PHYSIOTHERAPY

Table 2 highlights several key areas of interest to physiotherapists. While several of the projects presented in the table include the active involvement of physiotherapy researchers as co-investigator (denoted *), it can be seen from the titles that most have direct relevance to – and will undoubtedly have impact for – physiotherapy research and practice, now and into the future.

In addition, with the forthcoming Challenge contestable round, there will be further opportunities for physiotherapists to become involved and contribute to the work of the Challenge, as members of research teams, co-investigators, or as principal investigators.

New Zealand is already recognised for high quality research in the area of ageing, including pioneering research on falls prevention (Campbell et al 1999); a significant proportion of this research has involved or been led by physiotherapists (Hale et al 2012, Sullivan et al 2014, Taylor et al 2012, Wagenaar et al 2012). As the programme of research funded by Ageing Well continues to grow and develop, it is hoped that there will be similar opportunities for engagement by physiotherapy researchers, working with multidisciplinary research teams, to help push back the disability thresholds for all New Zealanders. This is important, as physiotherapists because of their background, skills and training can bring a unique perspective to the work of the Challenge.

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Challenges of undertaking a clinical trial using bubble-PEP in an acute exacerbation of chronic obstructive pulmonary disease: A feasibility study.

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ABSTRACT

The aims of this study were to compare the effect of bubble-positive expiratory pressure with a commercial positive expiratory pressure device and standardised physiotherapy in patients with an acute exacerbation of chronic obstructive pulmonary disease, and to assess the feasibility of inpatient research methods. Patients admitted to a medical ward at Middlemore Hospital, Auckland, New Zealand, with an acute exacerbation of chronic obstructive pulmonary disease were randomly assigned to a treatment group. Participants undertook one supervised treatment, then independently completed two further sessions. Participants' symptoms and ease of sputum expectoration were measured using the Breathlessness, Cough and Sputum Scale. Health-related quality of life and length of hospital stay were also recorded. Only eleven participants were recruited, over ten months. The study was, therefore, underpowered to show differences in end points. Useful findings were uncovered relating to the feasibility of the protocol. Limitations to the recruitment process were identified, including staffing issues and the assessment schedule. Findings from this study will enable revision of the study protocol to allow a modified trial to be performed in the future.

Eastwood B, Jepsen N, Coulter K, Wong C, Zeng I (2016) Challenges of undertaking a clinical trial using bubble-PEP in an acute exacerbation of chronic obstructive pulmonary disease: A feasibility study. New Zealand Journal of Physiotherapy 44(1): 8-16. doi: 10.15619/NZJPINZJP44.1.02

Key Words: Pulmonary Disease, Chronic Obstructive; Physiotherapy; Breathing Exercises; Sputum; Cough.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a respiratory disorder identified by persistent, progressive airflow limitation that is not fully reversible (Global Initiative for Chronic Obstructive Lung Disease 2016, McKenzie et al 2003). Individuals diagnosed with COPD present with chronic, progressive breathlessness, cough, and often sputum production (Seemungal et al 1998). Mucus hypersecretion, ciliary dysfunction, obstruction of airways and loss of elastic recoil of the lungs in COPD impair natural airway clearance (Kim et al 1987, Pryor 1991). Reduced secretion clearance is associated with increased frequency of COPD exacerbations, which are a major cause of hospital admissions and may result in premature death (MacIntyre and Huang 2008). There is limited good-quality evidence for the effectiveness of airway clearance treatments in an acute exacerbation of COPD (AECOPD) (Osadnik et al 2012).

Positive expiratory pressure (PEP) is a form of airway clearance. It splints the airways open on expiration, allowing greater movement of air and more effective sputum movement (Kim

et al 1987). In the presence of sputum plugging, PEP allows an increased volume of air to accumulate behind the sputum via collateral ventilation, moving sputum centrally towards larger airways to aid expectoration (Holland and Button 2006). It has been found to be an effective form of airway clearance for people with COPD (Ides et al 2011). Commercial PEP devices are expensive, costing between NZ\$40-160; however, an alternative form of PEP that is inexpensive (costing less than \$2 to make) and is used by some New Zealand and Australian physiotherapists to manage secretion clearance in COPD, is bubble-PEP (Lee et al 2008, Miller et al 2005). Bubble-PEP is an easily constructed device consisting of a bottle, part-filled with water, and a piece of tubing, through which the patient exhales to create bubbles in the water (Mestriner et al 2009). Despite bubble-PEP being commonly used, there is limited evidence assessing the effectiveness of this particular device for use in secretion clearance in the COPD population (Miller et al 2005). This paper reports a clinician-led feasibility study to investigate the effects of bubble-PEP.

Recruitment problems are common in clinical trials (McDonald et al 2006, Osadnik et al 2012, Seemungal et al 1998, Su et

al 2007). It is estimated that less than a third of randomised controlled trials successfully achieve their recruitment target in the given time, and 50% of trials extend recruitment time in order to achieve their target (McDonald et al 2006, Osadnik et al 2012). Clinician-led research brings its own challenges, adding to the complexity of conducting research in the clinical setting. Clinicians undertaking research often lack the time to focus on research, have demanding clinical responsibilities and do not have adequate support staff to carry out a trial (Trewick et al 2013). Many clinician-researchers perceive a conflict between the two roles and do not feel they have adequate training to take on the role of the researcher (Rahman et al 2011). Our study confronted these challenges while undertaking an inpatient clinical trial.

The aims of this feasibility study were firstly, to compare the effect of bubble-PEP with TheraPEP® (a type of commercially available PEP, registered trademark of Smiths Medical) and standardised physiotherapy in patients with an AECOPD, and also to assess satisfaction with the intervention and feasibility of recruitment. This paper reports the methods employed and difficulties encountered when undertaking this clinical trial, including issues around participant recruitment, interventions, assessment scheduling and choice of outcome measures. This discussion may inform the development of a future study.

METHODS

Design

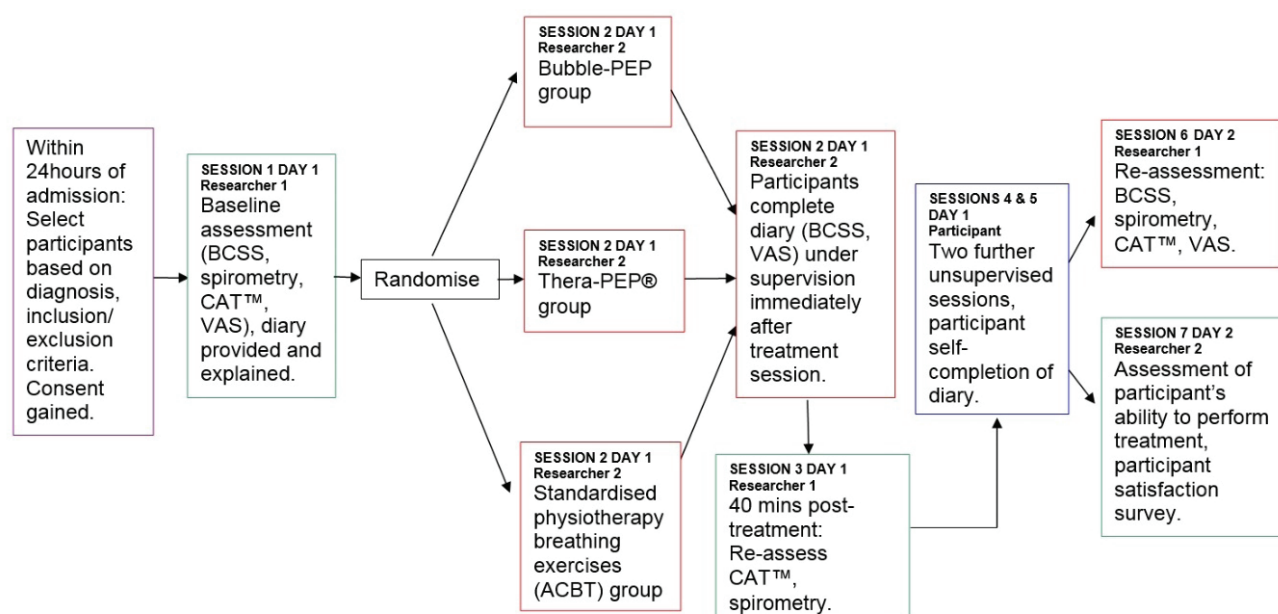
This was a single-centre, single-blinded, parallel group trial with adult patients admitted to Middlemore Hospital with an AECOPD with sputum production. The trial received approval from the Health and Disability Ethics Committee (reference number 13/NTA/81) and the Counties Manukau District Health Board Research Committee. It was registered with the Australia New Zealand Clinical Trials Registry, with the Universal Trial Number U1111-1142-1941.

The process for assessment and intervention is outlined in Figure 1. Potential participants were identified via the Ward Information Management System (trademark of PimsProduction) by physiotherapists working Monday to Friday on the medical wards. Participants were assessed by the first researcher, who was blinded to the intervention, within 24 hours of admission. Baseline outcome measures are listed in Figure 1 and further described later in this paper. Participants were randomly allocated to one of three treatment groups – 1) bubble-PEP, 2) TheraPEP® or 3) standardised physiotherapy. Participants received one supervised treatment (supervised by the second researcher) on day one and were reassessed 30 minutes later, using the same outcome measures, by the first researcher. Participants then completed two further independent treatment sessions on day one and completed a diary to document the time and effectiveness of treatment, using outcome measures listed in Figure 1. On day two, participants were reassessed on baseline outcome measures by the first researcher. The second researcher assessed the participant's ability to perform the treatment and collected the diary, and the participant completed the participant satisfaction questionnaire.

Participants

Participants were recruited between August 2013 and May 2014 from the acute medical wards at Middlemore Hospital. Patients over 18, admitted on week days with an AECOPD and sputum production were considered for inclusion. Inclusion criteria comprised:

- Diagnosis of mild, moderate or severe COPD, based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (2010), with spirometry showing a forced expiratory volume in one second (FEV_1) / forced vital capacity (FVC) ratio < 0.7.



Notes: BCSS, Breathlessness, Cough and Sputum Scale; CAT™, COPD Assessment Test; VAS, visual analogue scale indicating ease of expectoration; ACBT, Active Cycle of Breathing Technique.

Figure 1: Flow chart showing the process for assessment and intervention

- Exacerbation with reported sputum, based on GOLD (Global Initiative for Chronic Obstructive Lung Disease 2010) definition: "An event in the natural course of the disease characterised by a change in the patient's baseline dyspnoea, cough and/or sputum that is beyond normal day-to-day variations, is acute in onset, and may warrant a change in regular medication in a patient with underlying COPD" (p 64).
- Able to speak and read English.
- Informed consent to participate in research.
- Were currently receiving bi-level positive airway pressure treatment (as they were already receiving a form of positive pressure).
- Had any contraindications to PEP, for example risk of barotrauma, undrained pneumothorax (American Association for Respiratory Care 1993).
- Had any contraindications to airway clearance techniques, for example active haemoptysis (American Association for Respiratory Care 1993).
- Had been recruited to the trial on a previous admission.
- Had a diagnosis of bronchiectasis, confirmed on high resolution computed tomography, or a highly suspected clinical diagnosis.

Patients were excluded if they:

- Were unable to complete questionnaires or actively participate in treatment for any other reason.
- Had regularly used any form of PEP at home.

The process of recruitment and exclusion is outlined in Figure 2. Eligible participants were randomised using computer-generated

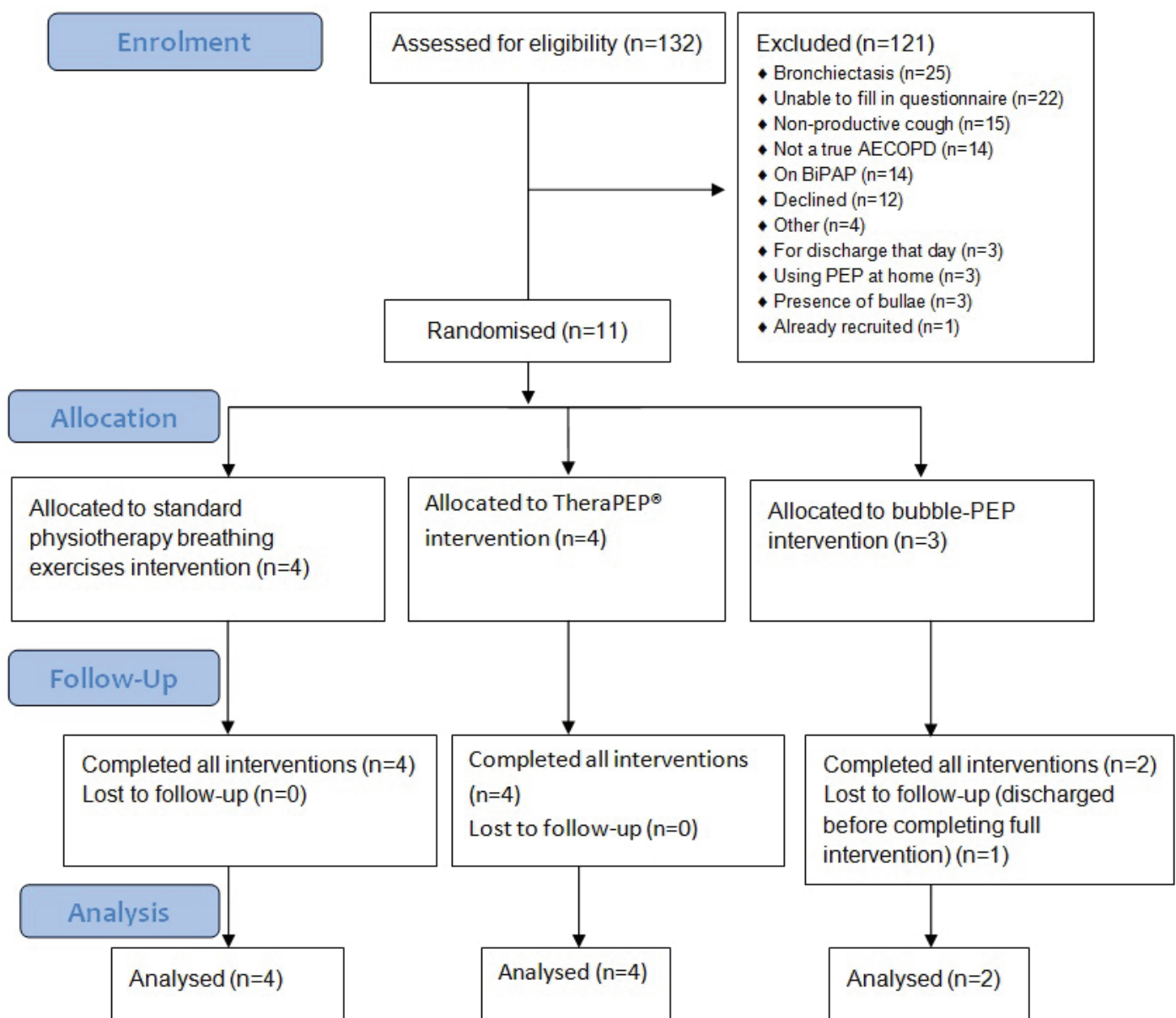


Figure 2. CONSORT diagram (2010) showing the process through the phases of the trial

treatment codes, which were placed in a sealed envelope and opened prior to the intervention by the second researcher.

Intervention

Three secretion clearance techniques were carried out with participants in the intervention groups: bubble-PEP, TheraPEP® or the active cycle of breathing technique (ACBT) (Pryor 1991) as the standardised physiotherapy intervention. Each session consisted of three sets of the allocated intervention, with a five minute rest between sets. Participants were provided with a written instruction sheet for their intervention. All groups also received education regarding inhaler use and physical activity, and mobility was assessed as required.

The bubble-PEP intervention was carried out using a home-made bubble-PEP device constructed according to the recommendations outlined by Mestriner et al (2009). The bottle was part-filled with 10cm of water to give 10cmH₂O pressure. A photo of the device is presented in Figure 3. The device was set up in front of the participant on a table, and they were instructed to:

1. Seal their lips around the tubing and exhale with a little force for three seconds to create bubbles.
2. Repeat this for 10 breaths.
3. Perform two huffs (forced expiratory technique – demonstration was given).
4. Cough.

Repeat steps 1-4 twice more, with a 5 minute rest in between sets.



Figure 3. Set-up of bubble-PEP device

The TheraPEP® intervention was carried out as per the manufacturer's instructions, with the participant sitting upright with elbows resting on a table, holding the device in front of them. The participant was instructed to:

1. Seal their lips around the mouth piece and exhale with a little force for three seconds, so the blue disc rises to between the lower and upper black line. Hold at that pressure for a count of three.
2. Repeat this for 10 breaths.
3. If it is too easy to reach the top line, increase the resistance.
4. Perform two huffs (forced expiratory technique – demonstration was given).
5. Cough.
6. Repeat steps 1-4 twice more, with a 5 minute rest in between sets.

ACBT, the standardised physiotherapy intervention, was carried out with participants sitting upright. They were instructed to perform:

1. Three slow deep breaths in through their nose.
2. Three relaxed breaths.
3. Three more slow deep breaths.
4. Three relaxed breaths.
5. Two huffs (forced expiratory technique – demonstration was given).
6. One cough.
7. Repeat steps 1-6 twice more, with a 5 minute rest in between sets.

Primary outcome measure

Breathlessness, Cough and Sputum Scale (BCSS)

The BCSS is a valid and reliable outcome measure that is responsive to change in people with COPD (Leidy et al 2003a). While it has not been specifically validated in an inpatient population, it has been shown to identify symptomatic improvements in an AECOPD (Leidy et al 2003a).

Secondary outcome measures

Length of stay

Length of stay was recorded in hours from the Patient Information Management System (trademark of PimsProduction), from the time of admission until the time the participant left the medical ward.

Visual analogue scale

The visual analogue scale is a 10cm horizontal line with 'Very Easy' marked on the left and 'Impossible' on the right. Participants were asked to "please mark on the line how easy you found it to cough up your sputum". The point at which the participant's mark intersects the horizontal line was measured in millimetres from the left of the line.

Spirometry

Spirometry was completed by one researcher using a Microlab™ spirometer, registered trademark of CareFusion Corporation.

The spirometer was calibrated weekly. A standardised instruction sheet, meeting American Thoracic Society and European Respiratory Society standards, was followed (Miller et al 2005). At each assessment session, three good quality blows were completed and the FEV₁ and FVC from the best blow were recorded.

Health-related quality of life - COPD Assessment Test™ (CAT™)

The CAT™, registered trademark of GlaxoSmithKline, is a simple, valid and reliable questionnaire for assessing the impact of COPD on quality of life that is strongly correlated with other respiratory-specific quality of life questionnaires (Jones et al 2009). It is recommended for use in clinical trials to assess the ability of interventions to reduce exacerbation severity (Mackay et al 2012).

Participant satisfaction survey

This survey was created and trialled specifically for use in this study. It contains items on ease of performing the intervention, how effective participants felt their intervention was and reasons for not completing the treatment as prescribed. This gave an indication of compliance and perceived benefits of the three different treatment options.

Ability to perform treatment

Participants were observed performing the treatment intervention on day two by the second researcher. Participants' ability to perform the treatment was assessed using a visual analogue scale to score their positioning, technique and their ability to follow the written instructions given for the treatment.

This provided useful information for the researchers to assess how easily participants could follow the given instructions.

Sample size

Based on studies by Leidy et al (Leidy et al 2003a, Leidy et al 2003b), the mean (standard deviation) for the BCSS total scores for patients with COPD is reported to be 5.2 (2), and a decrease of greater than 1 point indicates a substantial symptomatic improvement. A power calculation determined that a sample size of 75 (25 in each arm, allowing for a possible 5% withdrawal rate) would be sufficient to detect a significant difference of 2 points in the BCSS between the active arms and standard care, with a 90% statistical power.

Statistical analysis

The continuous variables were presented as either mean and standard deviation, or median and inter-quartile range for the three randomised participant groups. The categorical variables were summarised as frequencies and percentages for each group.

RESULTS

Approximately 1085 patients were admitted to the hospital with an AECOPD during the 10 month recruitment period (extended from the expected 7 months), including weekend admissions. Of the 132 patients screened, 36 (27%) met the inclusion criteria and 11 (8%) consented to participate in the study. Reasons for exclusion are documented in Figure 2. One participant who was successfully recruited was discharged before undertaking the second day's assessment and treatment sessions and was subsequently lost to follow-up. The other ten participants

Table 1. Participant characteristics by group

Characteristics	Standard care (n=4)	TheraPEP (n=4)	BubblePEP (n=3)	Total (n=11)
Male	4	3	2	9
Ethnicity:				
NZ European	3	3	2	8
Māori	0	1	1	2
Cook Island Māori	1	0	0	1
Age (years)*	73 (9)	74 (16)	78 (11)	
Spirometry:*				
FEV ₁ (L)	1.1 (0.2)	1.0 (0.6)	0.8 (0.3)	
FEV ₁ (%)	39.0 (7.3)	34.0 (13.9)	34.0 (11.8)	
FVC (L)	2.5 (0.92)	2.1 (0.95)	1.6 (0.15)	
FVC (%)	36 (1.2)	37 (0.6)	31 (0.3)	
FEV ₁ /FVC (%)	55.5 (8.1)	46.5 (13.2)	47.3 (17.9)	
CAT score*‡	23.8 (2.8)	26.3 (6.4)	20.7 (15.4)	

Notes: NZ, New Zealand; FEV₁, forced expiratory volume in one second; FVC, forced vital capacity; CAT, COPD Assessment Test; * Data presented are mean (SD); † Scored from 1-5, where higher scores indicate worse dyspnoea; ‡ Scored from 0-40, where higher scores indicate a greater impact on HRQoL; § Data presented are median (IQR).

participated in all assessment and treatment sessions. These results provide estimates of eligibility rate (27%), decline rate (33%) and attrition rate (9%). Recruitment was ceased after 10 months because of difficulty in recruiting, and researchers leaving the organisation.

Characteristics of participants and groups

A total of eleven participants were recruited. Nine out of eleven participants were male, and most were of New Zealand European ethnicity. COPD severity was similar across groups. All

groups had an average FEV₁ of between 30 and 50% predicted, which indicates severe COPD (Global Initiative for Chronic Obstructive Lung Disease 2016). Health-related quality of life scores were similar across groups, as shown by the CAT™. A full outline of participant characteristics is shown in Table 1.

There were no adverse effects experienced by any of the participants during the study. Scores for all outcome measures for each of the three groups are presented in Table 2. On statistical analysis, no significant differences were detected.

Table 2. Mean (SD) scores per group for outcome measures at all re-assessment points

Assessment	Standard Care (n=4)	TheraPEP (n=4)	Bubble-PEP (n=3)
BCSS*:			
Day 1, after supervised treatment (30 minutes post-baseline)	4.3 (1.0)	7.0 (4.8)	6.5 (3.5)
Day 1, after unsupervised treatment 1	4.8 (2.9)	6.0 (3.4)	6.5 (3.5)
Day 1, after unsupervised treatment 2	5.3 (1.2)	5.5 (1.3)	5.0 (NA)
Day 2 re-assessment	6.8 (1.5)	6.0 (4.1)	5.0 (1.4)
VAS†:			
Day 1, after supervised treatment	21.5 (19.3)	59 (40.8)	57 (39.6)
Day 1, after unsupervised treatment 1	20.3 (15.7)	70.8 (44.4)	67 (39.6)
Day 1, after unsupervised treatment 2	56.3 (40.1)	49 (33.9)	76 (NA)
Day 2 re-assessment	32.3 (34.4)	47.5 (44.3)	58 (52.3)
Spirometry:			
Re-assessment day 1 (40 minutes post-treatment)			
FEV1	1.2 (0.3)	1.0 (0.5)	0.8 (0.2)
FVC	2.15 (0.87)	1.92 (0.85)	1.72 (0.27)
FEV1/FVC	58.3 (17.1)	55.0 (16.1)	48.0 (20.8)
Re-assessment day 2			
FEV1	1.0 (0.1)	1.2 (0.7)	0.8 (0.3)
FVC	1.99 (0.45)	2.31 (1.06)	1.36 (0.57)
FEV1/FVC	51.5 (11.1)	51.0 (14.2)	48.5 (14.9)
CAT:			
Re-assessment day 1 (40 minutes post-treatment)	22.5 (5.0)	24.8 (6.9)	29.3 (3.5)
Re-assessment day 2	21.3 (5.5)	21.8 (8.1)	27.0 (8.5)
LOS‡:			
	3.5 (2.5-7)	4 (3-5.5)	7 (1-7)
Patient satisfaction survey: "The treatment was worthwhile"			
Agree	1	2	2
Neutral	1	0	0
Disagree	2	2	0

Notes: BCSS, Breathlessness, Cough and Sputum Scale; VAS, Visual Analogue Scale; FEV₁, forced expiratory volume in one second; FVC, forced vital capacity; CAT, COPD Assessment Test; LOS, length of stay; * Scored from 0-12, where higher scores indicate more severe symptoms; † Expressed in millimetres. Participants marked on a 100mm line how easy it was for them to clear their sputum, from very easy (0mm) to impossible (100mm); ‡ Presented as median (IQR).

Findings of this study show that participants found it easy to perform all treatment interventions. Of the participants who completed the scheduled follow up, all participants in the bubble-PEP group found the treatment worthwhile. In the standardised physiotherapy care group, two participants did not think the treatment was worthwhile and one was neutral about this. In the TheraPEP® group, half of participants thought the treatment was worthwhile and half did not.

DISCUSSION

Bubble-PEP is widely used by physiotherapy practitioners in New Zealand and Australia as a secretion clearance technique, yet there is little evidence to support its efficacy (Lee et al 2008, Miller et al 2005). Other PEP devices, such as TheraPEP®, have been investigated and found to be useful, but expensive, adjuncts to standard physiotherapy (Ides et al 2011, Su et al 2007). While this study set out to investigate the efficacy of such techniques, several barriers limited recruitment, resulting in a small sample and an insufficiently powered study, hence few conclusions relating to the investigated outcome measures could be made. Lessons were learnt regarding the methods used in this study; these feasibility issues will need to be addressed to enable a fully powered study to be completed.

Feasibility of recruitment

This study recruited eleven participants over ten months – 1% of total COPD admissions to the medical wards at Middlemore Hospital over this period, and only 15% of the recruitment target. Recruitment difficulties are common in clinical trials, for many reasons, including patient eligibility, patients declining to participate and staffing (McDonald et al 2006).

Patient eligibility was a significant problem in the present trial. Many trials find fewer eligible participants than were expected before initiation of the trial (McDonald et al 2006). In this trial, the most common reasons patients were excluded from participating in the study were a comorbid diagnosis of bronchiectasis and being unable to complete questionnaires due to language or other difficulties. Only 12 eligible patients declined to participate. A flow chart indicating reasons participants were excluded is provided in Figure 2.

Inadequate staffing and poor allocation of dedicated research time are common barriers to clinician-led research (Rahman et al 2011). The push for productive patient care often impedes research activity in the clinical setting, and staffing problems, funding limitations and investigators leaving the facility are common reasons that research projects are not completed in Allied Health departments (Bailes and Baldwin 1995). Significant staffing limitations hindered recruitment to this study, which affected the ability to screen and recruit potential participants. Only 12% of all patients admitted to the hospital with an AECOPD were screened for inclusion. There were four months in which no participants were screened or recruited due to staffing limitations in the wider physiotherapy team, meaning the researchers had to prioritise clinical work over research to ensure adequate patient care. While grant funding was available to fill the clinical roles of the researcher-physiotherapists, their positions were unable to be filled and the clinical physiotherapy team was understaffed during much of the trial period. As

well as this, the two lead researchers left the organisation during the extended recruitment period of the study; this was one of the reasons for discontinuing the study. The assessors worked a standard (5 days/week) working week during the time of recruitment. Recruitment was limited to week days to reduce the number of assessors involved and to avoid penal rates for weekend work. Some potentially eligible participants were therefore not recruited as they were admitted over the weekend.

Having a dedicated research team and a longer recruitment period would have ameliorated the above limitations. A research team would be able to approach a greater proportion of patients admitted with an AECOPD, improving the likelihood that an adequate sample could be recruited. Earlier recruitment of participants would also be possible, ensuring that all interventions are undertaken in a timely manner prior to discharge. Researchers working with similar beliefs and attitudes are likely to initiate research and work collaboratively to conduct quality research (Janssen et al 2013). Partnership with a university may be an effective way to conduct clinical research, using an established research team and experienced researchers, who have the resources and skills to assist clinicians to initiate, develop and carry out a research project.

Rahman et al (2011) identify organisational culture as a barrier to clinician-led research. Many clinicians are keen to engage in research, but are not given the time or support from their organisation to do so. Dedicated research teams require adequate funding and support from organisations involved. This must start from within the team – when senior clinicians and managers are involved in research, junior clinicians are likely to follow, helping to build an organisational culture that values research (Janssen et al 2013). Organisations must embrace the potential benefits of clinician-led research to clinicians, patients and the organisation and encourage clinicians to engage in research (Rahman et al 2011).

A multi-centre trial may increase the number of participants eligible for enrolment in the study and would improve the generalisability of findings (Cooley et al 2003, Gul and Ali 2010). Multi-centre trials do, however, have associated disadvantages, such as cost, difficulty maintaining research integrity and cooperation of research teams across sites (Cooley et al 2003). Alternatively, sampling from an outpatient population could aid recruitment of appropriate participants.

Another limitation to recruitment was the reduced sputum load of patients admitted to the medical wards over one winter. Sputum production is not always a clinical feature of COPD - the prevalence of chronic cough and sputum production (chronic bronchitis) has been reported to be between 14 - 35% in people with COPD (de Oca et al 2012, Kim et al 2011, Lu et al 2010, Munro and Bloor 2010). Patients with a dry cough were not recruited to the study because they did not require therapy for secretion clearance. Expanding the participant group to include those with bronchiectasis would increase the number of potential participants for recruitment.

Feasibility of the intervention

All interventions were performed and tolerated well by

participants. Of the three techniques, ACBT (standardised physiotherapy) can be taught and performed by people at home free of cost, whereas PEP requires some equipment – bubble-PEP is inexpensive, while TheraPEP® is more costly. In the current economic climate, cost-effective therapy options are important for the maintenance of hospital physiotherapy services. As well as this, for the population involved in this study, cost is a barrier to participation in therapy. For these reasons, ACBT and bubble-PEP would be the most feasible options for secretion clearance interventions in hospital and community settings.

Feasibility of the assessment schedule

This study protocol required participants to take part in assessment and treatment on two consecutive days. There were several limitations to this schedule. Firstly, timing three sessions (assessment, treatment and reassessment) on one day was difficult for the assessors, who were also working as clinicians, managing acute case-loads on the medical wards. Secondly, in order for participants to have enough time to complete their assigned treatment three times on the first day, assessments needed to be completed on the morning of that day, adding further pressure to the assessors' scheduling challenges. Lastly, several patients were unable to be recruited as they were preparing for discharge, so would be unable to complete reassessment on day two. Middlemore Hospital has the lowest average length of stay for COPD patients in Australasia; those patients admitted to Middlemore Hospital with an AECOPD during the study's recruitment period had an average length of stay of just 3.6 days. One participant was lost to follow-up due to being unexpectedly discharged before completing reassessment.

Choice of outcome measures

Identification of specific, sensitive, valid and reliable outcome measures to assess short-term responses to therapy is a challenge, as demonstrated by this study. There is no gold-standard outcome measure to assess effective secretion clearance. Spirometry was the only objective measure used, which is the internationally accepted tool for diagnosing COPD (McKenzie et al 2003). It is widely used to assess severity of COPD, but is insensitive to sputum transport and the efficiency of secretion clearance techniques (van der Schans 2002).

While the questionnaires used in this study were appropriate, valid and specific outcome measures for identifying symptoms of COPD, the use of questionnaires presented a barrier to recruitment. The Counties Manukau population is multi-cultural; many potentially eligible participants did not speak English and were unable to accurately fill in English questionnaires. Translations of the questionnaires have not been validated, so these patients were excluded from the study. If questionnaires were translated and assessed to have adequate validity, the use of these questionnaires would allow for greater participation from a wider range of the population.

The nature of the inpatient population presents another difficulty with using questionnaires. Those considered for inclusion in the study were predominantly older adults, some of whom reported they found reading and writing challenging due to poor eyesight or dexterity. Some people were therefore excluded because they would not be able to accurately fill in the

questionnaires or diary. If the outcome measures were validated to be read out by the researcher then this would also allow for greater participation.

Assessment findings

This study was not sufficiently powered to detect differences between groups. The sample size required to fulfil the power calculation was 75; this number would only be achievable in a multi-centre trial, or with a dedicated research team who were not juggling clinical duties as well as research.

CONCLUSION

This study highlighted several unforeseen challenges in the recruitment and assessment process. Undertaking a clinician-led clinical trial in an inpatient population proved difficult, because of the challenges experienced by clinician-researchers in recruiting participants and efficiently carrying out the intervention and assessment. This study suggests that further research investigating the effectiveness of PEP as a secretion clearance technique would be useful, if changes are made to the research protocol. Validation of translated questionnaires will be imperative to aid recruitment. Further investigation of the study population prior to initiation of the trial will also help to set realistic timeframes for recruitment targets.

When undertaking research in the acute medical ward environment, flexibility is required in order to recruit and carry out interventions in a comprehensive and timely manner. It would be more efficient to have a dedicated team of researchers with dedicated research time, who are not simultaneously managing clinical work. Alternatively, a larger group of physiotherapists could each dedicate some time to research, as long as research is prioritised above other competing interests. The challenges faced by clinician-researchers must be recognised; organisations must support and value clinician-led research in order to promote evidence-based health care practice.

KEY POINTS

1. Bubble-PEP is performed easily and is enjoyed by participants, though there is little firm evidence to support its efficacy.
2. The challenges of managing research and clinical workloads simultaneously limited our ability to efficiently recruit participants to this study.
3. A dedicated research team is necessary to carry out an adequately powered study in the COPD population.

PERMISSIONS

This study was approved by the Health and Disability Ethics Committee under the ethics reference code 13/NTA/81. The Universal Trial Number is U1111-1142-1941. Informed consent was obtained from all participants.

DISCLOSURES

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The researchers have no conflict of interest to declare.

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Embedding an allied health service in the Nelson Hospital Emergency Department: A retrospective report of a six month pilot project

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ABSTRACT

Embedding allied health into the emergency department (ED) was considered the best option by a 2011 Nelson Marlborough District Health Board (NMDHB) strategic planning group exploring innovative ways to bridge the gap between primary care and the ED and thus enhance the service. A six month pilot project implemented in 2012 aimed to provide a more timely multidisciplinary approach to patient care, facilitate safe discharge and linkages into the primary care sector, reduce multiple presentations and keep within ED designated time frames. Physiotherapy and social work practitioners worked as part of an inter-disciplinary team to comprehensively assess clients' specific needs. The establishment of primary physiotherapy contact, where appropriate patients were identified directly from initial presentation, solely assessed and treated by the physiotherapist improved patient flow for lower triage presentations and made full use of staffing resources. Data collection over the first 22 weeks showed the allied health practitioners in ED had 749 new patient contacts, including 120 primary physiotherapy contacts. ED patients found the service extremely helpful. Survey responses from key stakeholders and ED staff highlighted the benefit of allied health interventions in improving safety of ED discharges, and the value of comprehensive client centred patient care. The Executive Leadership Team of the NMDHB unanimously endorsed the continuation of the allied health service in the emergency department from December 2012.

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Key Words: Physiotherapy, Social Work, Emergency Department, Allied Health, Multidisciplinary team

INTRODUCTION

Changing population demographics with an increase in the number of people presenting with often multiple long term conditions have placed strain on emergency department (ED) service provision in New Zealand and internationally. The traditional medical ED model of care is considered not well suited to fully manage the comprehensive package of care these patients require (Rea et al 2010). Also, there are increasing issues in providing the care required within expected time frames. Different models of ED care (Australian and New Zealand Society for Geriatric Medicine 2008, Ministry of Health 2008, 2011, New South Wales Health 2006, The National Ageing Research Institute Australia 2007) point to improved access to allied health as being important in care provision.

Limited studies have been undertaken in the UK (Jibuik et al 2003, McClellan et al 2005, 2010), Australia (Farrell 2014, Gill and Stella 2013, Lau et al 2008, Morris et al 2015) and New Zealand (Canterbury District Health Board 2006) on the introduction and benefits to ED of physiotherapy. These studies largely looked at the role of an ED physiotherapist in

an advanced scope of practice (primary contact) role treating musculoskeletal presentations or specific injuries. Patient satisfaction was high, with decreased wait times for more minor injuries shown. However, there were no major differences in long term patient outcomes. Physiotherapy was felt to be a beneficial adjunct to ED care, especially in reduction of acute musculoskeletal back pain (Lau et al 2008). Two studies explored and discussed the positive impact the social work ED role could make to emergency care and costs by addressing client psychosocial issues. These studies speak positively but have limited evidence (Bywaters et al 2003, Van Pelt 2010). Studies looking at a multidisciplinary team approach to ED patient care in relation to high intensity users and complex presentations showed stronger links with the primary care sector and improved discharge planning (Moss et al 2002, Rea et al 2010).

In 2011, the Director of Allied Health and the Clinical Director of the Emergency Department Nelson became the sponsors of a project to best manage the identified gap in service delivery between the ED and primary sector (Ministry of Health 2011). The gap was caused by the increasing complexity and multi

factorial nature of presentations. The previous system of paging allied health services from elsewhere in the hospital did not provide a timely coordinated service. Due to time, bed space constraints, and ED staff not being fully aware of the benefits of allied health input, complex patients often would not receive allied health assessment and interventions.

The aims of the pilot project were to: (1) provide comprehensive patient care by a multidisciplinary team (MDT) in a timely manner, ensuring patient allied health needs were fully addressed, (2) support and enhance the ED six hours length of stay target required by the Ministry of Health (Ministry of Health 2011), and (3) facilitate safe discharge and linkages into the primary care sector, address falls risk issues, reduce multiple presentations and create management plans where appropriate.

This paper describes the implementation and delivery of a physiotherapy and social work service in ED and investigates patient, staff and key stakeholder perceptions of allied health input in ED.

METHOD

Nelson Emergency Department (ED) serves a catchment of over 100,000 people in the Nelson Region, providing a 24 hour service, seven days a week. It is categorised as a Level four dedicated 17 bed unit. The ED service sees approximately 25,000 patients per annum, seeing patients with serious injury or illness as a priority using the Australasian Triage System (ATS) with triage guideline categories one to five. Triage 1 patients are deemed medical emergencies requiring medical assessment and management immediately. Medically unstable patients should receive care within 10 minutes (triage 2) or medically unwell, within 30 minutes (triage 3). Triage 4 and 5 patients are deemed medically stable suffering non-life threatening injuries requiring input within 1 hour (triage 4) or 2 hours (triage 5).

In 2009, a weeklong trial of allied health service within ED in Nelson was undertaken. This short trial was valuable in deciding the parameters and direction of the 2012 planned pilot project, and also ensured the engagement of the whole ED team. Two allied health professions were chosen to be trialled in the pilot project: social work and physiotherapy. It was considered that these two professions could provide a wide skill base in practical assessment and management of physical, mobility, rehabilitation, support and psychosocial issues, and could link with other allied health services as required. Utilising the New Zealand legislation for direct physiotherapy referral (HPCA 2003), the pilot project established primary physiotherapy contact, where suitable patients were assessed and managed solely by the physiotherapist direct from the initial triage nurse assessment.

A six month pilot project to deliver both social work and physiotherapy services from within the ED was implemented in 2012. A working group between allied health, medical, nursing and key stakeholders ensured a robust quality, safety and clinical governance framework was in place. Due to the pilot process, time was set aside for regular meetings and initiatives related to the pilot.

Stakeholders involved in the pilot included Service Directors, Clinical Leaders for Allied Health Medical and Nursing, Support Works, Service Managers for Allied Health and Medical Directorate, Violence Intervention Co-ordinator, Nga Pukenga Hauora (an inpatient Māori Health support service), Paediatric Service, Alcohol and Drugs Service, Mental Health Services, Nelson Bays Primary Health Organisation, Primary Care (medical practitioners), community health providers, Accident Compensation Corporation, and the Medical and Injury Centre.

Staff Recruitment and Training

Clinicians with a minimum of five years post-graduate experience were recruited to fill the roles of full time social worker and full time physiotherapist. The allied health team consisted of three staff, the physiotherapy role being filled in a job share arrangement. Staff underwent a training and orientation programme in the ED and relevant information technology systems. Physiotherapists became accredited to issue basic occupational therapy equipment, and reviewed orthotic options. While the pilot was underway the physiotherapists underwent the Nelson Hospital X-ray training to be aligned to the established Nurse Initiated X-ray (NIXR) protocol for X-ray ordering, also plastering and splint workshops for simple fracture management. The social worker spent time in the community liaising with primary care services and community organisations to develop a strong knowledge of available options for clients.

Patient Referral and Selection Criteria

All patients presenting to ED were initially triaged by a nurse. A primary physiotherapy contact framework with clear inclusion and exclusion criteria was developed by physiotherapy personnel to provide safety parameters for appropriate referral. Patients to be recruited to the service were triage 4 and 5 patients with primarily musculoskeletal injuries. Exclusion criteria for primary physiotherapy intervention were patients presenting with constant unremitting pain, cauda equina signs and symptoms, raised temperature or signs of infection, significant mechanism of action/head injury, open wounds, children under five years, major deformities, confusion or altered level of consciousness, recent seizure activity, marked neurological change, and observations triggering an Early Warning Score (a system to detect abnormal observations of vital signs).

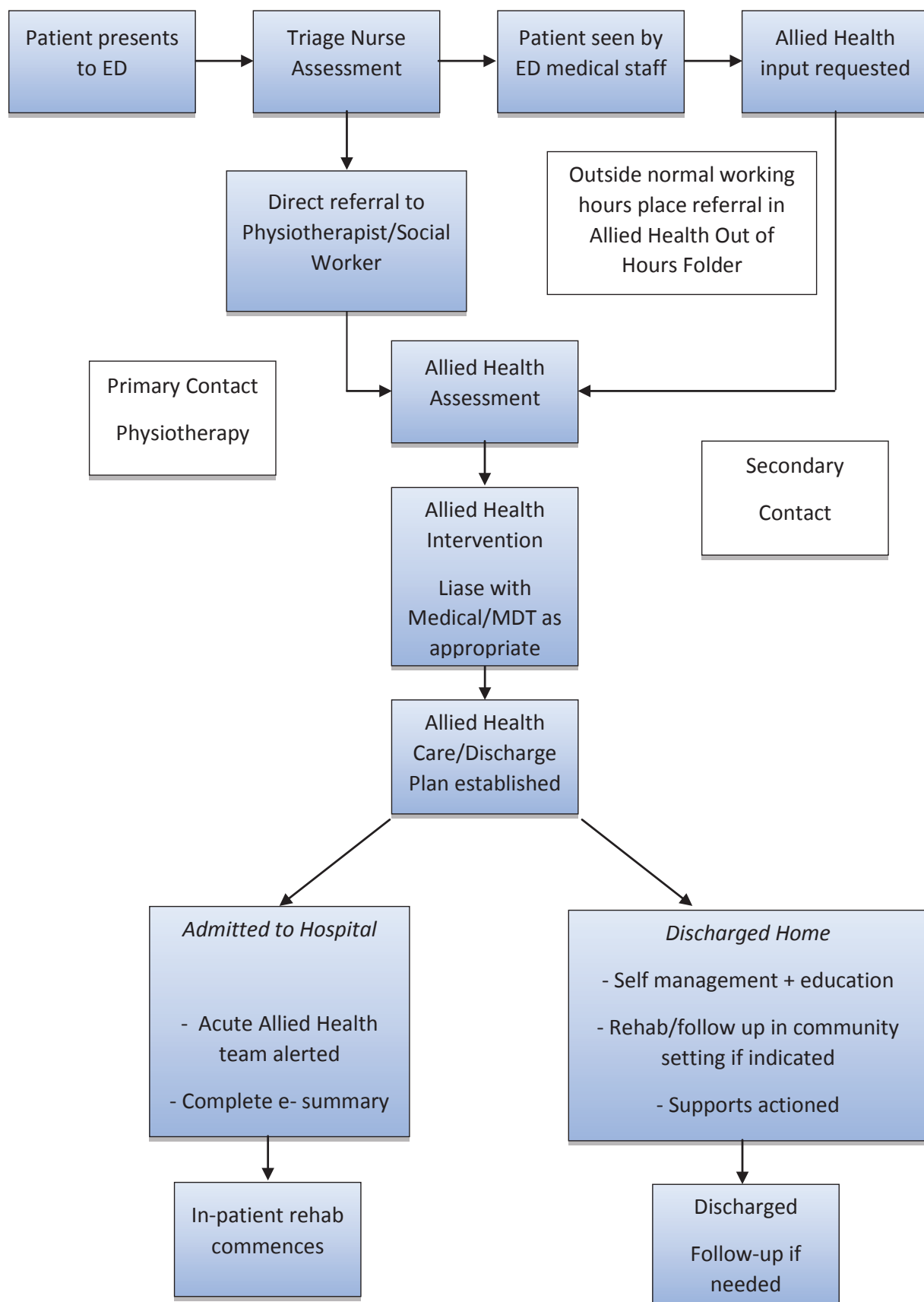


Figure 1: Emergency Department allied health intervention flowchart

Figure 1 shows the patient pathway through ED when allied health intervention was indicated. Physiotherapists were able to access primary referrals directly following the triage process either by verbal contact from the triage nurse or reviewing the patient folder. The triage nurse could also refer directly to the social worker if appropriate, who would then liaise with the primary clinician. Secondary referrals for both social work and physiotherapy were usually by direct verbal contact or phone, easily enabled by being embedded in the department. Physiotherapists proactively targeted any patients aged over 65 years presenting following a fall, or with a high falls risk. Following care, patients returned to community and primary care services or were admitted to hospital.

Multiple presenters are patients who present frequently to ED over a short time period with complaints not always appropriate for an emergency service that usually could be well managed in the primary sector. A group initiative including the ED social worker, ED team leaders, Registered Nurse Multiple Presenter coordinator, Mental Health representative, and a representative from St John (a charitable organisation providing frontline medical response) met regularly in 2012. The group's aim was to focus on the most frequent multiple presenters, to identify their main issues and see if or how their needs could be best met in the primary sector. The social worker had an active role in this process, linking patients with appropriate primary care services, facilitating multidisciplinary team meetings and helping develop workable management plans.

Data Collection and Analysis

As an audit of the new service, a data collection system and agreed evaluation framework were developed. Data were initially collected over a 22 week period from 30 April till 1 October 2012 for presentation to the Executive Leadership Team. A further data collection was undertaken at 35 weeks, the week of 31 December 2012. The allied health team recorded all allied health contacts, either new or follow-up, documenting the time seen, intervention reason, duration of intervention, onward referral pathway, and other patient related activity. Non-patient related activity was also captured. To assess benefits of allied health input outside normal working hours, practitioners worked several later shifts into the evenings and weekend days during the pilot. An "Allied Health After Hours"

folder was made available for ED staff to alert allied health to patients presenting outside normal work hours. These patients were followed up the next working day, and interventions instigated as appropriate.

Five months after initiation of the pilot project written questionnaires, especially designed for the project, were offered to ED patients, ED staff and stakeholders (as listed above) to evaluate how successfully the pilot was progressing. ED patients were asked to rate how helpful the allied health professional was on a scale where 1=extremely helpful and 5=unhelpful. Open questions were used to find out in what way patients found the allied health professional helpful and what suggestions they had for improving the service. This self-report questionnaire was either given to ED patients as they left the department to be completed and deposited in a post box at reception, or posted out and returned by mail. All questionnaires were anonymous.

ED staff received a questionnaire via the internal mail system, and could deposit anonymous replies in a slotted reply box in ED. They were asked to rate the service on a scale of 1 to 5 (1=extremely helpful and 5=unhelpful) as to how helpful they believed the allied health service was for ED, then complete open-ended questions on what they valued about the service, what improvements in care and cost savings it provided, the impact of discontinuing the service and ideas for service improvement. Key stakeholders were sent a questionnaire to provide qualitative feedback on how the allied health team had impacted on the wider hospital and primary care facilities, the impact on patients, and financial benefits. Administration staff collated all replies and entered the data into excel spreadsheets.

RESULTS

The total number of referrals to the allied health professionals represented 7% of the total ED presentations over the first 22 weeks. Of these 56% were female, 44% male, with ethnicity 81.8% New Zealand European, 10.2% Māori, 5.9% European, 1.3% Asian and 0.7% Pacific Island or other. There were 2.8% registered as living outside the NMDHB catchment area, travellers from other areas in New Zealand or overseas. The age range was widespread, with 35% of allied health contacts being over 65 years, followed by 30% in the 17 to 44 age group, 18% in the 45-64 age group and 17% 16 years and under.

Table 1: Number of allied health contacts

Discipline	Patient Contact	Week 1 - Week 22	Week 1 - Week 35
Physiotherapy	New Patients	429	824
	(Primary Contacts)	(120)	(258)
	Follow ups	45	50
	Total Contacts	474	874
Social Work	New Patients	320	510
	Follow Ups	287	459
	Total Contacts	607	969
Total Allied Health contacts in ED	New Patients	749	1334
	Total Contacts	1081	1843

Notes: ED, Emergency Department

Table 2: Total allied health non-contact time 22 weeks (%)

Non-Contact Activity	Percentage
Documentation/Notes/Admin	28%
Meetings operational	22%
Conference/study leave/education	12%
Liaison with Health Professionals	11%
Meetings clinical (not patient related)	9%
Presentations/ Teaching	8%
Liaison Community Organisations	4%
Travel	3%
Phone contact (not linked to patient)	2%

Table 3: Referral reason allied health

Referral Reason Social Work	New Contacts 35 weeks	Referral Reason Physiotherapy	New Contacts 35 weeks
Home cares	186	MSK Lower limb	295
Child Concerns	74	MSK Upper limb	186
Family Support	63	Falls	131
Financial	54	MSK Spine	92
Domestic Violence	41	Medical/Respiratory	87
Mental Health	24	MSK Multi Body Part	28
Multiple Presenters	18	Other	5
Alcohol/drugs	16		
Loss and Grief	14		
Trauma	10		
Homeless	7		
Isolation	3		

Notes: MSK, musculoskeletal

Table 4: Consumer and Emergency Department staff feedback

1-5 scale of value	Consumers Allied Health (n=51)	ED Staff Physiotherapy (n=42)	ED Staff Social Work (n=42)
1= Extremely helpful	44	39	41
2 = Very helpful	6	3	1
3 = Helpful	1	0	0
4 = Not very helpful	0	0	0
5 = Unhelpful	0	0	0

Notes: ED, Emergency Department

Table 1 shows the number of allied health contacts over the first 22 weeks and during the second data collection period from week 1 to week 35. This shows new contacts (including primary contact numbers for physiotherapy in brackets), follow up contacts and total contacts for each profession. Total allied health contacts are listed below. Table 2 presents the non-patient contact time and the way it was spent during the first 22 weeks of the pilot, documentation and operational meetings taking up most of this time.

The referral reasons for social work and physiotherapy interventions are shown in Table 3. Social work services focused on provision of home care support, child and family issues, addressing multiple presenters and financial stresses. The majority of physiotherapy contacts were for musculoskeletal injuries (MSK) and falls, but there was a diverse spread of presentations for both primary and secondary interventions.

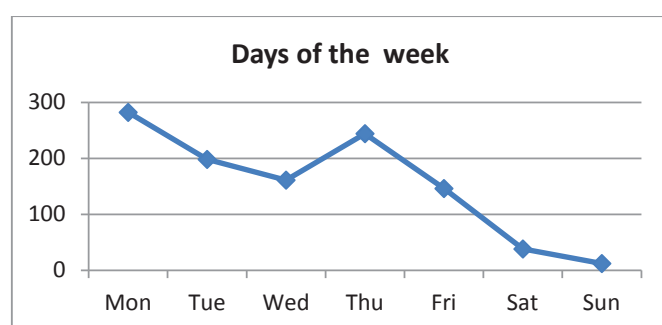


Figure 2: Allied health contacts over days of the week

Figure 2 shows the daily distribution figures of allied health interventions over the first 22 weeks. Presentations over the week were reasonably evenly spread, with an increase on Mondays, largely explained by weekend injuries. Allied health working weekend hours showed higher figures for Saturdays than Sundays, with contact numbers significant considering the few weekends trialled.

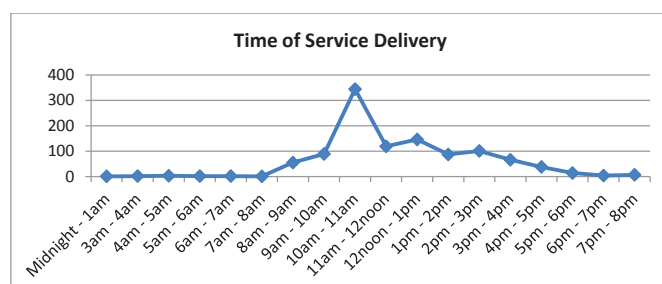


Figure 3: Time of allied health service delivery contacts

Figure 3 shows the daily allied health intervention time over this 22 week period. Intervention times showed a sharp increase in contacts from commencement of work till a peak mid-morning, then a steady flow, tailing off late afternoon/evening. By the end of December 2012 there were 278 referrals recorded in the Allied Health After Hours folder.

Following on from the multiple presenter meetings involving the ED social worker, by the end of 2012, management plans were in place for 70% of the most frequent ED presenters. These were formulated with client and primary case manager involvement and mutually agreed to.

Onward referrals in the first 22 weeks to community agencies and providers totalled 208. Of these 69 were to the hospital physiotherapy service, mainly the community therapists, and 56 to private physiotherapy providers. A further 83 were principally social work referrals for home care via Accident Compensation Corporation or Support Works, or child concerns. In total 18 different pathways or primary care services received referrals.

Allied Health Service Feedback

Consumers returned 51 questionnaires, a return rate of 60%. Table 4 shows the feedback from the allied health consumers. Allied health consumers found the service helpful in providing information, treatment, practical support and giving follow up advice (n=48). No concerns of not seeing the doctor were mentioned. Many consumers who had primary physiotherapy contacts appreciated the reduced waiting times (compared with what they were expecting), and found the service supportive and professional (n=23). Other consumers appreciated the allied health follow up call or onward referrals to community services (n=13), and being able to talk to someone empathetic (n=8). There were no suggestions given for improvements in the service received.

ED Staff Feedback

Questionnaires were returned from 42 ED staff, an 80% response rate. Table 4 shows how helpful they felt the service was to ED. Replies to open ended questions were collated and were found to be positive. Comprehensive quality patient care providing better outcomes (76%) was what ED staff valued most from the allied health ED service. These staff appreciated the individual expertise the professions were able to offer ED (73%), finding a social worker experienced in client psycho social needs of immense benefit (33%) and facilitating multiple presentation reduction (7%). Staff appreciated the physiotherapy musculoskeletal, mobility and falls risk assessments and management (35%). Timely allied health interventions helped ED flow (57%). The service was seen as an effective use of staffing resources, taking pressure off the medical and nursing team to let them concentrate on their roles of treating medically unwell ATS triage 1, 2 and 3 patients (38%). Allied health staff also supported young doctors, providing a second opinion on assessment and management of presentations. As for care improvements and cost savings, improved safety of ED discharges rated highly (64%), along with decreased admissions (38%), and fewer representations (38%). Increased community liaison and follow up (21%) all added to a holistic client centred model of care (12%).

Table 4: Consumer and Emergency Department staff feedback

1-5 scale of value	Consumers Allied Health (n=51)	ED Staff Physiotherapy (n=42)	ED Staff Social Work (n=42)
1 = Extremely helpful	44	39	41
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5 = Unhelpful	0	0	0

Notes: ED, Emergency Department

Staff felt the impact of discontinuing the allied health in ED service would be huge, with an increased workload for medical and nursing staff and a return to coordinating multiple services (40%). An increased length of stay was expected through having to page allied health staff stationed elsewhere in the hospital. They felt this would be a step backwards in service provision losing specialist input (38%), with again the threat of unsafe discharges, admissions for social and mobility issues, and representations (26%). Respondents considered allied health an integral part of a modern ED service, addressing social issues and improving staff morale and patient satisfaction (48%). When asked for ideas on service improvement, extending allied health into after hours (26%), weekend service (45%) and allocating a designated office space (5%) were mentioned.

ED staff reported that the allied health assessment and interventions of ED patients appeared to prevent an average of three hospital admissions per week; an estimated total of 66 prevented admissions over the initial 22 weeks.

Stakeholder Feedback

All stakeholders replied to the questionnaires, providing feedback as to how the pilot project had impacted on their diverse roles. Improved communication across the hospital and community had eventuated, through background work done to support patients admitted to hospital, and early identification of rehabilitation patients. Additional interventions meant fewer hospital admissions and positive links to primary providers. There was a change in workload with increased community physiotherapy referrals, decreased occupational therapy referrals for non-complex presentations, and acute allied health staff no longer being called to ED as well as having to manage their own inpatient workload.

Stakeholders felt the impact of allied health in ED on patients were: improved timely access for patients to ED, early assessment and identification of patient requirements, improved MDT interaction with higher quality information available, and that families were better supported.

Key stakeholders estimated financial benefits from the implementation of the pilot project over the first 22 weeks outweighed the costs. Cost savings were from an estimated 66 prevented admissions (average length of acute ward hospital stay 1-3 days). Furthermore there were 120 primary physiotherapy interventions where ED patients were assessed, treated and managed for less financial outlay than when using medical personnel. These cost savings outweighed the financial costs incurred with funding two full time allied health positions and administration outlay.

DISCUSSION

The pilot project embedding allied health in ED proved successful with 429 physiotherapy new patient contacts, 120 of these primary physiotherapy interventions and 320 social work new patient contacts over the first 22 weeks. Patients found the allied health input extremely helpful. Feedback from ED staff and key stakeholders was overwhelmingly positive with improved safety of discharges from ED to the community and comprehensive patient care rating highly important. Linking with primary health services helps improve care in the

primary sector and keep patients out in the community where possible, a model of care better suited to manage long term conditions (MOH 2011). With allied health working as part of an interdisciplinary ED team to provide comprehensive patient care, approximately 66 admissions to hospital were estimated to have been averted. Other cost savings harder to quantify were reduced representations due to social or mobility issues and falls reduction due to screening and appropriate intervention.

Multiple presenter management plans help guide clinicians in any future ED presentations, and are regularly reviewed as required to respond to clients' changing needs. It was deemed helpful to have a social worker with the time and skills to support patients and families in stressful situations in hospital; this strength based approach is in keeping with the principles of Whānau Ora, a Ministry of Health initiative to place families at the centre of service delivery (MOH 2012)

This project had similar findings to other studies (Lau et al 2008, McLellan et al 2005, Morris et al 2015) in terms of positive feedback from patients, staff and stakeholders, and supports the benefit of a team approach in addressing the needs of complex presentations (Moss et al 2002). Where this study differs is in viewing both social work and physiotherapy as part of an allied health team, and also in their individual roles, providing data to support both professions being embedded within the ED service. This is particularly pertinent to social work service, which has limited data studies to date. In a small/medium sized hospital ED department this fluidity of practice best provides for individual patient needs and fills the gaps in service provision as required, making full use of staffing resources.

There were noticeable differences between social work and physiotherapy ED patient contacts. Physiotherapy had more new contacts, but fewer follow up interventions. This was largely due to the physiotherapy referral pathways from the ED service to other providers to continue appropriate care such as: (1) private physiotherapy and primary care providers, (2) community physiotherapy/occupational therapy, (3) community based services such as Falls Prevention, (4) fracture clinic, and (5) inpatient care. The social work ED service had fewer new referrals but a marked increase in follow up contacts, largely due to client psychosocial issues requiring further input, and community liaison requirements. The number of contacts increased (especially for physiotherapy) in the second data collection. This increase was due to reduced non-contact time taken up with pilot related activities and therefore increased amount of time available on the floor for patient contact. Referrals increased as ED staff became more aware of the benefits of allied health clinicians' interventions and developed a better understanding of what patient presentations could benefit and be referred. Also the physiotherapist's ability and confidence to assess and manage a wider range of injuries such as plaster skills for fracture management increased.

The time of service delivery (Figure 3) showed an increase in contacts mid-morning. The Allied Health After Hours folder captured patients requiring allied health input from the previous evening or weekend, which were actioned early the next working day. Also this time was often used for follow up contacts, mainly social work, which could account for the

increase in contacts at this time. Trials of working later shifts into the evening appeared to have positive benefits for ED staff and patients, especially on busy days, but not enough to justify altered hours of working. Contact data showed benefits to ED of allied health working weekend shifts, particularly on Saturdays. Weekend shifts would have been appreciated by ED staff but were not funded.

There was resistance from some ED staff at first initiation of the pilot project, but this dissipated once the benefits of allied health input became obvious. The medical and nursing staff were able to perform their individual roles more effectively and no longer had to attempt to provide additional interventions outside their normal practice scope, stretching already busy service demands.

Limitations

Although allied health interventions were thought to have prevented admissions, backed by the clinical team and stakeholder feedback, it is difficult to produce hard evidence to prove this. This is largely due to the multi-factorial nature of complex presentations and variables in the ED environment. With an estimated three admissions a week averted it is not easy to show a trend, though each admission is highly significant, and has ongoing ramifications. Similar problems were encountered in a previous study (Moss et al 2002), which showed that hospital admissions were reduced post implementation but multiple variables could not be fully excluded.

Triage wait times have been used in other studies (Gill and Stella 2013, McClellan et al 2005, Morris et al 2015) to prove effectiveness of primary physiotherapy service in reducing waiting times. This would have been difficult to use in our study with physiotherapists treating both primary and secondary referrals, and with other co-jointly running initiatives, such as encouraging people with minor injuries to seek treatment in the primary care sector rather than ED. Again, reduced workload of medical and nursing staff is hard to quantify and subjective, though proof of contact data shows that interventions not only added to patient care but decreased patient numbers these disciplines would have needed to manage, so they could focus on higher triage medically unwell patients.

The allied health service was unable to deliver a 24 hour service, in line with the ED staffing structure. By ensuring an allied health service was present over much of the busiest time during the week, aided by the "Allied Health After Hours" referral folder to reach patients presenting out of normal working hours, the gap in service was minimised.

CONCLUSION

The benefits of allied health embedded in the emergency department were clearly evident after a six month pilot project of introducing full time positions of both social work and physiotherapy to Nelson Hospital Emergency Department, as shown in contact data and feedback surveys.

All initial aims of the pilot were fulfilled. The allied health team input provided a multi-faceted interdisciplinary team approach to patient care in a timely manner, facilitating safe discharge

back into the community with linkages into primary care, preventing admissions to hospital where appropriate. Multiple presentations were reduced, with management plans in place. Primary physiotherapy contacts helped ED flow. Managing consumers' physical, mobility, rehabilitation, support and psychosocial needs and advocacy filled gaps in the traditional medical ED model, providing a more holistic client centred model of care.

Following the pilot full time physiotherapy and social work positions have been appointed and allied health has been permanently embedded in Nelson Emergency Department since December 2012, and has now been extended to the Wairau Hospital.

KEY POINTS

1. Allied health in ED work as part of an interdisciplinary team to facilitate timely and safe ED discharge and link patients with primary health services.
2. Allied health in ED assists in providing comprehensive client centred patient care.
3. Primary contact physiotherapy service has high patient satisfaction and aids ED flow.

PERMISSIONS

Permission has been granted by NMDHB management for figures and tables from the NMDHB 2012 pilot to be published in the New Zealand Journal of Physiotherapy by Hilary Exton, Director and Service Manager of Allied Health NMDHB and co author of this paper, who can be contacted via email if there are any queries.

DISCLOSURES

Financial support for the Pilot project came from the Nelson Marlborough District Health Board budget, covering staffing and administration costs for the 6 months of the pilot.

The authors of this paper have all been closely involved with the 2012 pilot and instigation of Allied Health in the Emergency Department. Care has been taken to objectively present all information, and there has been no compromise of the information this paper contains.

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Positive thinking and physical activity motivation for one individual with multiple sclerosis: A qualitative case-study

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ABSTRACT

Regular physical activity (PA) is known to benefit individuals with multiple sclerosis (MS) but people with MS tend to do less PA than the general population. Thought processes such as positive thinking may help to explain PA motivation among individuals with MS. The present study investigated thoughts about PA motivation in one man with MS (aged 70 years; pseudonym Norman). We asked Norman to think aloud while completing standardised measures of PA, stages of change, self-efficacy and in response to planned and spontaneous questions. The data were subjected to inductive thematic analysis and two major themes were formulated: positive thinking as Norman's way to fight against MS; and goals give a positive purpose to Norman's engagement in PA. Theme one consisted of three subthemes: coping with MS by choosing to think positively; using positivity to maintain control; and using PA to think positively. Theme two consisted of two subthemes: viewing PA as a necessity for goal achievement; and goals providing determination. Norman's case has implications for enhancing future physiotherapy interventions. In particular, addressing positive thinking and purposeful goal setting may help physiotherapists to increase PA motivation in individuals with MS and thereby encourage more regular engagement in PA.

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Keywords: Physical activity, Motivation, Qualitative research, Case-study, Multiple sclerosis

INTRODUCTION

Regular physical activity (PA) is beneficial for people with multiple sclerosis (MS) and has the potential to reduce the physical impact of MS after three months (Hale et al 2013, Learmonth et al 2013). In the longer term, people with MS doing regular PA report less fatigue, fewer symptoms of depression and a greater quality of life (Stroud and Minahan 2009). Despite these benefits, people with MS tend to be less active than the general population (Motl et al 2005). Thus, it is important to understand what motivates people with MS on a case by case basis so physiotherapists and other healthcare professionals can help individuals with MS engage in regular PA over the long-term.

Individuals with MS are motivated to do PA for a variety of reasons. For men with MS, goal readjustment is used to overcome the impact of fatigue on PA levels (Smith et al 2014). Men and women with MS may also be motivated to exercise as a means of cultivating optimism and hope (Kasser 2009).

Thought processes such as positive thinking may provide an avenue for enhancing PA motivation for individuals with MS. Kosma et al (2012) argued PA interventions should first emphasise cognitive processes of change such as positive thoughts about PA and then be followed by behavioural strategies like goal setting.

Indeed long-term engagement in PA may be influenced by particular thoughts. According to Smith (2012), the positive thinking inherent in self-efficacy may influence enjoyment of exercise and thus long-term exercise engagement. In addition, Morrison and Stuifbergen (2014) found social and physical outcome expectations explained 11.5% of the variance in PA participation among individuals with long-standing MS (>15 years). They concluded positive social and physical outcome expectations may enhance PA motivation in people with long-standing MS. Hence, thought-based practices may provide a positive addition to current strategies to help people with MS increase motivation for PA. However, there is an unaddressed need to investigate the kinds of thoughts that affect motivation for PA among individual cases with MS.

Case study methodology provides useful insights into the experiences of unique individuals (Radley and Chamberlain 2001) that can inform further research into ways of potentially improving practice. In addition, the concurrent think-aloud method, in which thought processes and responses to questions are verbalised, can provide substantial insight into a participant's perspective (Lundgrén-Laine and Salanterä 2010).

The aim of the present study was to explore thoughts around PA motivation in one man with MS who took part in a larger qualitative study, which used a think-aloud framework (Hall-

McMaster et al 2015). The participant stood out based on his relatively high level of impairment, and description of thinking positively. A case-study approach allowed us to further understand how positive thinking may relate to PA motivation within his particular context (Willig 2008). In addition, it enabled an in-depth exploration of this one individual's experience, revealing thoughts and processes that might apply to others (Radley and Chamberlain 2001). Our main research question was: How does this person with MS describe his positive thinking related to PA and his motivations to be physically active, despite having a high level of physical impairment?

METHODS

Participant

We gave the pseudonym Norman to our case-study participant. Norman was diagnosed with MS 5 years prior to the interview and had been experiencing symptoms for 8 years. At the time of the interview in December 2013 Norman was 70 years old and dependent on an electric wheelchair for mobility. He identified as straight, New Zealand Pākehā and had been married for 49 years. The study was approved by the University of Otago Human Ethics Committee. Norman was recruited through an exercise class at the University of Otago's School of Physiotherapy and signed informed consent before taking part.

Design

In this article we describe an in-depth qualitative analysis of a single case, which focuses on our interpretation of Norman's experience (Braun and Clarke 2013, Radley and Chamberlain 2001, Koro-Ljungberg et al 2013, Thomas 2010, Willig 2008). We used the concurrent think-aloud method, a valuable method in health research (Adamson et al, 2004), to gather qualitative and quantitative data, and understand Norman's perspectives in-depth (Lundgrén-Laine and Salanterä 2010). The think-aloud method is appropriate for a case-study (Fonteyn et al 1993) in which the focus is on in-depth understanding, rather than prevalence of certain perspectives (McGavock and Treharne 2011). We utilised triangulation (the integration of various sources) to better understand Norman's experience by considering how quantitative data (his responses to items in standardised questionnaires) compared to qualitative findings (his think-aloud responses). In accordance with Willig's (2008) typology our case-study design was instrumental, with an interest in the phenomena of positive thinking and PA motivation; explanatory, considering Norman's case in the context of existing theoretical frameworks; and pragmatic because our central research question guided data collection and analysis.

Procedure

We made use of Norman's data from a single interview session. Norman completed a series of standardised questionnaire measures during a concurrent think-aloud procedure, in which he verbalised his thought processes while reading items and responding to questions. The think-aloud approach has been widely used in health psychology (see Al-Janabi et al 2013, Anderson-Lister and Treharne 2014), to explore perceptions of people undergoing physiotherapy (Van Oort et al 2011) and attempting to increase PA levels (French et al 2007) because it gains substantial insight into participants' perspectives

(Lundgrén-Laine and Salanterä 2010, Koro-Ljungberg et al 2013, McGavock and Treharne 2011). To date, in the field of MS, the think-aloud method has only been used to assess the content validity of new questionnaires (Wicks et al 2012). In the present study, we took a semi-structured approach to the think-aloud interview by using a combination of a standardised set of questionnaires, a series of 11 planned verbal questions (details available upon request from the corresponding author) and further questions asked as needed to reach the desired depth in our qualitative data. The interview lasted one hour and 16 minutes. It was audio recorded and transcribed by an independent company under a confidentiality agreement.

Measures

Six questionnaire measures were used in the following order:

Demographics. Questions about age, gender identity, sexual orientation, relationship status, living situation, ethnicity, qualifications and job status. The date MS symptoms first appeared and the date of MS diagnosis were also requested.

A diary of self-reported PA from the previous day (Hale et al 2013). Norman's most active type of PA from the previous day formed the basis for a series of planned verbal questions exploring his feelings, thoughts and motivations for that specific activity.

Barriers and strategies for physical activity (BSPA) (Hale et al 2013). Twelve PA barriers and 12 strategies for overcoming barriers (answered 'No', 'Maybe' or 'Definitely').

Stages of change for physical activity (Plotnikoff et al 2007). One question using the definition of 'Physical activity' as doing activities at a moderate intensity, such as brisk walking and 'Regular physical activity' as doing a total of 30 minutes of PA (or more) on a given day, three or more days every week.

Stages of change for positive thinking (adapted from Plotnikoff et al 2007). One question using definitions of 'positive thinking' as focusing on the positive aspects of a situation, including the use of uplifting thoughts, images or sounds and 'choosing to think positively' as deliberately bringing these to mind for five minutes or more, without interruption, three or more days each week (based on Bekhet and Zauszniewski 2013).

The MS Self-efficacy Scale (MSSS) (Rigby et al 2003). Fourteen questions about control over quality of life specific to MS, with two additional questions in this study: "I deliberately choose to think positively in order to help me cope with my illness" and "I choose to take control of how I interpret my MS symptoms". A higher MSSS score indicates higher self-efficacy.

Analysis

The qualitative data from Norman's think-aloud interview were analysed using inductive thematic analysis based on the steps outlined by Braun and Clarke (2006, 2013). The themes formulated were data-driven. Analysis was conducted under the epistemology of critical realism and at a semantic level, based on surface word meanings (Braun and Clarke 2006, 2013). Norman's transcript was repeatedly read by the first author and initial impressions were noted. The transcript was systematically coded for content relating to the research questions. Codes were collated into candidate themes/subthemes for Norman

as a single case and then critically reviewed by systematically re-reading extracts coded under each theme. The themes were named and data relating to each theme were discussed by the researchers. Finally, the following results section was produced, outlining the two major themes formulated from Norman's qualitative data. Supporting quotes are presented and questionnaire scores on the standardised measures are used to provide context and triangulation (Treharne and Riggs 2014). Within quotes any clarifications are contained in square brackets. Short pauses are indicated by ellipses and short edits are indicated by ellipses within square brackets. Italicised sections indicate where Norman was directly reading items from the questionnaires.

RESULTS

Theme one: Positive thinking as Norman's way to fight against MS

Subtheme 1.1: Coping with MS by choosing to think positively

Norman expressed the importance of positive thinking as a means to cope with his illness. Upon receiving his diagnosis he chose to see his MS optimistically and has "been positive ever since". This positivity requires Norman to undertake deliberate cognitive action. His motivation for choosing to think positively is to avoid entering a negative cycle, which might prevent him from feeling good about himself:

I deliberately [think] positively in order to help me cope with my illness [MSSS] ... I think that the big big part about it is positive, um being positive at all times because if you're not positive you go into depression and there's no way I'm going into depression.

On the MSSS, Norman strongly agreed with the italicised statement above. Furthermore, he indicated a relatively strong disagreement (2/6, where 1 = strongly disagree) that he sometimes felt inadequate as a person because of his condition. This highlights Norman's positive self-worth, which he indicated helps him cope with his MS.

Subtheme 1.2: Using positivity to maintain a sense of control

Positivity is a way for Norman to ensure he is not controlled by his MS. Although his MS has confined him to a wheelchair, Norman refuses to let it dictate his life. His ability to remain in control is driven by his positivity and optimism for the future. Norman repeatedly described having a "positive feel" about being able to walk independently, which has allowed him to remain in control of his life:

I often feel that MS controls my life [from the MSSS]... No... well it is controlling that, not being able to walk but um there's a positive feel that I'm gonna walk so ... so I'm not gonna let it you know control, control my life.

Overall, subthemes 1.1 and 1.2 are supported by Norman's MSSS score of 72/84. This score indicates Norman is very high in self-efficacy, supporting his descriptions of coping with MS (subtheme 1.1) and maintaining control over his condition (subtheme 1.2). Furthermore, Norman strongly agreed that he could keep MS from interfering with time with friends and family, that there were things he could do to control his fatigue and that he had as much independence as he felt he needed. All of these statements support the proposal that he has a strong confidence in his ability to cope and a high degree of perceived control.

Subtheme 1.3: Using PA as a means to think positively

For Norman, PA is one way of maintaining a positive outlook. He described gaining huge satisfaction in doing PA because he knows it is helping him to better his current situation and makes him believe his goals are possible. PA also allows Norman to maintain a positive self-image, as a confident individual who would "attempt anything". The positive thinking generated through Norman's PA flowed onto positive emotional states, reinforcing his efforts and helping motivate him to continue PA:

I would tell myself that I would feel more confident in myself if I were more physically active [from the BSPA].... Well I do feel confident in myself ... it's through the fact the physical activity is keeping me feeling like that, yeah that things are going to get better, so I would say that is a definite.

...and afterwards, yeah you do, you a lot, you feel good with it because you think well what I'd like to be able to do is ah, once they've been done is be able to get up and do some walking.

While PA helps Norman to think positively, positive thinking also helps him to engage in PA. On the BPSA (Hale et al 2013), Norman indicated that deliberate positive thinking strategies would definitely be helpful to overcome PA barriers. In particular, he indicated that self-talk statements, such as 'I am being good to myself by taking care of my body in this way' from the BPSA would be effective. Positive thinking about his future self would also be helpful, as Norman indicated that he would do PA despite barriers because he knows he will feel better afterwards.

Table 1: Themes and subthemes

Theme 1	Subthemes	Theme 2	Subthemes
Positive thinking as Norman's way to fight against MS	1.1 Coping with MS by choosing to think positively	Goals give a positive purpose to Norman's PA	2.1 Viewing PA as a necessity for goal achievement
	1.2 Using positivity to maintain a sense of control		2.2 Goals provide determination
	1.3 Using PA as a means to think positively		

Overall, the theme of positive thinking in spite of MS and its relation to PA is supported by the fact that Norman is in a maintenance stage of change for both choosing to think positively and regular PA, having been doing so for more than 6 months at the time of the interview. While this does not imply causation, the data presented above would suggest that, for Norman, the two are very much interlinked.

Theme two: Goals give a positive purpose to Norman's engagement in PA

Subtheme 2.1: Viewing PA as a necessity for goal achievement

Norman talked about PA being a necessity to make his goal of walking become a reality; to "get the legs moving and walking". Seeing PA as a necessity for his rehabilitation allows Norman to relentlessly pursue his goals, which he described in a similar way to his sense of control (subtheme 1.2). Here his "positive feel" relates to positive thinking about improvements in the future and ultimately a purpose in doing PA:

... I don't stop [...] going to the class ... because I know they're a necessity ... for my recuperation or for me getting up to walk ... that's you know the positive feel I've still got, I'll always have that positive feel there that um, these things, these physical activity are there to help me get better, not for me to sit back and say bugger it.

Subtheme 2.2: Goals provide determination

Norman showed remarkable determination towards his "ultimate" goal of walking, despite his relatively high level of physical impairment. Seeing PA as a means to help him get there, Norman's motivation for PA has remained high "all the way throughout" his illness. Setbacks, and rare moments of doubt, only increase his motivation to be physically active and his determination to walk again:

I sometimes have thoughts about whether my condition will get worse [from the MSSS] ... Not very often do I think about that ... it just makes me more determined ... what worse could it do to me now, I can't walk ... I wanna walk and that's my determination...

Norman's determination to reach his goals through PA was further supported by his indication of being in the maintenance stages of change for PA. His determination (as well as positivity and optimism) were also highlighted by his indication of experiencing very few barriers to PA, despite being the most physically impaired of the participants in our wider study (Hall-McMaster et al 2015). Of 12 possible barriers, Norman indicated only two may apply to him (but do not definitely), which related to cold weather and not feeling like doing PA. However, Norman did not believe barriers like fatigue, friends' expectations, being worried and stressed would affect his PA engagement. This supports Norman's strong sense of self-efficacy, and earlier subthemes around his ability to cope (1.1) and control (1.2).

DISCUSSION

In the present study, we used a single case-study method to explore Norman's thoughts about his PA motivation. Two major themes were formulated: positive thinking as Norman's

way to fight against MS; and goals that give a positive purpose to Norman's engagement in PA. Norman had very high PA motivation and was extremely positive, despite being wheelchair-bound due to his MS. His case demonstrates how positivity and purpose may benefit physiotherapy practice by helping improve PA motivation in individuals with MS.

Theme one was characterised by positivity. For Norman, deliberately thinking positively is critical in coping with the challenges presented by his MS, especially given his relatively high level of impairment (subtheme 1.1). Positivity also allows Norman to retain control over his life (subtheme 1.2). Indeed the importance of control has been previously documented in the MS literature. Smith et al (2011) found control over fatigue influenced exercise choice, while Hale et al (2012) concluded control over PA increases the likelihood of long-term PA engagement. For Norman positivity is one way to achieve a sense of control. Thus control gained through positivity may be useful in encouraging PA engagement for individuals with MS, particularly those who have lost former capabilities. Furthermore, Norman's case suggests that positivity may not only be important when people with MS begin an exercise programme (Smith et al 2009) but also over the long term. Physiotherapists could consider fostering positivity in people with MS using thought strategies, such as positive self-talk, which can be helpful for focusing on the positive aspects of life for people with neurological conditions (Roger et al 2014). For example, at the end of an initial appointment, physiotherapists could ask patients if they would be willing to include positive self-talk in their treatment plan. If patients feel this would be helpful, physiotherapists could then provide a list of self-talk phrases to be repeated 30 times or more throughout the day. Examples of positive self-talk phrases from questionnaires in the present study were 'I deliberately choose to think positively in order to help me cope with my illness' and, in relation to PA, 'I am being good to myself by taking care of my body in this way'. People with MS and physiotherapists may benefit from working together to create personalised self-talk statements about ways to engage in PA and overcome barriers. Thus when PA motivation is required or a barrier is experienced, the patient has a series of phrases they can call upon and repeat to psychologically ready themselves for physical action.

Norman's use of PA as a means to think positively (subtheme 1.3) is consistent with Dlugonski et al's (2012) findings that women with MS are motivated to do PA to feel good and gain a sense of accomplishment. The present case extends these findings by providing evidence these reasons can also apply to men with MS. Using PA to think positively is consistent with Kasser (2009) who found individuals with MS may be motivated to exercise as a means of cultivating optimism and hope. For Norman, PA was critical to maintain optimism and hope about being able to walk in the future, suggesting these forms of positivity may be strong motivators for PA, as well as exercise.

In addition, Norman was motivated to do PA in order to retain a sense of self-confidence. He scored very highly on self-efficacy and was in the maintenance stage both for regular PA and choosing to think positively. In combination, these findings

are consistent with research by Chiu et al (2012), showing individuals with MS in a more advanced stage of change for PA had higher levels of self-efficacy. Norman's case also shows that high self-efficacy may present itself in a maintenance stage of change for PA, as well as the action stage examined by Chiu et al (2012). Physiotherapists may consider assessing self-efficacy for both PA and wider contexts, using tools such as the MSSS. Where it is low, consideration may be given to strategies that boost self-efficacy, such as intensive wellness education (Ng et al 2013). This is supported by previous suggestions that measuring and promoting self-efficacy may help increase exercise participation for individuals with MS (Smith 2012).

Theme two centred on goals and the purpose they give to Norman's PA engagement. For Norman, the goal of regaining his ability to walk gave him a strong purpose to pursue regular PA. While the role of ambitious goals in neurological rehabilitation is controversial, some clinicians believe that goals do not have to be achievable to be motivating (Playford et al. 2009). Indeed Norman's case provides evidence that, at least for some individuals, seemingly unrealistic goals can sustain PA motivation. The value of goals in Norman's case supports arguments made by Kosma et al (2012) that goal setting should form an important part of PA interventions. It is also consistent with Morrison and Stuifbergen (2014), who found social and physical outcome expectations partly explained PA participation levels in individuals with long-standing MS (>15 years).

Norman had experienced the symptoms of MS for 8 years when interviewed. Building on previous research, therefore, the present case suggests that goals or outcome expectations may also encourage PA participation in individuals with MS who do not meet long-standing criteria. In combination, these findings suggest it may be valuable for people with MS to establish positive goals or outcome expectations with their physiotherapists. In particular, our findings support the idea that programmes like Blue Prescription (Hale et al 2013) that are guided more by the goals of people with MS could provide a greater sense of purpose that motivates PA participation and adherence.

Norman saw PA as a necessity for achieving his "ultimate" goal of walking again (subtheme 2.1), giving him a strong motivation to engage in PA on a regular basis. Therefore, appraising PA as a necessity may be a deliberate cognitive strategy useful for enhancing PA participation in other individuals with MS. In particular, physiotherapists could consider encouraging people with MS to see PA as a necessary component of their well-being. However, such a strategy would likely require interdisciplinary commitment, given the different exercise advice individuals with MS may receive from different healthcare professionals (Smith et al 2013). Norman's goal of walking also kept him determined to engage in PA despite setbacks (subtheme 2.2). Thus physiotherapists may consider setting an overarching, purposeful goal with patients, such as working towards regaining a former capability or completing an appropriate physical event (e.g. a 5km fun run). In turn, this may assist individuals with MS in garnering the motivation necessary to overcome PA barriers when setbacks are experienced.

The present study was limited by methodological constraints of carrying out a mixed methods case-study and the use of only one think-aloud interview with Norman. The think-aloud process is an established method of collecting qualitative data (Al-Janabi et al 2013, Anderson-Lister and Treharne 2014, Lundgrén-Laine and Salanterä 2010, Koro-Ljungberg et al 2013, McGavock and Treharne 2011) with some strengths and limitations. Think-aloud interviews are less like a natural conversation than semi-structured interviews and require considerable attention in answering the questionnaires as well as verbal questions, which can be fatiguing (although this was not the case for Norman). Think-aloud interviews are not necessarily any more leading than semi-structured interviews where interviewers often dominate the flow of the interaction with very detailed lists of questions (Willig, 2008). The benefit of think-aloud interviews is that they provide qualitative data directly relating to the questionnaire items and thus inform knowledge about key concepts covered by the questionnaires. The method also allows for probing verbal questions to be asked as in a semi-structured fashion but with less focus on pseudo-naturalistic conversational talk because the participant and researcher are oriented to talking about experiences prompted by the questionnaire items. Our use of both qualitative data and quantitative data (from the questionnaires) allowed for triangulation to create a more holistic understanding; however, mixed methods research and triangulation can result in the loss of some context-specific instances of the phenomena under investigation (Willig 2008). While every attempt was made to capture the nuances of Norman's experience, some of these may have been lost in making sense of his story as a whole. Furthermore, case studies are characterised by an idiographic or individual nature (Willig 2008). Thus Norman's experience may only transfer to some other individuals with MS. However, use of a single case approach has allowed us to present an in-depth account of Norman's thoughts related to PA motivation in the hope that thought processes useful in improving PA intervention strategies for the MS community might be revealed.

Future research could address whether the processes identified for Norman's case, such as using positivity to stay in control, using PA to generate positive self-talk and setting purposeful goals, would likely be considered helpful by other members of the MS community. In addition, future research could address whether goal setting underlies positivity and PA motivation. Studies would ideally include individuals of other genders as well as a range of ages and ethnicities. In addition, research into the efficacy of the aforementioned processes would help assess whether they are valuable elements to incorporate into physiotherapy interventions. Ultimately, such studies would further our understanding of whether thought processes and, in particular, positive thinking could enhance PA participation in the MS community.

In summary, there are several ways Norman's case may apply to physiotherapy interventions for people with MS. Physiotherapists may consider using thought strategies such as positive self-talk to attempt to foster positivity among people with MS. They may consider assessing self-efficacy and implementing strategies to boost self-efficacy where appropriate. People with MS may

benefit from setting overarching, purposeful goals with the input of their physiotherapists to motivate PA engagement in the face of setbacks. Finally, physiotherapists may encourage patients to think about PA as a necessary element of their well-being. These considerations must be recognised as important aspects from one individual case of MS. As such, they may be useful for some individuals with MS and not for others. Nonetheless, the elements identified may be of benefit for improving future physiotherapy interventions for individuals with MS, particularly once their effectiveness for the wider MS community has been investigated.

CONCLUSION

In the present study we have presented a case of the thought processes and PA motivation of one individual, who is both particularly positive and motivated to engage in PA. For Norman, being positive is a choice which he argues helps him to cope with his MS and remain in control of his life. PA helps him to maintain this positive outlook. Goals give him a purpose for doing PA and provide determination to engage in PA on a regular basis. While it is too early to conclude these thought processes would enhance motivation in the MS community, Norman's case certainly raises this possibility. Furthermore, it justifies the need for further investigation into whether these thought processes might benefit physiotherapy interventions for individuals with MS.

KEY POINTS

1. Positive thinking and purposeful goals were central to high PA motivation in our case study of one individual with MS.
2. Physiotherapists may consider fostering positive thinking and purposeful goal setting to strengthen PA motivation in physiotherapy interventions for individuals with MS.
3. In particular, positive self-talk statements, self-efficacy assessment, setting overarching goals with MS patients and having them view PA as a necessary component of well-being could be useful as tools for physiotherapists.
4. Further research should test the relevance of positive thinking and purposeful goals to the wider MS community and their effectiveness in promoting PA participation.

PERMISSIONS

This study was approved by the University of Otago Human Ethics Committee (allocation number: DP29/11). The participant signed informed consent before taking part.

DISCLOSURES

This study was funded by the Department of Psychology at the University of Otago. The authors declare no conflict of interest.

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The physiotherapy management of patients undergoing abdominal surgery

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ABSTRACT

Abdominal surgery is performed to remove cancerous tissue, to resolve visceral tissue perforations or to remove inflammatory bowel segments, benign growths or vascular aneurysms. Postoperative complications, including pulmonary complications, are common following abdominal surgery and physiotherapy aims to prevent and treat many of these complications. Much of the literature investigating physiotherapy interventions is over a decade old and advances in surgery, including minimally invasive surgery and fast track pathways, require physiotherapists to re-evaluate their practices. This narrative review aims to examine the evidence investigating the effectiveness of physiotherapy interventions and apply this to contemporary surgical practices. Recommendations for practice and research are outlined.

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Key words: Physiotherapy, General surgery, Abdomen, Evidence-Based Practice

INTRODUCTION

Abdominal surgery is the most frequently undertaken surgery type in Australia and New Zealand. At least 130,000 operations were performed in 2012-2013 across 246 hospitals in Australia alone and this is increasing by 2-5% per year (AIHW 2013). World-wide, approximately 500 to 1,000 procedures per 100,000 head of population are performed annually in developed countries (Weiser et al 2008).

Postoperative complications are common following major abdominal surgery with one third to half of all patients having some type of complication following their operation (Aahlin et al 2015, Hamel et al 2005). Complications, such as postoperative pulmonary complications (PPC), prolonged postoperative ileus and the sequelae of prolonged immobility are potentially preventable with physiotherapy interventions. Physiotherapists have routinely provided care to patients undergoing abdominal surgery since the 1950s (Cash 1955, Innocenti 1996) and research investigating the effectiveness of physiotherapy following abdominal surgery is generally over a decade old (Pasquina et al 2006). Since this time, major advances in surgery, such as minimally invasive surgical techniques and improved perioperative management, have significantly reduced postoperative complications and length of hospital stay

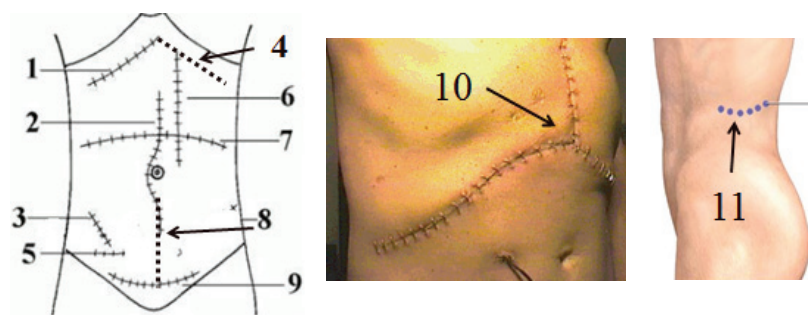
(LOS) (Spanjersberg et al 2015). These advances require a re-evaluation of physiotherapy for patients undergoing abdominal surgery.

What is abdominal surgery?

Abdominal surgery can be categorised according to the location and length of the main incision. Upper abdominal surgery (UAS) involves an incision above or extending above the umbilicus and lower abdominal surgery (LAS) involves incisions wholly below the umbilicus (see Table 1 and Figure 1). Surgery may be open (with an incision >5cm), laparoscopic or a combination of both. Historically, laparoscopic surgery was predominantly performed for cholecystectomy and gynaecological procedures only. Recently, major procedures such as bowel, liver, stomach, oesophagus and kidney resections are being performed laparoscopically or as laparoscopic hand-assisted surgery (minimally invasive surgery), whereby an additional incision allows a hand to pass into the abdomen for surgical manipulation and tissue removal (see Figure 2). Although, minimally invasive surgery involves longer anaesthetic times (Owen et al 2013) compared with the equivalent open procedure, accelerated recovery, reduced complication rates and shorter LOS have been demonstrated (Spanjersberg et al 2015).

Table 1. Type and location of abdominal surgical procedures

Surgical Category	Upper Abdominal	Lower abdominal
Colorectal	Anterior resection Abdominoperineal resection Hartmanns Hemicolectomy Low anterior resection Laparoscopic (+/-hand) assisted colectomy Partial colectomy Proctocolectomy Reversal of Hartmanns Sigmoid colectomy Small bowel resection Subtotal colectomy Total colectomy	Ultra low anterior resection Recto-sigmoidectomy Ileostomy Appendectomy
Upper Gastrointestinal	Gastrectomy Liver resection Oesophagectomy Open cholecystectomy Open hiatus hernia repair Pancreatic surgery Whipples	
Urology	Adrenalectomy Cystic duct excision Nephrectomy Laparoscopic +/- hand assisted nephrectomy Pyeloplasty Radical cystectomy +/- ileal conduit Radical cystoprostatectomy	Radical prostatectomy Ureterectomy
Other	Explorative laparotomy Splenectomy Complete pelvic exenteration	Inguinal hernia repair Total abdominal hysterectomy



1. Subcostal (Kocher)	Liver and pancreas operations
2. Midline laparotomy	Upper and lower intestinal procedures, major bladder
3. McBurney	Appendix removal
4. Bilateral subcostal (Chevron)	Oesophageal, liver, pancreatic, and gastric procedures
5. Lanz	Appendix removal
6. Paramedian	Upper gastrointestinal surgery
7. Transverse	Upper intestinal procedures
8. Lower midline	Lower intestinal procedures and bladder
9. Pfannenstiel	Major gynaecological and prostate procedures
10. Mercedes (Chevron + Sternotomy)	Major trauma, combined cardiac and abdominal
11. Flank/transverse lumbar	Kidney procedures

Figure 1: Incisions used for abdominal surgery and associated procedures (Mercedes image: Said 2008)

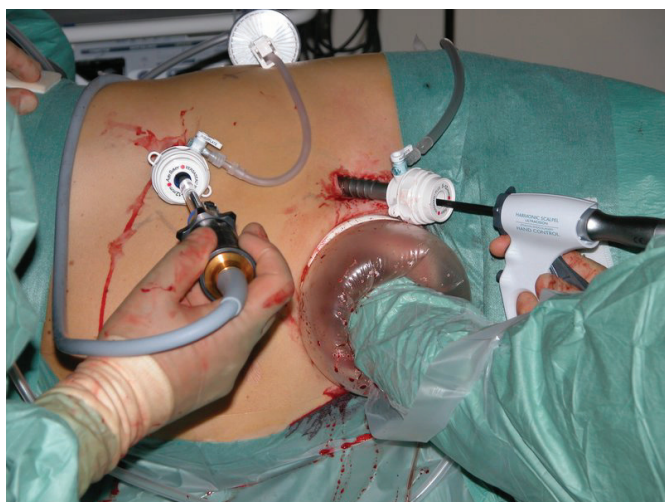


Figure 2: Laparoscopic hand-assisted abdominal surgery (Dols et al 2009)

Significant changes in perioperative care have also been initiated, most notably Enhanced Recovery after Surgery (ERAS) or 'fast track' pathways. Elements include minimal preoperative bowel preparation and fasting, admission on the day of surgery, aggressive early ambulation, strict analgesia protocols, early postoperative introduction of oral fluids and food, and minimal use of drips and drains. These pathways are safe, feasible and reduce complication rates and LOS across all types of abdominal surgery (Adamina et al 2011, Cerantola et al 2013, Coolsen et al 2013, Li et al 2012, Lin et al 2011, Varadhan et al 2010, Wijk et al 2014).

Prevention of postoperative complications relevant to physiotherapy

Postoperative pulmonary complications (PPCs)

What are PPCs and how are they measured?

A PPC is commonly described as "a pulmonary abnormality that produces identifiable disease or dysfunction, that is clinically significant and adversely affects the clinical course" (O'Donohue Jr 1992). This can include respiratory failure, pneumonia, severe atelectasis, pulmonary oedema, pneumothorax, and pleural effusion. A PPC is the most common complication following UAS (PROVHILO group 2014) with a reported incidence of 13-53% (Browning et al 2007, Haines et al 2013, Mackay et al 2005, Parry et al 2014, Scholes et al 2009, Silva et al 2013). This is higher than other major surgical procedures, such as open lung resection, cardiac surgery via sternotomy, and orthopaedic surgery (Arozullah 2001, Pasquina and Walder 2003, Reeve et al 2010), whereas the PPC rate following open LAS is as little as 1% (Arozullah 2001, Smith et al 2009a).

The wide range in reported PPC rates following UAS may be explained by the surgical procedures, patient populations studied, and the PPC diagnostic tool or criteria utilised. Diagnosis of a PPC differs greatly between studies. Variations include the individual signs and symptoms required for diagnosis (e.g. some tools incorporate auscultation changes where others do not), how each criterion is measured (e.g. the different grading scales used for radiographic atelectasis or consolidation) and the threshold number of positive criteria equating to a PPC (Agostini et al 2011, Wynne 2004). These inconsistencies make comparison of PPC rates and interpretation of research findings into clinical practice problematic. Although there is no consensus on the ideal tool for PPC diagnosis, recent physiotherapy-led studies have used the same multi-factorial scoring tool, the Melbourne Group Score (Table 2) in both UAS (Browning et al

Table 2: Melbourne Group Score PPC Diagnostic Tool

Diagnosis confirmed when 4 or more of the following are present:

CLINICAL FACTORS

- New abnormal breath sounds on auscultation different to preoperative assessment
- Production of yellow or green sputum different to preoperative assessment
- Pulse oximetry oxygen saturation (SpO_2) $<90\%$ on room air on more than one consecutive postoperative day
- Raised maximum oral temperature $>38^\circ C$ on more than one consecutive postoperative day

DIAGNOSTIC FACTORS

- Chest radiograph report of collapse/consolidation.
- An unexplained WCC greater than $11 \times 10^9/L$
- Presence of infection on sputum culture report

OTHER

- Physician's diagnosis of pneumonia, respiratory tract infection, undefined respiratory problem.
- Prescription of an antibiotic for a respiratory infection

Notes: C, centigrade; L, litre; SpO_2 , Peripheral oxygen saturation; WCC, white cell count.

2007, Haines et al 2013, Parry et al 2014, Scholes et al 2009) and thoracic surgery (Agostini et al 2013, Reeve et al 2010). Reliable clinometric properties for the Melbourne Group Score (MGS) are beginning to be demonstrated when compared to other PPC diagnostic tools (Agostini et al 2011). Studies using the MGS have reported PPC rates of 13-18% in all patients undergoing major UAS (Browning et al 2007, Scholes et al 2009), and specifically 39-42% in high-risk UAS patients (Haines et al 2013, Parry et al 2014).

Key Point:

For research, audit and clinical purposes, the use of the Melbourne Group Score tool is recommended to diagnose a PPC amenable to physiotherapy.

What are the consequences and costs of a PPC?

Postoperative pulmonary complications significantly increase morbidity, mortality, hospital utilisation, cost, and length of hospital stay (Dimick et al 2004, Knechtle et al 2014, Lång et al 2001, Rotta et al 2013, Thompson et al 2006). The greatest proportion of hospital costs are associated with intensive care utilisation and hospital LOS (Knechtle et al 2014). Australian prospective observational studies measuring PPC rates using the MGS found that PPCs increased hospital LOS by 3-13 days (Denehy et al 2001, Scholes et al 2009). To date, reported costs associated with PPCs have been derived retrospectively from hospital clinical coding databases that often underreport rates of complications and costs (Koch et al 2012). The true costs of PPCs are important to establish so that the cost-effectiveness of prophylactic interventions, including physiotherapy, can be calculated. It may not be cost effective to provide physiotherapy to *all* patients undergoing abdominal surgery. Where the likelihood of developing a PPC is known to be low, e.g. one PPC in every 100 patients, providing prophylactic physiotherapy to all 100 patients may cost more than the costs saved through preventing the one PPC. However, if PPCs are shown to be high cost, the benefit of preventing one PPC in 100 patients may outweigh the cost of providing a relatively low-cost intervention such as physiotherapy to all 100 patients. Until we have contemporary high quality physiotherapy evidence and cost-benefit analyses, physiotherapists may be best to target interventions to those patients who are at high-risk of postoperative complications. It is therefore important that physiotherapists are able to determine which patients are most at risk of developing a PPC.

Key Point:

Cost-benefit analyses of physiotherapy interventions to reduce PPCs, improve recovery and reduce LOS are needed to inform resource allocation.

How can we predict who is at risk of developing a PPC?

The ability to predict the development of a PPC has been widely investigated. An often cited large prospective cohort study (n=160,805) (Arozullah 2001) investigated *all* patients undergoing non-cardiac surgery and found that those undergoing UAS were almost three times more likely to develop pneumonia (OR 2.68, 95%CI 2.38-3.03) compared to LAS and orthopaedic surgery where the pneumonia rate was less than 1%. A recent retrospective study found that PPCs were 15 times

more likely following UAS when compared to LAS (Smith et al 2009a).

The incidence of PPCs after traditional laparoscopic surgery is also negligible (<1%) (Antoniou et al 2014). However, pneumonia rates of 2-5% have recently been reported following minimally invasive bowel resections and, whilst this is half the rate of the equivalent open procedure, PPC incidence has been shown to increase by 13% with each additional 60 minutes of surgery time (Owen et al 2013). The risk of PPCs following other types of minimally invasive UAS is not well reported. Until more data and cost-benefit analyses of physiotherapy interventions are published, it is uncertain if these PPC rates are high enough to justify providing routine prophylactic physiotherapy to these lower-risk patients.

To assist in directing physiotherapy resources to the highest need patients, PPC risk prediction tools should be utilised. Most PPC risk prediction tools following UAS have been developed by medical researchers (Barnett and Moonesinghe 2011) and have limited clinical utility for physiotherapists. To address this a physiotherapist led prospective study (Scholes et al 2009) investigated predictors for PPCs (with MGS diagnosis) to enable the development of a multifactorial scoring tool to dichotomise patients having UAS into high or low risk groups. Independent predictors of PPCs were: anaesthesia longer than three hours, upper gastrointestinal surgery, current smoking history, respiratory disease and estimated VO_{2max} . High-risk patients were 8.5 times more likely to develop a PPC than those assessed as low-risk. Other physiotherapy studies have found additional independent risk factors for a PPC. A nasogastric tube (Parry et al 2013) for more than one day was associated with higher PPC incidence (OR 9.1, 95%CI 2.0 to 42) and delayed time to ambulate more than 10 metres (Haines et al 2013) was three times more likely to be related to the presence of a PPC (OR 3, 95%CI 1.2 to 8). These results should be interpreted with caution, as it is possible that the presence of a PPC delayed mobilisation, rather than vice versa. The use of available PPC risk prediction models to target provision of physiotherapy services to higher-risk patients may be a prudent use of finite physiotherapy resources.

Key Points:

1. Patients following LAS and standard laparoscopic surgery do not require routine postoperative physiotherapy to prevent PPC.
2. All patients undergoing UAS should be screened for risk of developing a PPC using a risk identification tool and those patients determined to be high-risk are targeted with PPC prophylaxis.
3. A PPC risk prediction tool is needed for advanced laparoscopic and minimally invasive UAS.

Complications associated with reduced or delayed mobility

Venous thromboembolism

The absolute risk of venous thromboembolic events (VTE) after major abdominal surgery without preventative measures is approximately 15 – 40% (Cayley 2007). Given the serious

consequences of pulmonary emboli (PE), several guidelines for prevention and management have been published by the American College of Chest Physicians (Holbrook et al 2012), Scottish Intercollegiate Guidelines Network (SIGN 2010) and the National Institute for Health and Clinical Excellence (National Institute for Health and Clinical Excellence (NICE) 2010). These guidelines recommend that all major surgical patients have VTE prophylaxis, including anti-coagulation and early mobilisation. If a deep vein thrombosis (DVT) is diagnosed and anti-coagulation has been commenced, early mobilisation is not associated with increased risk of PE, new DVT or death (Aissaoui et al 2009, Anderson et al 2009), thus physiotherapists should recommence active ambulation following medical clearance.

Postoperative paralytic ileus

Gut immotility immediately postoperatively is an expected consequence of abdominal surgery (Vather et al 2013). There is a widespread belief that early ambulation assists in the resolution of gut immotility and prevention of paralytic ileus, yet there is no conclusive evidence to support this hypothesis (Story and Chamberlain 2009). Indeed, there is stronger evidence for the routine use of chewing gum, which stimulates the neuro-hormonal response to eating and enhances the resolution of a normal gut peristalsis, to prevent paralytic ileus and reduce LOS (Li et al 2013), than there is for early ambulation.

Musculoskeletal and cardiovascular effects

Whilst early ambulation is recommended following major abdominal surgery, surgical drains/devices and the postoperative sequelae of hypotension, nausea, pain, and fatigue mean that achieving early ambulation as recommended is frequently not achieved (Haines 2013, Boulind 2012). Although the deleterious musculoskeletal and cardiovascular effects associated with prolonged bedrest are well documented (Pavy-Le Traon et al 2007), there is little evidence to support the use of early ambulation in the prevention of PPCs. A recent randomised controlled trial (RCT) found no increase in PPC incidence following three days enforced bed rest; rather this group had prolonged LOS and required more physical rehabilitation to assist recovery (Silva 2014).

Physiotherapy management for patients undergoing abdominal surgery

Physiotherapy aims to address well-known pathophysiological effects of abdominal surgery on the respiratory system including atelectasis (Duggan and Kavanagh 2005, Hedenstierna and Edmark 2010, Tusman et al 2012), reduced muco-ciliary clearance (Bilgi et al 2011, Gamsu et al 1976, Konrad et al 1993), diaphragm dysfunction (Blaney and Sawyer 1997, Ford et al 1983, Kim et al 2010), reduced lung volumes (Cheifetz et al 2010, Fagevik Olsén et al 2009, Stock et al 1985) and reduced respiratory muscle and cough strength (Barbalho-Moulim et al 2011, Bellinetti and Thomson 2006, Kulkarni et al 2010). It is hypothesised that combinations of these factors can lead to bacterial proliferation in the airways and/or severe atelectasis (Smith and Ellis 2000), increasing the risk of infection and PPCs.

It is a logical assumption that strategies to ameliorate the deleterious physiological effects of abdominal surgery will result in reducing the risk of PPC development. This has been the underlying premise of the delivery of 'chest

physiotherapy' to patients following major surgery for several decades. Physiotherapy may consist of preoperative education and training and/or postoperative respiratory and physical rehabilitation. More recently, there has been an increasing focus on preoperative exercise training (prehabilitation). Here we present the best available evidence to guide practice decisions.

Preoperative physiotherapy interventions

Preoperative education

Preoperative physiotherapy education is the delivery of targeted preparatory information to the patient regarding the expected postoperative participation in an early ambulation programme and necessity to perform deep breathing and coughing (DB&C) exercises. Patients are educated on the role these exercises have on the reduction of serious complications such as PPC and VTEs. Sessions consist of explaining the effect of anaesthesia and surgery on the lungs, teaching and training of DB&C exercises, education on the early ambulation programme and provision of any adjunctive devices as necessary.

Evidence from six clinical trials (Bourn et al 1991, Castillo and Haas 1985, Condie et al 1993, Denehy 2001, Fagevik Olsén et al 1997, Samnani et al 2014) suggests that a single preoperative physiotherapy session significantly reduces PPC rates. In the largest RCT (n=368, PEDro 5/10) the intervention group received a single preoperative physiotherapy education and training session and a single postoperative review of taught breathing exercises (Fagevik Olsén et al 1997). The control group received no pre or postoperative physiotherapy. The incidence of PPC was significantly lower in the treatment group (6% vs 27 %, $p<0.001$). Two other RCTs of 330 low-risk open abdominal surgery (Condie et al 1993) and 102 open UAS patients (Denehy 2001) concluded that the provision of additional postoperative physiotherapy of coached DB&C exercises conferred no extra benefit over and above a single session of preoperative education and DB&C training alone. A recent RCT (Samnani et al 2014) of 232 abdominal surgery patients again demonstrated a significant reduction in PPCs from 30% to 7% (ARR 22%, 95%CI 13%-32%) when preoperative education focused on the importance of postoperative early ambulation compared to no education at all. Both groups were provided with similar postoperative care. These studies demonstrate the effectiveness of preoperative education and DB&C training, independent of postoperative physiotherapy, in reducing the incidence of PPCs.

The reported reduction in PPCs with preoperative physiotherapy education is significant; however, the results need to be interpreted with caution. All trials had methodological limitations and sources of bias. This brings the reported effect on PPC rates into question. Further, most trials were conducted 10-15 years ago and there have been significant changes in surgical and perioperative care in this time. Preoperative education and training have previously been provided the day before surgery upon admission for surgery, however this no longer reflects current practice, whereby patients attend preoperative assessment clinics one to six weeks before their operation (Gupta and Gupta 2010). It is unknown whether preoperative physiotherapy education provided at these longer time intervals might reproduce the previously reported effect on PPC prophylaxis.

Surveys of physiotherapy services to UAS patients in Australia have shown a stark reduction in hospitals providing preoperative physiotherapy education over the past 15 years (Browning 2007, Scholes et al 2006). The reasons for this disinvestment of services are unknown. There are no cost-benefit analysis studies investigating physiotherapy to reduce respiratory complications, so conclusive evidence to inform the allocation of physiotherapy services to preoperative education and training is lacking. The potential to significantly reduce the incidence of a high-impact complication, such as a PPC, with a low-cost and easily provided intervention of a single preoperative physiotherapy session is appealing. It may not be *how much* physiotherapy that is important, but rather, *when* that physiotherapy is provided. The current weight of evidence appears to support the provision of a single preoperative physiotherapy education and DB&C training to all patients having abdominal surgery (Bourn et al 1991, Condie et al 1993, Denehy 2001, Fagevik Olsén et al 1997, Samnani et al 2014). Given the limitations of this research and the low incidence of PPCs following laparoscopic and LAS surgery, the authors recommend the provision of preoperative physiotherapy for all open UAS patients only. Cost benefit studies are required to analyse the fiscal benefits of providing preoperative physiotherapy to lower risk surgical patients as well.

Key Points:

1. A single face to face session of preoperative education and DB&C training should be administered to all patients undergoing open upper abdominal surgery.
2. It is currently unknown if other forms of this education and training, eg video or booklet, are effective.

Prehabilitation

Prehabilitation refers to the use of exercise-based interventions aimed at optimising preoperative function to improve postoperative outcomes or to increase surgical options in those patients who have borderline fitness for surgery. Evidence of the effectiveness of prehabilitation is relatively new, yet systematic reviews and meta-analyses have already been undertaken (Lemanu et al 2013, Olsén and Anzén 2012, Singh et al 2013, Valkenet et al 2011), although only two focused solely on major abdominal surgery (Pouwels et al 2014, Pouwels et al 2015).

Valkenet et al (2011) and Santa Mina (2014) conducted meta-analyses on the effects of preoperative interventions including inspiratory muscle training (IMT) and/or exercise training in patients undergoing major cavity and orthopaedic surgery. Mans et al (2015) investigated IMT prior to all types of open major cavity surgery, including UAS. Meta-analyses of the data demonstrated significant reduction in the risk of PPCs (Mans et al 2015, Valkenet et al 2011) and reduced postoperative length of stay (Santa Mina et al 2014, Valkenet et al 2011). Other systematic reviews report improvements in aerobic and functional capacity (Lemanu et al 2013, Olsén and Anzén 2012, Singh et al 2013). These reviews are limited by the lack of meta-analysis due to the small number of studies included and the heterogeneity of the surgical groups, which included combinations of orthopaedic, UAS, cardiac and thoracic surgery.

To our knowledge, there are only two systematic reviews specifically relating to prehabilitation in abdominal surgery

(Pouwels et al 2014, Pouwels et al 2015). These two reviews detailed six RCTs in both laparoscopic and open abdominal surgery (Pouwels et al 2014) and five studies in abdominal aortic aneurysm repair specifically (Pouwels et al 2015). Studies investigated strength and/or aerobic training, breathing exercises, education and IMT or combinations of these. The heterogeneity of the investigations precluded meta-analyses as studies utilised a variety of frequencies, intensities, durations, modes, locations and outcome measures. Both reviews (Pouwels et al 2014, Pouwels et al 2015) determined that preoperative exercise therapy is associated with improved physical fitness in patients prior to major abdominal surgery, but, due to heterogeneity and small sample sizes, whether this results in fewer complications or faster recovery remains unclear. Although the relationship between poor preoperative fitness and postoperative outcomes has been clearly demonstrated (Smith et al 2009b), the effect of improving fitness (via prehabilitation) and improved postoperative outcomes is yet to be demonstrated. Better quality, targeted research into preoperative physical fitness optimisation, particularly in high-risk patients, is warranted.

Key Point:

Given the small number of studies, the heterogeneity of interventions and costs involved in providing such services, the routine provision of prehabilitation in all patients undergoing abdominal surgery cannot be recommended. However, it may be worthwhile in high-risk UAS patients, given the assumed cost of complications. This remains to be confirmed with cost-benefit studies.

Postoperative physiotherapy interventions

Postoperative ambulation

Early mobilisation forms a routine part of postoperative care and physiotherapists are heavily involved in the initiation of mobilisation following UAS, with up to 91% reporting they always include mobilisation in their postoperative treatment (Browning 2007). Patients perform little mobilisation outside of physiotherapy treatment in the early postoperative period (Browning et al 2007) with one study demonstrating only 48% of patients mobilised more than 10m on the first postoperative day (Haines et al 2013). To address this, aggressive early ambulation protocols have become an essential component of ERAS guidelines whereby patients sit up out of bed for six to eight hours and ambulate at least 60m up to five times on the day after surgery (Delaney et al 2001). However only 40% of patients are able to achieve this (Boulind et al 2012). Studies investigating adherence to ERAS protocols found the early mobilisation component was the least adhered to (Boulind et al 2012, Gustafsson et al 2011). Barriers to achieving early ambulation include hypotension, pain and nausea (Haines et al 2013).

Research into the efficacy of physiotherapy to improve outcomes following abdominal surgery has almost always involved ambulation as part of an intervention package (e.g. preoperative education, DB&C exercises, early ambulation, adjunctive devices). It is difficult to determine which component of the intervention is responsible for any improvements in outcomes.

Only two studies have attempted to specifically isolate the effect of DB&C from standardised early ambulation. Mackay et al (2005) compared PPC rates in 56 patients randomised to an ambulation only group or a group provided with additional supervised DB&C exercises; of note the protocol for both groups was intensive, with three ambulation sessions on the first and second postoperative day and continuing twice daily for the next two days. The overall PPC rate was 14% with no significant difference between groups. A similar study replicated this protocol with a more realistic ambulation protocol. Silva et al (2013) randomised 86 high-risk UAS patients into three groups: mobilisation alone, mobilisation plus DB&C, and delayed mobilisation (commenced on the third postoperative day) plus DB&C. Participants were ambulated once daily to a BORG intensity of 6/10. There were no significant differences in PPC rate between groups even in the group that rested in bed for three days; although this group were no more likely to get a PPC, they had increased requirements for physiotherapy to assist in their physical recovery and significantly longer LOS (MD 4.4, 95%CI 0.3 to 8.8). Both of these studies suggest that the addition of DB&C to early ambulation does not reduce the incidence of PPC. However, it is important to note that these studies were not powered to measure small to moderate differences in PPC rates (less than 20% between groups). It is possible that coached DB&C exercises could provide a small, yet clinically worthwhile effect. Much larger clinical trials would need to be performed to test this.

Key Points:

1. Because of the undesirable sequelae associated with prolonged bedrest, ambulation should be commenced as early as safely possible for all patients undergoing all types of abdominal surgery.
2. There is little evidence to support the use of early ambulation in the prevention of PPCs.
3. The ideal amount, duration, and frequency, of ambulation required to improve postoperative recovery is untested.

Postoperative breathing exercises.

Coached DB&C exercises are traditionally provided to patients following UAS aiming to prevent PPCs. Incentive spirometers (IS) (do Nascimento Junior et al 2014), PEP devices (Orman and Westerdahl 2010, Zhang et al 2015), and non-invasive ventilation (NIV) (Ferreira et al 2008) are also utilised, but less frequently. These modalities are often delivered by physiotherapists (Haines et al 2013, Makhabah et al 2013), although in some countries these may be provided by other health professionals (Cassidy et al 2013, Zhang et al 2015). Despite widespread and ubiquitous provision of prophylactic respiratory physiotherapy following abdominal surgery, its efficacy and worth in preventing PPCs is unclear.

Two systematic reviews have investigated interventions to prevent PPCs following abdominal surgery (Lawrence et al 2006, Pasquina et al 2006). Despite being conducted in the same year, the conclusions were contradictory. Lawrence et al (2006) investigated all non-pharmaceutical interventions to prevent respiratory complications including a wide range of interventions (such as nasogastric decompression, postoperative analgesia)

in open, laparoscopic, LAS and UAS. Findings suggested there is good evidence for any type of lung expansion manoeuvres compared with no treatment at all but that studies were confounded by the use of multimodal interventions, inconsistent definitions of PPC and poor methodologies. Pasquina et al (2006), in a robust and detailed systematic review, focused solely on physiotherapy interventions and meta-analysed 35 studies conducted in both LAS and UAS. Less than half of all trials found that DB&C exercises were more effective than a no-treatment control or alternative technique. They concluded that the routine use of respiratory physiotherapy after open abdominal surgery is not justified.

Since the 2006 publication of these systematic reviews (Lawrence et al 2006, Pasquina et al 2006), seven additional RCTs have been published (Baltieri et al 2014, Barbalho-Moulim et al 2011, Dronkers 2008, Kulkarni et al 2010, Samnani et al 2014, Silva et al 2013, Zhang et al 2015). The findings of these further studies are summarised in Table 3 and the results and context of the findings are discussed elsewhere in this paper where appropriate. The methodological quality of each of these trials has been assessed using the PEDro scale and absolute risk reduction (including confidence intervals) and number needed to treat have been calculated from the dichotomous PPC data supplied in the studies where possible.

One further systematic review assessed specifically the effect of breathing exercises on physiological aspects of pulmonary function following abdominal surgery such as respiratory muscle strength and diaphragm mobility (Grams et al 2012). This study and others (Grams et al 2012, Lunardi et al 2013, Lunardi et al 2015) have demonstrated that DB&C improve respiratory function following UAS, although it remains unclear whether these physiological improvements translate to clinically meaningful reductions in LOS or incidence of PPCs.

In the face of contradictory evidence for the use of DB&C exercises, an international panel of experts have attempted to provide a consensus statement on physiotherapy management for patients following UAS (Hanekom et al 2012). Using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach (Guyatt et al 2008), the panel considered the potential benefits of coached DB&C exercises outweighs the potential costs and harms of the intervention. Until this is confirmed with further high-quality evidence and cost-benefit analysis this recommendation remains supported by a weak level of evidence.

Regarding laparoscopic and LAS, although respiratory physiotherapy demonstrates physiological improvements in pulmonary function (Forti et al 2009, Gastaldi et al 2008, Krishna et al 2013), the PPC rate is very low (Arozullah et al 2000, Condie et al 1993) and postoperative respiratory physiotherapy for this population has not been shown to alter clinical outcomes such as incidence of PPC and LOS. However, with the increasing use of advanced technology, more complex surgeries are now being performed laparoscopically. Due to their complexity, the average time of these type of laparoscopic operations are usually greater than three hours (Fagevik Olsen M 1999, Kuo et al 2013, Park et al 2011). In these studies, the

PPC incidence between open and laparoscopic surgery is similar, suggesting that there may be an increased PPC risk in prolonged laparoscopic surgery (Kuo et al 2013, Park et al 2011). This needs to be confirmed with prospective observational studies to enable risk prediction models to be developed, which will in turn assist physiotherapists and hospitals to determine which patients require targeted PPC prophylaxis following these newer types of procedures. To date, no study has investigated the effectiveness of any type of respiratory therapy to *treat* a PPC following diagnosis and this requires urgent investigation.

Key Points:

1. DB&C exercises should not be provided routinely following LAS, standard laparoscopic surgery or for patients screened as being at low-risk of a PPC following UAS.
2. For high-risk UAS patients, on balance of the available evidence, the provision of coached DB&C exercises may be unnecessary as long as patients are provided with an early ambulation programme of assisted walking at least once a day. It is suggested this assisted walking targets a BORG score > 6/10.

Respiratory adjuncts

Systematic reviews and meta-analyses (do Nascimento Junior et al 2014, Overend et al 2001) have investigated the use of incentive spirometry (IS) for patients following abdominal surgery. In the most recent meta-analysis, do Nascimento Junior et al (2014) investigated 12 studies with a total of 1834 participants undergoing UAS including laparoscopic surgery. Trials compared IS to either no respiratory treatment; DB&C; or to other types of chest physiotherapy. There were no statistically significant differences between any groups in the risk of developing a pulmonary condition. There are limitations with this literature due to mixed patient populations in some studies (UAS, LAS, laparoscopic) and due to varying risk profiles of patients. These limitations and the generally low quality of the evidence regarding the lack of effectiveness of IS in preventing PPCs following UAS highlight the need to conduct well-designed trials in this field. Recently there has been a renewed interest in investigating IS in high-risk populations. For example, a pre-post cohort study in patients undergoing high-risk UAS has shown promising results (Westwood et al 2007) and these results now need to be tested in a RCT.

Only one systematic review has investigated the use of PEP devices (including bubble PEP) in patients undergoing open abdominal or thoracic surgery (Orman and Westerdahl 2010). The review found weak evidence that PEP confers any benefit over standard respiratory physiotherapy but due to the age and limited quality of the included studies (PEDro 4 – 6), firm conclusions are unable to be drawn. A recent well-designed RCT (PEDro 8/10) compared routine medical management and early mobilisation with the use of modified oscillating PEP in 203 patients following UAS and thoracic surgery (see Table 3 for details) (Zhang et al 2015). The study found a significant reduction in days of fever and LOS in the PEP group (MD=2.6, 95% CI -4.8 to -0.4). The use of postoperative (oscillatory) PEP now requires further corroboration with studies in other

countries and other surgical contexts, utilising outcome measures that include PPC incidence.

Two meta-analyses have compared prophylactic continuous positive airways pressure (CPAP), to prevent postoperative morbidity and mortality in patients following major abdominal surgery, with standard care (including physiotherapy) (Ferreira et al 2008, Ireland et al 2014). Whilst no differences were found in the effects of CPAP on mortality and hypoxaemia, both studies showed significant reductions in atelectasis, pneumonia and re-intubation rate with CPAP. Caution is required in extrapolating these results as the included studies had substantial heterogeneity, small sample sizes and a number were old with poor methodological reporting. There is evidence to suggest that CPAP and NIV are both effective in improving outcomes in patients who have developed postoperative respiratory failure although this is based on a small number of studies (Antonelli et al 2000, Chiumello et al 2011, Kindgen-Milles et al 2005).

Other adjuncts

The use of an abdominal binder, a firm removable elastic girdle placed around the abdomen, is popular in some countries following abdominal surgery in attempting to prevent wound dehiscence and improve postoperative pain and respiratory function (Bouvier et al 2014). Its use has shown improvements in postoperative walking distance following major UAS (Cheifetz et al 2010), but only weak effects on reducing pain (Rothman et al 2014) and no effect on pulmonary function or seroma formation (Fagevik Olsén et al 2009, Larson et al 2009, Rothman et al 2014) or LOS (Larson et al 2009). There is some evidence to suggest that abdominal binders improve psychological distress in the early postoperative period (Rothman et al 2014). Its use has yet to be related to PPC rates but evidence suggests that binders can be worn without compromising pulmonary function (Rothman et al 2014).

Key Points:

1. Incentive spirometry should not be routinely provided following abdominal surgery.
2. The use of oscillatory PEP may assist in preventing PPCs.
3. Postoperative prophylactic CPAP/NIV is efficacious in the prevention of PPCs, although evidence is insufficient on the potential for harm and the cost implications of providing CPAP/NIV prophylactically to all patients following UAS need to be considered.

Post-discharge rehabilitation

Health-related quality of life (HRQoL) has become an important end-point in the abdominal surgical literature. Delayed recovery and persistent disability following UAS has been demonstrated up to six months postoperatively (Lawrence et al 2004), with complications in the immediate postoperative period being independent predictors of poorer recovery and poor HRQoL (Davies et al 2013, Lawrence et al 2004). It is unknown if delays in functional recovery (or functional decline) following UAS are related to increased health utilisation costs, morbidity and mortality or if postoperative rehabilitation programmes would hasten recovery and reduce disability. To our knowledge, there are currently no studies investigating the impact of

postoperative rehabilitation specifically for patients having undergone UAS. There is, however, a plethora of emerging literature demonstrating positive health benefits (including disease-free survival) at all stages of treatment in cancer survivors. Given that patients with cancer frequently present for abdominal surgery, and the known delayed recovery from UAS in some patients, the value of post-discharge rehabilitation for patients following UAS warrants further exploration.

Key Point:

In the absence of any evidence regarding postoperative rehabilitation programmes we are unable to make any recommendations regarding post-discharge physiotherapy.

CONCLUSION

The research regarding physiotherapy in the perioperative period for patients undergoing abdominal surgery is limited and equivocal. Physiotherapy services rely not only on the balance of evidence but on the balance of resources to provide these services. It is feasible that the potential high cost of PPCs

following abdominal surgery justifies the provision of low-cost interventions such as physiotherapy. Until this has been confirmed with good quality research and cost analysis studies, physiotherapists should provide a service based on the best available evidence. This study has attempted to summarise such evidence, highlight the areas required for further research and make balanced recommendations for practice on the basis of these factors.

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Table 3: PPC incidence rates in studies investigating physiotherapy interventions in major upper abdominal surgery published since systematic reviews of Lawrence (2006) and Pasquina (2006)

Author/year /country	Study type	Abdominal surgery types and risk profiles	Sample size	PEDro score	Interventions	PPC diagnostic criteria	PPC rate, % (95% CI)	ARR % (95% CI) NNT	Conclusion
Randomised controlled trials									
(Zhang et al 2015) China	Randomised controlled trial Multi-centre	Thoracic and UAS (open and laparoscopic) Mixed risk profiles	203	8/10	C: Standard ward care. No pre or postop physiotherapy Rx: Postop flutter 5-10 reps, 3 times daily, POD1-5	Any of the following: • Incidence of fever • Abnormal CXR • WCC • Antibiotic therapy	Fever incidence C: 39% (30-49%) Rx: 22% (15-31%)	17% (4-29%) NNT= 6 (3 to 22)	Flutter use following major thoracic and UAS halves fever incidence and reduces LOS, but not abnormalities in CXR or WCC, nor does it reduce antibiotic usage.
(Baltieri et al 2014) Brazil	Randomised controlled trial Single centre	Gastric bypass via open laparotomy, BMI > 40 High-risk	40	6/10	C: Physio DB&C, incentive spirometry, early mobilisation Rx A: BiPAP 1 hr prior to surgery Rx B: BiPAP 1 hr after surgery Rx C: PEEP 10cmH2O intraoperatively	Atelectasis on CXR	C: 20% (6-51%) Rx A: 10% (2-40%) Rx B: 0% Rx C: 10% (2-40%)	Not significant	Inadequate sample size to determine a conclusion.
(Samnani et al 2014) Pakistan	Pseudo randomised controlled trial Single centre	Low-risk, non-smokers, ASA 1 and 2, elective and emergency, open upper and lower abdominal surgery	224	5/10	C: Basic preop education Rx: Additional preop education on early ambulation Postop all received early ambulation > 10 minutes duration and those with prolonged operation time received "chest physio" and incentive spirometers.	Modified Melbourne group scale with 3 or more of the factors	C: 30% (22-39%) Rx: 7% (4-13%)	22% (13-32%) NNT= 4 (3 to 8)	Preop counselling on expected postoperative early ambulation leads to earlier mobilisation and significantly reduces PPCs.
(Silva et al 2013) Australia	Cluster randomised controlled trial Single centre	High-risk elective UAS Excluded: AAA, oesophagectomy	86	7/10	C: Assisted ambulation with Physio once daily at least RPE 6/10. Rx A: As control + coached DB&C (4 x 5 reps with 3 sec inspiratory holds) Rx B: Rest in bed for POD1 and 2 + coached DB&C as above. Assisted ambulation on POD3.	3 or more in the same day: • Auscultation changes • Temp >38 • CXR changes • Sputum changes	C: 21% (10-40%) Rx A: 25% (13-43%) Rx B: 10% (3-26%)	No significant difference in PPC rates	Inadequate sample size to determine a difference in PPCs.

(Barbalho-Moulim et al 2011) Brazil	Randomised controlled trial Single centre	Elective open bariatric surgery in females of short LOS (<3days)	32	7/10	C: Preop education on DB&C and early mobilisation. Postop daily physio of DB&C, incentive spirometry, early mobilisation Rx: Additional preop IMT, 15min, once daily, 6 days/wk, 2-4 wks prior to surgery. 30% MIP increasing twice weekly.	One or more of: • Pneumonia • CXR atelectasis with dyspnoea • Acute respiratory failure	0%	n/a	Inadequate sample size to determine a difference in PPCs in this low risk, short LOS population.
(Kulkarni et al 2010) England	Randomised controlled trial Single centre	Major elective UAS	80	5/10	C: No treatment RxA: DB exercises RxB: Incentive spirometry RxC: IMT, 20-30% MIP All exercises performed 15mins, twice daily, 7 days a week for 2 weeks prior to surgery	Chest infections requiring antibiotic treatment	C: 10% (3-30%) RxA: 5% (1-24%) RxB: 0% RxC: 0%	ISQ	Inadequate sample size to determine a difference in PPCs.
(Dronkers 2008) Netherlands	Randomised controlled trial Single centre	High-risk AAA repairs	20	7/10	C: Preop DB&C training, incentive spirometry. Postop physio of coached DB&C, incentive spirometry and early mobilisation Rx: IMT daily for 15min, 6 days a week. 2 weeks prior to surgery. 20% of MIP and increasing resistance to maintain RPE >5/10	Atelectasis on CXR	C: 80% (49-94%) Rx: 30% (11-60%)	50% (6-74%) NNT=2 (1-15)	Preop IMT reduces postoperative atelectasis following AAA repairs
Pre-post cohort studies									
(Lunardi et al 2011) Brazil	Pre-post cohort Single centre	Elective Oesophagectomy High-risk	70	n/a	C: No physiotherapy Rx: 20 minutes daily DB&C, early mobilisation	Any of the following: • Atelectasis on CXR • Pneumonia • Pleural effusion	C: 37% (22-54%) Rx: 15% (7-29%)	21% (1-41%) NNT = 5 (2 to 80)	Chest physio is likely to reduce PPCs following oesophagectomy
(Lunardi et al 2008) Brazil	Pre-post cohort Single centre	Oesophagectomy High risk, elective	40	n/a	RxA: Chest Physio only in ICU RxB: Chest Physio in ICU and through to hospital discharge	Any of the following: • Atelectasis on CXR • Pneumonia • Pleural effusion	RxA: 30% (14-52%) RxB: 10% (3-30%)	Not significant	Inadequate sample size to draw conclusions. Trend towards additional Physiotherapy beyond ICU reducing PPCs.

Table 3: PPC incidence rates in studies investigating physiotherapy interventions in major upper abdominal surgery published since systematic reviews of Lawrence (2006) and Pasquina (2006) (continued)

Author/year /country	Study type	Abdominal surgery types and risk profiles	Sample size	PEDro score	Interventions	PPC diagnostic criteria	PPC rate, % (95% CI)	ARR % (95% CI) NNT	Conclusion
(Nakamura et al 2008) Japan	Pre-post cohort Single centre	Elective oesophagectomy High-risk	184	n/a	C: Open surgery, no physiotherapy 1991-1995 RxA: VATS surgery, no physiotherapy 1996-2000 RxB: VATS or open surgery, corticosteroid medication, pre-and postoperative chest physiotherapy. 2001-2005	Any of the following: • Bronchopneumonia • Aspiration pneumonia • Acute respiratory failure • Pleural effusion	C: 27% (14-46%) RxA: 36% (25-49%) RxB: 8% (4-15%)	28% (15-42%) NNT = 4 (2 to 7)	Patients who did not receive pre and postop physiotherapy were 4 times more likely to get a respiratory complication.
(Westwood et al 2007) England	Pre-post cohort Single centre	All elective and emergency UAS Mixed risk	263	n/a	C: Daily DB&C ex Rx: Daily DB&C ex + incentive spirometry	Presence of clinical features of collapse/consolidation, plus one of the following: • Temp >38 • Positive CXR • Positive sputum	C: 17% (11-25%) Rx: 6% (3-12%)	11% (3-20%) NNT=9 (5-35)	The addition of incentive spirometry to chest physiotherapy may reduce PPCs following major UAS
Observational studies									
(Haines et al 2013) Australia	Prospective observational Single centre	High-risk elective and emergency UAS	72	n/a	Daily postop physiotherapy of early mobilisation, DB&C exercises, +/- NIV for 7 days	Melbourne group scale	39% (28-50%)	n/a	PPCs were 3 times more likely for each POD they did not mobilise away from the bed.
(Parry et al 2014) Australia	Prospective observational Single centre	High-risk elective and emergency UAS	50	n/a	Daily postop physiotherapy of early mobilisation, DB&C exercises, +/- NIV for 7 days	Melbourne group scale	42% (29-56%)	n/a	Patients with a nasogastric tube > 1 day were 9 times more likely to have a PPC
(Paisani et al 2012) Brazil	Prospective observational Single centre	Elective UAS Mixed risk profiles	137	n/a	Daily postop physiotherapy of early mobilisation and DB&C till hospital discharge	One or more of: • Pneumonia • Tracheobronchitis • CXR atelectasis with dyspnoea • Acute respiratory failure • Bronchoconstriction	7% (4-13%)	n/a	PPCs increase LOS and mortality.
(Feeney et al 2011) Ireland	Prospective observational Single centre	Elective oesophagectomy High-risk	37	n/a	Not specified	Melbourne group scale	27% (15-43%)	n/a	

(Chen et al 2011) Taiwan	Prospective observational Single centre	Elective oesophagectomy High-risk	68	n/a	Not specified	Any of the following: • Acute respiratory failure • Pneumonia • Pleural effusion	35% (25-47%)	n/a	ICU admission, length of surgery, preoperative estimated VO2max, upper GI surgery, and smoking predict PPCs.
(Scholes et al 2009) Australia	Prospective observational Multi-centre	All elective UAS Mixed risk	268	n/a	All patients standardised to receive preop education and DB&C training and a single postop physiotherapy (early mobilisation and DB&C) session on POD1	Melbourne group scale	13% (10-18%)	n/a	Patients are upright for only 3-13 minutes a day for the first 3 postop days. Time upright predicted LOS, but not PPC risk.
(Browning et al 2007) Australia	Prospective observational Single centre	All elective UAS Mixed risk	50	n/a	All patients standardised to receive preop education and DB&C training and a single postop physiotherapy (early mobilisation and DB&C) session on POD1	Melbourne group scale	18% (10-31%)	n/a	
(Kanat 2007) Turkey	Prospective observational Single centre	All elective UAS Mixed risk	60	n/a	Not specified. 95% achieved early mobilization as classified as <48hr post-op.	Any of the following: • Atelectasis • Pulmonary emboli • Bronchitis • Pneumonia • Pneumonitis • Acute respiratory failure	58% (46-70%)	n/a	
(Serejo et al 2007) Brazil	Prospective observational Single centre	All emergency UAS Mixed risk	266	n/a	Not detailed	Any of the following: • Atelectasis on CXR • Pneumonia • Pleural effusion • Acute respiratory failure	28% (23-34%)	n/a	

Notes: ARR, absolute risk reduction; ASA, American association of anaesthesiologists; AAA, abdominal aortic aneurysm; BiPAP bi-level positive airway pressure; BMI, body mass index; C, control; CI, confidence interval; CXR, chest Xray; DB&C, deep breathing and coughing; GI, gastrointestinal; ICU, intensive care unit; IMT, inspiratory muscle training; Intraop, intraoperatively; LOS, length of stay; MIP, maximal inspiratory pressure; n/a, not applicable; NNT, number needed to treat; NIV, non-invasive ventilation; PEP, positive expiratory pressure; POD, postoperative day; Postop, postoperatively; PPC, postoperative pulmonary complication; Preop, preoperatively; RPE, rate of perceived exertion; Rx, treatment; UAS, upper abdominal surgery; VATS, video assisted thoracic surgery; WCC, white cell count.

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A novel communication application to encourage social interaction by children with autism spectrum disorder

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ABSTRACT

Difficulty with social interactions is a feature of Autistic Spectrum Disorder (ASD) and can be present in children who have other developmental disorders. A novel application using computer technology was designed by Callaghan Innovation to improve social interaction in this population by assisting casual conversation between two people with minimal external facilitation. We compared the application with the children's existing Augmentative and Alternative Communication (AAC) devices and Picture Communication Symbols (PCS™). A sample of three pairs ($n = 6$) of adolescents, who have a diagnosis of ASD or another developmental condition affecting their social interaction and communication, were videotaped and analysed using all three modes. The new application provided better social interaction, attention, independence and enjoyment than the existing systems.

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Key Words: Social interaction, Autistic Spectrum Disorder (ASD), Special needs population, Augmented and Alternative Communication (AAC), Computer technology

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental syndrome which may result in differences in cognitive processing, reduction in social interaction, and stereotypical behaviour and fixated interests (American Psychiatric Association 2013). The prevalence of ASD in the US is 1 in 68 (Centres of Disease Control and Prevention 2010), with approximately 40,000 individuals with ASD in New Zealand (Ministries of Health and Education 2008). As it is a spectrum disorder, there

is a large variation in severity and no individuals with ASD will have the exact same symptoms. Impaired social interactions seen in ASD include lack of social or emotional reciprocity including a lack of eye contact and hand gestures, resulting in difficulty in developing and maintaining relationships with others (Lord et al 2000).

It is estimated that about 50% of children with ASD do not develop functional speech, therefore requiring an alternative way to communicate (Ganz et al 2012). Augmentative and

Alternative Communication (AAC) systems are commonly utilised to aid people with complex communication needs. AAC systems constitute an array of communication aids, such as sign language, gestures, symbols, pictures and speech generating devices. One of the modes for aided communication is the Picture Exchange Communication System (PECS®) (Pyramid Group Management Services, Inc., Syracuse, New York, USA) which is a low tech system that is well established for use in the speech-affected population. It was designed specifically to aid social interactions in children with communication problems (Bondy and Frost 2001). The use of touch pad-based AAC systems has recently become popular because of the medium's ability to create low-cost applications.

AAC systems are typically used by a single individual rather than in a collaborative conversation, possibly due to a lack of systems available that support interactive conversation, or to the wide variety of vocabulary and symbols used, making it difficult to integrate conversations across such devices (Gonzales et al 2009). Also, for those with severe communicative disabilities, even communication with electronic AAC systems can be limited, through difficulty in comprehension by peers due to abnormal sentence structure (Soto and Hartmann 2006).

Callaghan Innovation, a New Zealand government agency, developed a novel communication application to encourage social interaction and casual conversation between people who use AAC devices. The aim of this study was to investigate the feasibility of this application for adolescents by asking whether the novel application enabled better social interaction, joint attention and independence as compared to Picture Communication Symbols (PCST™) and each adolescent's usual AAC system.

METHOD

This feasibility study was approved by the University of Otago Human Ethics Committee (ref 11/195) and comprises of a comparative case series.

Participants

Recruitment took place at a special needs centre situated within a state high school in Christchurch, New Zealand. This facility caters for around 40 adolescents with ASD, Down's syndrome or other developmental disorders and who have high or very high needs. The study and its inclusion criteria were described by members of the research team to the teaching staff at the facility, who then identified potential participants for the study. The inclusion criteria included i) a diagnosis or impairment which affects social interaction and communication, ii) the ability to follow very simple instructions and demonstrations, iii) adequate motor control to manipulate a touch screen and picture cards, iv) regular use of an electronic AAC tool, and v) familiarity with PCST™ cards.

Written informed consent for each participant to take part in the study was obtained from the parent/s or caregiver/s. Teaching staff paired participants so that individuals in each pair were familiar with each other (for example, were in the same school classroom), were of similar age, and had similar communicative ability.

Six participants (3 females, 3 males, mean age 16.2 years, age range 12-19 years) were recruited to form three pairs. Each pair had one participant with ASD and one participant with a different neuro-developmental condition. Each participant was assigned a code from P1 to P6. The pairs were as follows; P1 and P2, P3 and P4, and P5 and P6.

Materials

This study compared the novel application with two AAC systems: the PCST™ cards and the participant's usual electronic AAC device or application. The novel application used symbols that participants were already familiar with through their usual use in the school setting. We orchestrated a turn based conversation in each mode (see Table 1).

Table 1: Type of conversation used in the study

Participant A	Participant B
Hello	Hello
How are you	I feel... (good, tired, sick, sad)
What are you doing today?	I am going to... (swimming, smartboard, music and movement, walk, exercise, Special Olympics, computer, cooking, reading, sports)
Who with?	With... (photos of school staff and students)

We used a set of PCST™ cards (relevant to the conversation in Table 1) that attached temporarily to fabric mats to facilitate the conversation using this method. Each participant was given one mat with cards relevant to their turn and a larger third mat was used as the shared mat which participants conversed on with the cards. VELCRO® was placed on the PCST™ cards so they could be attached to the mats.

For the electronic AAC system, each participant used their own device or application that included speech generation, icons and written words or phrases. The personal AAC systems used were DynaVox (Tobii Dynavox, Pittsburgh, USA) (two participants), Proloquo2go (AssistiveWare, Amsterdam, the Netherlands) (one participant) and TouchChat (TouchChat Apps, Apple Inc., Cupertino, California, USA) (three participants).

The novel application was designed in such a way that the features to facilitate a conversation such as in Table 1 were built into it and did not require any special setup.

Procedure

Before data were collected, the three pairs of participants received two training sessions of 10-15 minutes for each mode: PCST™, their electronic AAC devices/applications, and the novel application. These sessions were facilitated by two members of the research team in collaboration with one of two Speech and Language Therapy (SLT) students interning at the school. As the SLT students were to act as the facilitators during data collection, this training allowed them to practise instructing the participants and understand how to use all of the AAC systems used in the study.

Data collection took place in a quiet room at the school. One of the two trained facilitators was present in the room at all times during data collection. A teacher-aide was also present in the room for two participants who required supervision at all times. The teacher-aides were instructed not to speak to the participants or intervene unless the facilitator was unable to manage a participant's behaviour.

The room had one table in the middle with two chairs side by side in front of it, although a chair was removed for two participants who used wheelchairs. Three digital video cameras ensured all behaviours of the participants and facilitator were recorded: one from behind the participants to capture the screens/picture boards, and the other two in symmetrical positions on the front left and right sides. Data were collected over five school days with each pair of participants completing one mode (PCST™, electronic AAC and novel application) each day, in a randomised order, until the three modes were completed. If a pair was unable to complete a mode due to other school commitments or illness on the scheduled day, they completed that mode on the next available day. All data were collected between the hours of 9 am and 10.30am. The order of the pairs each day was subject to their availability as the research team did not want to disrupt normal school routines.

The type of conversation in Table 1 was attempted for all three modes of communication. The facilitator was in charge of ensuring each pair was seated appropriately for data collection. For each mode the facilitator gave the same appropriate instructions before starting the timer, and indicated which participant would begin the conversation. Each pair was then first given 30 seconds to begin conversing with their partner without any prompting or instruction from the facilitator to measure whether or not, and after how long do, participants initiate conversation without being prompted by the facilitator. After these 30 seconds, the facilitator was allowed to intervene or prompt participants as necessary and allowed to select the appropriate picture card or icon in order to facilitate the conversation. Total time of the conversation was recorded. One conversation included participants switching roles i.e. Participant

A used Participant B's utterances in Table 1 and B used A's. Conversations were terminated if they exceeded 10 minutes.

For the PCST™ cards setup, participants were given one felt mat each; mat 1 had Participant A's words and mat 2 held Participant B's words. A larger shared mat was used to display the cards participants selected to use in the conversation. After A had placed their words on the shared mat, B would reply in the same manner. This continued until either the conversation or the time finished; if there was still time left, the facilitator would re-organise the mats and swap the conversation. For the Personal AAC tool, participants were asked to greet the other participant and then to tell each other what they were going to do that day and select appropriate symbols to create their utterances and form a conversation. The novel application had the conversation in Table 1 embedded in it.

Data Analysis

A data analysis sheet which listed behaviours that could potentially be demonstrated by participants was compiled. The chosen behaviours were identified in existing assessment measures of social and communicative behaviours commonly exhibited by adolescents with ASD or communicative impairments. These assessment measures included the TRIAD Social Skills Assessment (Stone et al 2010), the Autism Social Skills Profile (Bellini and Hopf 2007), the goals utilised in SCERTS (Prizant et al 2003) and the behaviours observed by Jordan et al (2013) in a small study that used a fine grain analysis to analyse behaviours in adolescents with ASD and other cognitive impairment.

To ensure the behaviours in the data analysis scoring sheet were relevant, we performed two trial data analyses (not included in the final analysis) using a short video of two individuals with ASD which was collected when the novel application was first introduced to staff and students at the centre. Based on this, modifications to the chosen behaviours were made and the final list of target behaviours was agreed upon. The chosen behaviours were divided into positive and negative behaviours (which could be measured either by frequency or length of time) and are described in Tables 2 and 3.

Table 2: Positive Behaviours

Behaviour	Description
Looks at facilitator	Participant looks at facilitator. This includes looking spontaneously or in response to prompting or intervention.
Looks at partner	Participant looks at partner. Includes spontaneous looks or looks in response to speech or elements in the mode.
Communicates with facilitator via gestures	Use of a gesture to communicate with facilitator in isolation, to support speech, or attempts to verbalise.
Communicates with facilitator via speech	Recognisable utterances spoken to facilitator. This included using facilitator's name, repeating words, reading from the two AAC systems and the novel application, greetings, questions and comments.
Communicates with partner via gestures	Use of a gesture to communicate with partner in isolation or to support speech or attempts to verbalise.

Communicates with partner via speech	Recognisable utterances spoken to partner. Includes using partner's name, repeating words, reading from the two AAC systems and the novel application, greetings, questions and comments.
Expression of joy	Any indication of joy through speech, noise, actions or facial/body expression.
Attempts to verbalise	Any noise that is an attempt to communicate but is not recognisable as a word. Laughing or yawning are not counted in this category.
Positive touch	Touching partner to communicate or enhance social interaction in a positive manner, commonly, touching to return focus, remind partner of a turn or to display excitement. Touch was deemed inappropriate if forceful or unwanted.
Joint attention	Total time both participants were simultaneously attending to the same elements of the mode, including eye contact.

Table 3: Negative Behaviours

Behaviour	Description
Repetitive behaviour	For example, rocking or continuous hand movements.
Turn taking error	Participant incorrectly took their turn including attempt to take turn before partner had completed their turn, or continuing to ask or answer questions without allowing partner to reply.
Focus away from the game	Total time participant not visually attending to the activity.
Inappropriate action	Behaviours deemed inappropriate such as refusal to participate and aggression.
Facilitator intervenes or prompts	Facilitator prompts or intervenes to assist activity, including behaviour management, reminding participants to take turn or return attention to activity, or physical assistance.

Five researchers analysed the video data, two or three target behaviours each. Each video was watched three times, with a fourth viewing from an additional angle if behaviours were obscured. The analysis of the video data commenced once the facilitator had finished speaking the initial instruction and was ended either on completion of the conversation or at the 10 minute mark. If there was ambiguity or question about any behaviour, the research team held a collaborative discussion until agreement was reached.

RESULTS

To allow equitable comparison between the modes, we recorded the length of time of each conversation and extrapolated the data to equal 10 minutes. The novel application performed noticeably better than the other two AAC modes for all metrics. It facilitated better social interaction, more joint attention, required less facilitator intervention, took less time, and participants seemed to enjoy using it more than the other two modes.

Positive and negative behaviours: The novel application resulted in the greatest frequency of positive behaviours (479.7) and the lowest frequency of negative behaviours (106.2) across the three modes (Figure 1). This was followed by PCSTTM cards and the personal AAC device, which performed the worst of all, with lowest frequency of positive behaviours (334.7) and highest frequency of negative behaviours (274.6).

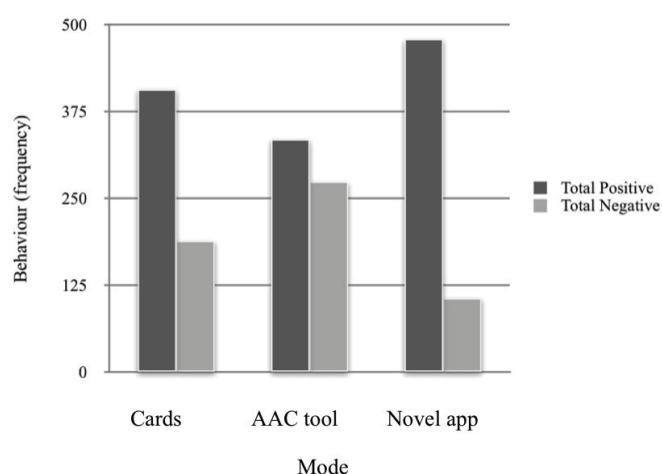


Figure 1: Total positive and negative behaviours

Time taken: The novel application allowed participants to finish their conversations fastest of all, followed by PCSTTM cards (Figure 2). When using their personal electronic AAC tools, only pair 1 completed the conversation in the allocated 10 minute time slot. Three trials were terminated by the facilitator because the planned time limit of 10 minutes was reached, one when using the PCSTTM cards (pair 3), and two while using their personal AAC tool (pairs 2 and 3). All trials with the novel application were completed well under the 10 minute time limit.

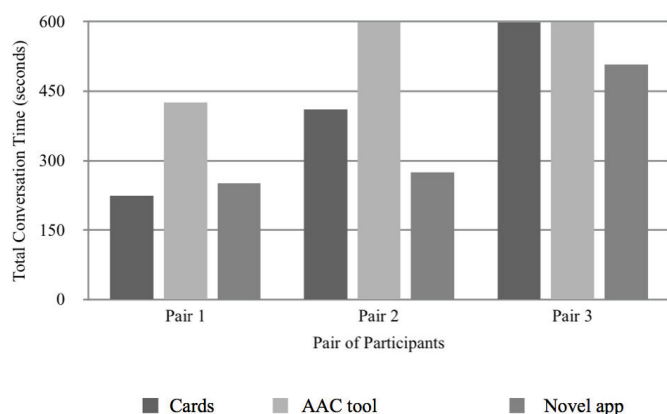


Figure 2: Time taken by each participant for each model

Attention: Participant's attention and level of engagement were measured via joint attention and amount of focus away from the game. The total time that each pair showed 'joint attention' was greatest for all pairs when using the novel application, followed by personal AAC tool, and lowest for all pairs when using the PCS™ cards (Figure 3). A significant decrease in 'focus away from the activity' was also noted for each participant while using the novel application (Figure 4).

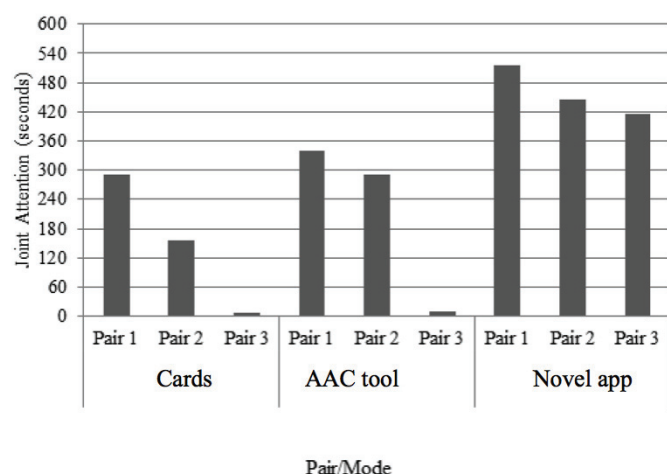


Figure 3: Joint attention of each participant pair

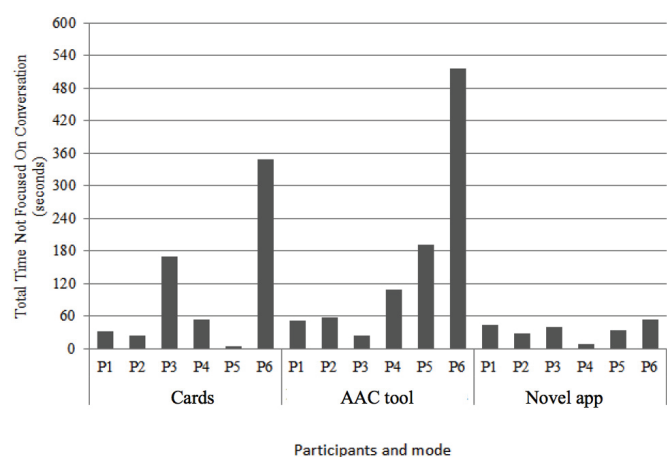


Figure 4: Focus away from the activity

Enjoyment: Participants appeared to enjoy using the novel application more than the other modes. The greatest frequency of expressions of joy for all participants occurred while using the novel application (Figure 5). Four of the six participants (P1, P3, P4 and P6) expressed joy at least twice as often while using the novel application compared to the other two modes.

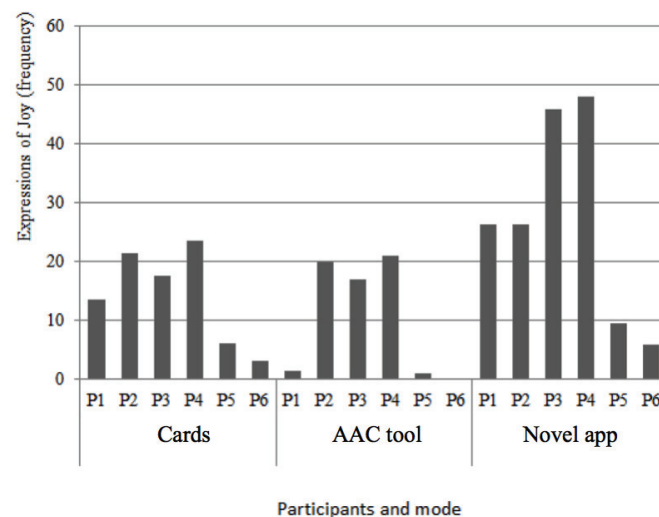


Figure 5: Expressions of joy by each participant

Facilitator intervention: Participants demonstrated greater independence when using the novel application. After just two training sessions, participants required considerably less assistance using the novel application than with either the PCS™ cards or their personal AAC tool, even though they were already familiar with these and used them in everyday life. Participants 1 and 2 required no prompts or intervention from the facilitator to complete both parts of the conversation when using the novel application but required 5 - 10 prompts each for PCS™ cards and 31 - 39 prompts each when using their personal AAC tool. Participant 5, however, who also had an upper limb motor impairment, required more facilitator intervention while using the novel application (49.7) as opposed to 39 for PCS™ cards, but required 70 for the personal AAC device (Figure 6).

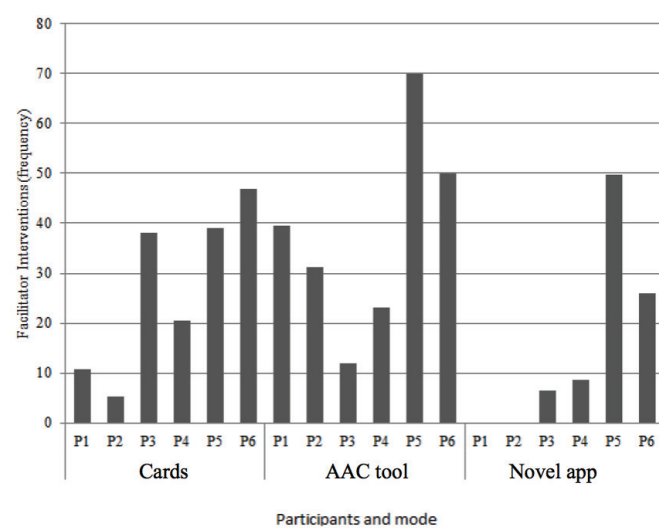


Figure 6: Facilitator interventions for each participant

Attempts to verbalise: The highest frequency of attempts to verbalise by participants was observed while using the novel application. For PCS™ cards and their personal AAC tool, numbers of attempts were somewhat similar (Figure 7). Participant 1 and Participant 2 made no attempts to verbalise in any mode.

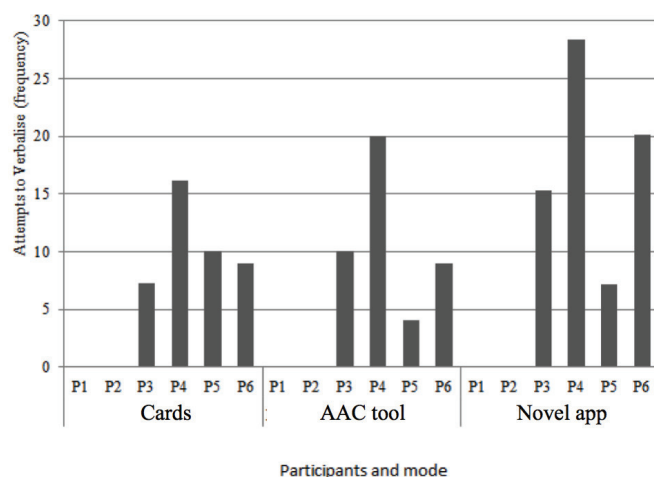


Figure 7: Attempts to verbalise by each participant

DISCUSSION

The findings of this study support the use of the novel application as an encouraging application for improving social interactions by adolescents with special needs. It required considerably less facilitation than the two modes of PCS™ cards and personal electronic AAC devices/applications, thereby providing increased independence for its users. The novel application also showed superior ability to the other forms of AAC systems with which it was compared in increasing positive social interactions, such as expressions of joy and attempts to verbalise, and also in improving the participant's simultaneous attention to the task and eye contact with their communicative partner.

Reciprocity: To compare the three modes of communication, the way the picture cards were normally used had to be altered. The cards had been previously used by participants in communication to others when they wished to express wants and feelings, but not to converse back and forth with another person. Therefore, communicative reciprocity through typical 'turn taking' interaction was withheld. As explained in the method, a new style of picture card interaction was taught to the participants in order to facilitate reciprocity and allow comparison to the novel application. However, the physical task of having to locate, identify, and pull off each picture card and then place it on the 'shared conversation mat' in appropriate order appeared more cognitively and physically demanding for our participants than the demands of the novel application. This may have slowed down the interaction with the partner, thereby explaining why our results demonstrated the least amount of joint attention across all three pairs when they used the picture cards for interaction. On the other hand, the features of the novel application appeared to positively influence dual engagement and thus promote communicative reciprocity.

Attention: Joint attention is a behaviour that is often decreased in ASD and other developmental disorders (American Psychiatric Association 2013). It describes a lack of simultaneous attention to objects, and an inability to attend to objects of another person's interest by following eye-gaze or gestures (Dawson and Sterling 2008). Therefore, the increase in joint attention of participants when using the novel application was a very positive result.

Facial expressions: Whilst using the novel application, each participant expressed joy at a considerably higher frequency in comparison to the other two modes. Although 'expression of joy' was counted as "any indication of joy through speech, noise, actions or facial/body language", video-analysis proved this was most often displayed by the participants through facial expression. Considering both children and adults with ASD commonly have reduced outward facial expression (Gordon et al 2014), these results suggest the novel application has a positive socio-communicative influence. It is known that facial expression can aid in initiation, modification and regulation of social interaction (Gordon et al 2014). Therefore increases in non-verbal elements of communication (such as expression of joy) may facilitate social interaction and understanding between children with ASD when using the novel application.

Verbalisation: Each participant in this study had a different level of communication skill. Facilitation and the use of an AAC device is required to enable four of our six participants to communicate in their everyday life. For these four participants, the effectiveness of the different modes to facilitate any form of verbal communication was measured by counting any noise that was an attempt to communicate but was not recognisable as a word. The other two participants also used an AAC device even though they are able to verbalise intelligibly, albeit only sometimes; these two participants (P1 and P2) therefore did not have any counts recorded under 'attempts to verbalise' and instead were recorded under 'speaks to partner'. Our results supported the use of the novel application as the most effective mode for facilitating 'attempts to verbalise' (for P3, P4 and P6) and for 'speaks to partner' (for P1 and P2) over the other two modes used in this study. Improved initiation of sound or words due to the use of the novel application is an extremely positive outcome for our study as the lack of social and communication skills often hampers learning (Ennis-Cole 2015).

Timespan: The time slot allocation of 10 minutes was decided by the research team together with school staff, after the practice trials, as being an adequate amount of time for a simple two way conversation to be completed. Of the nine sessions of data collection, three took the total 10 minutes, while the other six sessions were under the 10 minute cap. We therefore extrapolated the data out to give a fair representation of the interactions recorded across the different modes, for example, three minutes is not a long time to hold concentration compared to 10 minutes. It would have been interesting to examine attention span against time, to see whether, if a participant was given the freedom to use the application for as long as they wished to, how long this would be and at what rate the behaviours would occur.

Measures: Although the measures of behaviours used in this study were based on validated assessment tools, modifications were required to remove components irrelevant to our study. For example, the item “interacts with peers during unstructured activities” on the Autism Social Skills Profile (Bellini and Hopf 2007) was unable to be assessed, as the nature of our study required pairs of participants to communicate within an orchestrated and structured environment. Of the three participants diagnosed with ASD involved in our study, only one was known to commonly display repetitive behaviours. This is somewhat unusual as repetitive behaviours are a common characteristic displayed by people with ASD (American Psychiatric Association 2013). Therefore, while a change in data about repetitive behaviour may indicate the potential influence of each mode, it was not an important factor in our study, due to only one participant exhibiting this behaviour.

Discrepancies: As shown in our results, the category “Looks at Facilitator” was analysed as a positive behaviour. However, during data analysis, researchers noticed this target behaviour was more often displayed in a negative manner. Often this occurred when the facilitator was intervening due to difficulty in game-play. This possible mixture of positive and negative interactions may explain why our findings for the novel application were low, as it also required less facilitator intervention than the other two modes.

Interestingly, teaching staff reported anecdotally that after regular use of the novel application (the application was left at the school for use by its students after the study was completed), two students were seen conversing via the novel application for approximately 20 minutes, something highly unusual at the facility. Also, some of the participants had begun greeting each other spontaneously and one pair developed an enduring friendship. This had not been observed prior to exposure to the novel application, despite the adolescents having attended school together for a number of years. It appears, therefore, that the novel application has the potential for transfer of its skills to real life.

CONCLUSION

This study tested the feasibility of a novel application to engage adolescents with ASD or another developmental condition, in interactive social communication. The novel application facilitated an improvement in positive behaviours of joint attention, expressions of joy and attempts to verbalise. When compared with picture cards and the participants’ personal AAC applications, the novel application resulted in a decrease in frequency of negative behaviours, such as loss of focus and intervention by the facilitator. Further research with a larger cohort and with a wider range of children with communication disorders would help determine how the use of this application can be optimised for developing social interaction skills.

KEY POINTS

1. A novel application enabled better and more enjoyable social interaction among adolescents with communication impairment than when they used their usual methods of PCS™ cards or personal electronic AAC device.

2. The novel application required much less facilitator intervention than the user’s usual methods of interaction, thus enabling the users to be more independent.

DISCLOSURES

This study was unfunded.

Two authors are affiliated to Callaghan Innovation, the organisation that designed the novel application. However, neither of these authors were involved in data collection for this study. The other authors report no conflicts of interest. The study was unfunded.

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Gaining perspectives of people with stroke, to inform development of a group exercise programme: A qualitative study.

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ABSTRACT

This study explored the perspectives on participation in group rehabilitation in the inpatient setting for people with moderate to severe stroke. A qualitative descriptive study using in-depth semi-structured interviews ascertained the experiences and impressions of participating in a group exercise programme. Six participants were interviewed, and analysis of the data identified four main themes: *Loss of self; I can't do it alone; Being part of the whole* and *Therapeutic approach in the context of personhood*. These themes allowed identification of key components that may inform development of group exercise for people with moderate to severe stroke. People with moderate to severe stroke expressed feelings of loss of who they had been. Some were reluctant to join group exercise; the need to be part of a group was sometimes overwhelmed by doubt that they could participate in a meaningful way. Those who overcame their reluctance to join found a benefit in shared experience and mutual assistance to progress. The way they were treated and the degree their autonomy was respected by physiotherapists had a significant impact on their willingness to exercise and their enjoyment of group sessions. These findings will assist the development of a group programme to increase opportunities for activity in the inpatient stroke rehabilitation setting.

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Keywords: Stroke, Group exercise, Qualitative, Severity, Participation

INTRODUCTION

Stroke is the third leading cause of death and the greatest cause of disability in adults in New Zealand. Approximately 9,000 strokes are reported every year and there are an estimated 60,000 stroke survivors at present (Ministry of Health 2014). Approximately 43% of survivors experience a moderate to severe disability and many continue to require assistance with at least one activity of daily living after discharge (Hartman-Maeir et al 2007). Despite the significant number of people with a moderate to severe stroke, research has consistently shown that this population does not receive the recommended amount of therapy, as the ratio of physiotherapists to patients in an acute stroke unit is often insufficient (Bernhardt et al 2004).

Recent research has shown that an increase in the amount of activity undertaken by people with severe stroke is possible and well tolerated (Askim et al 2012). One potentially effective way to increase activity in the inpatient rehabilitation setting is to include patients in group activity. Several studies have demonstrated that group-based programmes lead to positive outcomes for people with stroke, including psychosocial gain, positive impact on confidence, and functional improvement (Graham et al 2008, Schouten et al 2011, Song et al 2015). Depression is also commonly seen in people after stroke and several studies have indicated that group-based classes may increase confidence and hope with a consequent reduction in depression (Anderson and Whitfield 2013, Townend et al 2010). However, people with moderate to severe stroke are frequently

excluded from studies investigating group-based rehabilitation due to their limited ability to participate without assistance, so little is known about its potential use in this population. The current study aimed to explore the experiences and perceptions of group exercise programmes from the perspectives of people with moderate to severe stroke in the inpatient setting. The findings will inform the development of a group-based rehabilitation programme in the acute stroke rehabilitation setting.

METHOD

Design

This study drew on Qualitative Descriptive Methodology, using semi-structured individual interviews. This methodology has been identified as being useful to inform intervention development (Sandelowski 2000, Sullivan-Bolyai et al 2005). Ethics approval was obtained from AUT Ethics Committee (14/154) and institutional approval was gained from Auckland District Health Board Ethics Committee prior to commencing this study.

Participants

People were eligible to take part if they: (1) had sustained a moderate to severe stroke, (a score of 5 or above on the National Institutes of Health Stroke Scale); (2) were 65 years old or over; and (3) were able to converse in English. Exclusion criteria were: (1) communication impairment (sustained expressive / receptive dysphasia) that would impact their ability to engage in the interview process; and (2) a score below 4 out of 6 on the 6-item cognitive impairment test (Slater and Young 2013), conducted by an experienced senior clinician.

Participants were identified and recruited from an Older Persons Health ward in an inner city hospital between April and June 2015. Convenience sampling was used to identify potential participants due to the unpredictability of the occurrence of the condition, and the time and resource constraints on student researchers. Effort was however made to include a diversity of people with regard to sex and ethnic diversity to capture a breadth of perspectives and improve transferability of findings when applied to similar settings and contexts. Informed consent was sought from all potential participants who met the inclusion criteria and agreed to participate in the study.

Data Collection

The interviews were conducted face to face by a student researcher (CK or VW) and a senior clinician (LH-F). Each interview was undertaken prior to patient discharge from OPH, and took place in a private room on the ward. Family/whānau were invited to attend at the discretion of the participant. The interview questions (Appendix 1) were designed to explore the participant's rehabilitation experience and perspective during their hospital stay, and to help inform structure and content of future group-based programmes. The interviews were audiotaped and transcribed verbatim. Audio recordings and transcripts were kept in password secured files and pseudonyms were assigned to protect patient anonymity. Interviews were a maximum of one hour to avoid fatigue and terminated early if the participant so requested or if the information already gained satisfied the purpose of data collection.

Data Analysis

This study followed conventional content analysis, an inductive approach guided by step-by-step procedures to avoid preconceived concepts, suggested to be appropriate when there is limited research literature available on the topic (Hsieh and Shannon 2005). The initial analysis was carried out by the two student researchers. The transcripts were read repeatedly in order to become familiar with the data, then phrases and sentences were initially coded manually after each interview. Key thoughts and concepts were highlighted independently and discussed between student researchers. New data and codes were checked against the preliminary concepts. The codes were evaluated and grouped into categories based on their similarity. All transcripts were then uploaded to NVivo, a qualitative data management software (QSR International Pty Ltd. Version 10). Iterative comparison of coded data within categories was undertaken to identify themes. Two random transcripts were sent to senior qualitative researchers (NK and NS) for analysis, then the study team met as a group and discussed the analysis and interpretation to ensure consistency in interpretation of data. Following this, a tabular form of key categories, annotation and illustrative quotes was drafted by student researchers and sent to the two senior researchers to assist theme development. The senior researchers assisted in clarifying themes and the final themes were agreed upon after discussion.

RESULTS

Participant Characteristics

Six participants were recruited to take part in the study: four males and two females with a median age of 81 years (range 76-93). Five of the six participants identified as European New Zealanders and one as Indian. All participants had been independent in activities of daily living prior to the stroke and none regained independence prior to discharge from hospital. Table 1 provides a summary of participant characteristics and their pseudonyms.

Interview findings

Four main themes were drawn from the data. The themes were, *Loss of self*, *I can't do it alone*, *Being part of the whole* and *Therapeutic approach in the context of personhood*. The themes are described in more detail below.

Theme 1: Loss of self

This theme represents participants' views and feelings post-stroke and encompasses the effects it has on their lives. It embodies feelings of helplessness, loss of hope and identity and an end of a former life. The participants often appeared to experience the *loss of self* through a loss of roles or meaningful activities. One participant expressed her loss of role as a mother and portrayed feelings of guilt when she stated:

I feel like they could've done without having a mother falling by the wayside. I couldn't have had a stroke at a worse time. (Sally, 84 yrs)

A majority of the participants' stories portrayed feelings of sadness, with their former lives barely seeming real. Being unable to participate in the same way as prior to their stroke led to a loss of hope of recovering their former self. John expressed

Table 1 : Participants characteristics

Pseudonym	Age (Y)	Sex	Ethnicity	Length of Stay (days)	Social situation
Sally	84	F	New Zealand European	43	Previously lived alone in independent unit. Discharged to private hospital.
John	86	M	New Zealand European	35	Previously lived independently in own home. Discharged to private hospital.
Mike	78	M	New Zealand European	45	Previously lived with wife in own home. Discharged home with increased package of care.
Maggie	93	F	New Zealand European	20	Previously lived independently in retirement village. Assessed as requiring private hospital care.
David	79	M	New Zealand European	20	Previously lived with partner in pension flat. Discharged home with increased package of care.
Ravi	76	M	Indian	34	Previously lived with wife at home; discharged home with increased level of home care.

Notes: Y, years; M, male; F, female

this sense of loss and the impact it had on his hope of recovery:

Well, I would wish to be the fitness sort of person I used to be because I, we'd do long walks you know and they are only dreams now to me...all of them. It was disgusting to me... what I was doing [compared] to what I used to be able to do. (John, 86 yrs)

The emotional response to the sense of loss may impact engagement. Frustration or even despair was sometimes articulated:

All those good things in my life are over and that is hard to come to grips with. (John, 86 yrs)

Well of course you feel very frustrated when you can't do what you used to be able to do without even thinking about it. (David, 79 yrs)

Physical activity which did not seem to have any link to real life was negatively perceived. Each participant interviewed indicated the value in purposeful activities which had a link to their former life. However, they reported that it was not always clearly explained why they had to go to the gym and do exercises when they had never been physically active pre- stroke. John explained:

I never was the exercise type; I did sports to stay active like golf. (John 86yrs)

Other participants went into great detail of activities they enjoyed such as knitting, social clubs and cooking, but were unable to link their rehabilitation exercises to a return to those activities. When asked if they would have participated in group exercises to improve their fitness and strength to get back to those activities there was unanimous agreement that they would.

Some participants reflected on the potential for a group programme to reveal activities they were no longer able to do

and the potential for this to hinder engagement and impact negatively on mood. However, sharing the experience of loss of self with other group participants appeared to be helpful in envisaging hope of a different self. When reflecting on observing others with similar limitations, Maggie reported:

You can see the others have improved, well maybe you can improve as well as that's you. And it's not the end of the world but you have to adjust to things being different. (Maggie, 93 yrs)

People who were unable to envisage a different normal had a very different outlook on the situation. Another participant attending the same exercise group stated: "It's all gone..." (John, 86 yrs).

Theme 2: I can't do it alone

This theme represents the initial apprehension about engaging in a group programme. Support and encouragement from others was reported by several participants to have helped them through that early vulnerability.

Everyone sort of looked at each other and then they'd smile... you're all a bit nervous then you get a bit more confident as the days go on, and it's quite fun once you get over being frightened....or not frightened, but cautious. (Maggie, 93 yrs)

Maggie's statement seemed to suggest a sense of hope and belonging. Observing and learning from others in a similar situation seemed to uplift spirits and instill confidence. Having the opportunity to relate to others may have offered the support needed to gain courage and trust in one's new self and the motivation to engage in the group programme. When engagement with others was not possible the experience appeared to be very different. Mike was an inpatient in the same ward as Maggie, but was in isolation due to a virus. He

stated: "I'm so depressed...I've had enough." (Mike, 78 yrs)

Being in a group setting rather than alone and being able to gauge improvements relative to others can create a sense of responsibility for progress:

Is there anything that I can do to help myself? is what it really boils down to. If I'm not making progress, it's me who's at fault. (Sally, 84 yrs)

However, it also appeared important for there to be a good level of support from staff to counter feelings of powerlessness. This suggests the need for a balance between intrinsic and extrinsic feedback, so progress is not hampered by feelings of guilt from unhelpful comparison with others. This is reflected in Sally's comments, as she went on to say:

You have no idea the way I envy the other women in the ward who have worked so hard, and who can actually get out of bed, and back in again without falling over. And they walk to the toilet, by themselves. They must work very, very hard. A lot harder than me obviously. (Sally, 84 yrs)

There were also occasions mentioned when attendance at group activities was limited by a belief (perceived or real) that you had to be at a certain level to engage in group exercises. For example, Ravi commented: "I'd love to go there, but I can't do it myself. Because I'm unable to walk properly, stand properly." (Ravi, 75 yrs)

Some participants expressed a keenness to attend a class but felt they lacked the ability to do it alone and a strong desire not to be a burden to others meant they did not ask for help and consequently missed out. David relates why he didn't ask for help: "They have lives as well... [Referring to staff]" (David, 79 yrs)

An opposing view was expressed by others who could not manage activities such as toileting, walking and group programmes. There was a feeling that the assistance required was not available due to insufficient staff-to-patient ratios to meet that need:

I just continue to walk, because if I only do half an hour walking I have to wait for the next day, the nurse took me for a walk around once, instead of once, they should take me two, three times. (Ravi, 75 yrs)

A surprising finding within this theme was that despite the expressed need for help, none of the participants wished to have their families attend the exercise programme to offer additional support. Some participants stated they did not want to "burden (their) loved ones". When asked if he would want his family to be part of an exercise group with him, John pointed out that they were already stretched with doing things for him.

They are putting in more time than you can dream now, I mean [name of daughter] is only here because she works at school in the office, and has a tough job there. (John, 86 yrs)

Theme 3: Being part of the whole

This theme signifies the importance of human interaction, connection and support that can be offered by group activities. Creating relationships early in a hospital stay with peers or

instructors may facilitate engagement and improve confidence. A regular group exercise participant shared her experience of when she first attended class: "We are all in the same boat." (Maggie, 93 yrs)

Maggie also acknowledged the shared experience and role that others who were further along than her had as mentors in the group: "Some are better off, further ahead than others, but it doesn't seem to matter, 'cause they're sympathetic, they've been through it." (Maggie, 93 yrs)

The environment was frequently mentioned as an important factor in a sense of belonging and engagement in a group programme. Some clear recurring drivers which promote engagement were mentioned by participants. All participants stated the importance of music during exercise class. Some preferred something with a beat, others preferred country or rock 'n' roll and some could not say what they liked, but simply stated: "Music makes it better." (David, 79 yrs)

This seemed partly to do with creating a fun atmosphere in the group environment, which helps foster companionship. By building relationships with fellow group attendees, participants reported building trust, allowing fear and anxiety around exercise performance to ease.

It doesn't seem like work, it makes it seem more like fun, because you got the companionship, and you then know that no one is gonna let you fall or anything bad is going to happen. It then becomes quite fun. (Maggie, 93 yrs)

Theme 4: Therapeutic approach in the context of personhood.

The interaction between patient and practitioner clearly impacts patients' engagement in physical activity. Knowing how much to push someone during a treatment session involves skill from the practitioner. When participants were asked if they were receiving adequate therapeutic intervention, five out of the six responded 'yes.' They enjoyed a balance of stimulation (exercises) and rests. Maggie (93 yrs) was asked:

Interviewer: In a normal day in hospital were there enough activities? Was it ever too quiet?

Maggie: The normal day, no, because something was happening most of the time. There's enough time to rest and get over it to want to do something else. (Maggie 93 yrs)

However, the therapeutic part of treatment needed to be balanced with being treated as a person. There were times when participants noticed they felt their personhood was not being taken into account and the mechanics of the interaction had taken over. One participant described their experience of being moved and handled in this way:

Everyone is trying to turn you over by grabbing your leg. Every finger nail, every thumb leaves a bruise. (Sally, 84 yrs).

This was not a common situation and several participants gave the opposing view, that when they were appreciated as an individual by the physiotherapist it stimulated engagement and participation:

Well he has a pleasant nature and not pushy and doesn't keep telling me I walked 30 metres last time. (John, 86 yrs)

To ah get going...you rely on the instructors to ah point you in the right direction. (Mike, 78 yrs)

These statements illustrate the importance of considering individual preferences and needs within a therapeutic relationship and the potential influence that has on patient participation in exercise.

DISCUSSION

The findings from the study demonstrate that when developing an exercise programme there is far more to consider than suitable types of exercises, sets and repetitions. Rather, learning what matters to participants to make the exercises purposeful and enjoyable may encourage engagement and regular attendance. Poltawski et al (2015) found promoting a programme on factors such as enjoyment of recreation, increased self-esteem and life satisfaction enhanced the appeal of exercise. Health professionals often use standardised assessments to tailor programmes to a patient's level of impairment and spend less time gaining a clear understanding of their patients' former self and the impact the stroke may have had on their sense of self and quality of life. Research suggests that patients with significant disability can still have good quality of life, which is often the outcome most important to people after stroke (Aprile et al 2006). Our findings would suggest that acknowledging the sense of loss people have experienced and actively tailoring programmes to make them meaningful to participants have the potential to facilitate their engagement, and may have greater potential for impacting outcomes that matter most to patients.

Research suggests that some people find it difficult to recognise abilities because they are focused on their losses (Remer-Osborn 1998). Significant depression requiring treatment is strongly correlated with non-acceptance of impairment and affects as many as 50% of people with stroke (Townend et al 2010). A strategy to help patients distinguish between functional loss and 'loss of self' is to focus on new ways to perform activities. To be able to offer support and guidance to see rehabilitation as a time of transition when they are learning new strategies may facilitate acceptance (Ellis-Hill et al 2008). If physiotherapists do not give time to allow the patient to adapt, patients can experience lack of motivation, fear and isolation, which impact engagement in group-based programmes (Nicholson et al 2013).

Findings from this research are congruent with previous research that the patient-therapist relationship is extremely important and may positively impact outcomes (Hall et al 2010). Participants valued choice and a rationale for a particular exercise. In addition, the feeling of increased control appeared to increase participation and engagement. Mangset and colleagues (2008) described the importance of patients being acknowledged as individuals and their autonomy respected. They found that when confidence and trust were formed between patient and professional, this improved the patient experience of rehabilitation. Increased pressure from policies in the hospital environment, such as monitoring discharge dates and reducing

length of stay, can pressure healthcare professionals to push participants towards goals too early in their rehabilitation or not allow enough rest between interventions.

Research supports the benefits of family involvement in patient recovery; however, it also shows that families witnessing loved ones struggle can lead to emotional distress, grief, fear, anger at the patient and unrealistic expectations of the staff (Remer-Osborn 1998). The finding of participants needing help but not wanting to burden their family was explored in a study following a family assisted stroke rehabilitation programme (Galvin et al 2014). They found that families generally reported less stress when involved fully in the rehabilitation, despite having to do more work. Physiotherapists may need to explore further a participant's desire to save their family work, to ensure that those who would gain some reassurance from being involved are not unwittingly turned away.

A social group, where participants are treated as 'us' rather than the individual, provides attendees with a sense of belonging and purpose (Anderson and Whitfield 2013). Five of the six participants in this study preferred to exercise in a group setting rather than one-on-one with their therapist. They felt their limitations were not put under the microscope and dissected; instead individuals were welcomed, introduced to others and able to work through the class with positive encouragement from peers and instructors. Desrosiers et al (2008) found that a greater acceptance of the consequences of stroke is facilitated by a higher level of social participation.

In terms of specific feedback regarding programme components our findings highlight the following key points: First, music was considered to be a fundamental requirement for any group exercise class by all the participants. A study by Jun et al (2013) found that music has the capacity to capture attention, generate emotion, change or regulate mood, increase work output, reduce inhibition and encourage rhythmic movement. Second, all participants agreed that undertaking meaningful exercises to help them regain activities of daily living was of great importance and promoted participation and engagement. However, the data did not identify specific types of exercises or method of delivery. Some enjoyed a routine and stated they liked to know what was coming, others favoured variety in a circuit style workout. Third, social interaction was highlighted throughout our data and the findings suggest that being part of a social network, finding a sense of community and belonging in a positive and supportive environment will in turn lead to increased/sustained attendance. This is supported by Anderson and Whitfield (2013) who argued that social relationships are the foundation on which stroke-survivors rebuild their skills to engage with the world. Other studies have also confirmed that social support in group sessions is important in sustaining commitment by participants (Desrosiers et al 2008).

Recommendations

Based on the findings, several recommendations can be made for the development of a group exercise class tailored to the needs of this population:

- Include music to create a more relaxed environment and to engender a feeling of unity;

- Ensure time is allocated for introductions and socialising at the beginning of class to allow mutual support and networking;
- Develop a simple programme based on purposeful exercises that can be explained during the class, to make an explicit link to a return to 'real' activities.
- Organise the class to allow activities to mimic activities of daily living performed at home e.g. seated circular formation around plinths to allow for standing activities that reflect home activities such as cooking).

Limitations

This study gathered perceptions of people with moderate to severe stroke, a population which has been excluded from many other studies investigating group-based programmes. However, the findings need to be considered in the light of some limitations. No Māori or Pacific participants were recruited, which reflects the ethnic make-up of the participating Hospital, as reported by the Auckland District Health Board (2014), and the limited timeframe for recruitment. There were a number of potential participants from other Asian groups (e.g. Chinese and Korean) who were not approached as they were unable to converse in English. The choice of convenience sampling and constraints on time and location meant that participant numbers were modest and we were limited in the level of diversity we could achieve. That said, the participant characteristics highlight a reasonable breadth of experience to aid transferability of findings.

CONCLUSION

This study provides an insight into the complexity and potential challenges for health professionals planning inpatient group-based programmes to include patients with more severe impairments. The findings from this research helped identify several potential key components for a group based programme, including the use of music accompaniment, allowing time and opportunity for socialising between group members, and an emphasis on empowering the participants through keeping them connected to the real world and by explaining the purpose of the desired exercises and facilitating their understanding of the rehabilitation process.

KEY POINTS

1. Physiotherapists need to acknowledge the impact of *loss of self* on the ability to engage in rehabilitation.
2. Group programmes need to allow patients the opportunity to forge social connections.
3. Programmes need to be meaningful and incorporate activities patients see as connected to the real world.
4. The therapeutic relationship may be a critical factor in maintaining engagement in a group programme.

PERMISSIONS

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DISCLOSURES

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APPENDIX 1: Interview Question guidelines

1. Can you tell me about your rehabilitation after stroke?
2. Can you tell me about a typical day in hospital?
3. What kind of exercises do you do in hospital?
4. Did you take part in any group exercises/activities while in hospital?
5. Do you prefer to do activities that you enjoy with others?
6. If you think about times when you could have been part of an activity in hospital, can you tell me what might have encouraged you to join?
7. Is there anything you dislike about group activities? If so, what do you dislike?
8. What else would you enjoy doing in a group?
9. What would you like to get back to doing? What do you feel you need to work on or improve to get back to doing these activities?
10. Would you like family or friends to be involved in your physical recovery?
11. What could we do to make it easier for you to be more active in the hospital?
12. If you could make a wish list of what you would like to do in hospital, what would it be? It does not have to be realistic.

Arthroscopic versus conservative treatment of first anterior dislocation of the shoulder in adolescents

Gigis I, Heikenfeld R, Kapinas A, Listringhaus R, Godolias G (2014) Arthroscopic versus conservative treatment of first anterior dislocation of the shoulder in adolescents. *Journal of Pediatric Orthopedics* 34(4):421–425. doi 10.1097/BPO.000000000000108. (Abstract prepared by Amy Lean)

BACKGROUND

There is some debate regarding best practice for management of primary traumatic shoulder dislocation in adolescents. It is well documented in the literature that conservative treatment often results in further episodes of shoulder instability in the adolescent population (up to 95% incidence). No studies to date have investigated the outcomes of conservative versus surgical intervention following first time traumatic shoulder dislocation in adolescents.

AIM

To investigate if early surgical stabilisation following primary traumatic anterior shoulder dislocation can reduce the rate of re-dislocation in adolescents.

METHODS

Seventy-two participants aged between 15 and 18 years of age (mean 16.6 years, 27 male and 38 female [who completed the study]) with a recent primary traumatic shoulder dislocation requiring manual reduction were included. Following clinical examination individuals were advised if early surgical (arthroscopic) intervention was recommended, an option that was offered on a voluntary basis. A total of 43 participants consented to surgical intervention leaving 29 participants in the conservative group. Both post-operative and conservative rehabilitation followed the same protocol of immobilisation and passive movements progressing to active movements and a strengthening programme. Participants were reassessed annually for a total of three years.

RESULTS

Seven participants (9.7%) were lost to follow-up. Twenty-four participants suffered further dislocation of the treated shoulder within the three year follow-up period, 5 (13.1%) from the surgical group and 19 (70.3%) from the conservative group, respectively. The difference in number of re-dislocations between the two intervention groups was statistically significant ($p < 0.05$).

CONCLUSION

Early arthroscopic stabilisation following primary traumatic shoulder dislocation in the adolescent population leads to a reduction in subsequent episodes of shoulder instability. These findings suggest that surgical intervention should be offered as a treatment option early in rehabilitation to facilitate an optimal functional outcome.

COMMENTARY

The shoulder is the most commonly dislocated joint in the body, with approximately 95% of dislocations being anterior in nature (Aronen and Regan 1982, Cutts et al 2009, Lampert et al 2003, Li et al 2013). For traumatic injury, the mechanism is often a fall onto an outstretched arm, or impact with the shoulder positioned in abduction and external rotation (Cutts et al 2009, Lampert et al 2003). There is debate as to whether conservative or surgical intervention is the best approach following first time traumatic shoulder dislocation. This is due to the high reported rate of recurring dislocation following conservative treatment, especially in patients under 20 years of age where risk of recurrent instability has been documented to be as high as 95% (Cutts et al 2009). Given the expected increased risk of recurrent shoulder dislocation with conservative treatment, many authors advocate for surgical intervention either as soon as possible, or following a repeat episode of instability (Aronen and Regan 1982, Cutts et al 2009, Lampert et al 2003).

The authors of the current study have filled a void in the evidence surrounding primary management of shoulder dislocation by providing a study comparing the rate of repeat injury following surgical and non-surgical intervention. Due to the nature of the treatment options it would have been unethical to have randomly allocated participants into intervention groups as patients needed to be given the option to decline surgical intervention if they saw fit. Also, as surgery was one of the interventions it was impossible for participants or assessors to be blinded to group allocation. In view of these points, the authors created a well thought out and effective study, with an adequate follow-up period of three years to determine which approach produced superior results for adolescents.

A number of years ago, Aronen and Regan (1982) associated the high rate of reported recurrent dislocation with poorly developed rehabilitation programmes or poor adherence to an exercise programme. In their study, 20 individuals with primary anterior shoulder dislocation were prescribed a structured well-documented rehabilitation protocol and were followed for three years. The authors reported a 75% success rate following conservative treatment and concluded that future studies should report lower rates of failure of intervention if more rigid programmes were designed and adhered to.

The rehabilitation protocol has been outlined in the current study; however as described, it does not provide adequate information for an identical programme to be used in the future as it lacks information on the dosage of exercises. The authors did document employing the same exercise programme for both the conservative and post-operative treatment groups, implying that any difference in outcome was likely to be strongly influenced by the addition of surgery. Earlier publications on shoulder rehabilitation support the authors' hypothesis that conservative management will lead to higher rates of repeat episodes of shoulder instability (Cutts et al 2009).

The study by Gigis et al (2014) provides evidence that within the adolescent population early surgical intervention leads to improved shoulder stability when compared to conservative management. As the reported difference in recurrent dislocation is statistically significant it offers clinicians an evidence base with which they can inform patients of their options to the best of their knowledge, especially if the physiotherapist is the patient's primary health care professional following shoulder dislocation. However, clinicians must take care with the evidence provided by this study as the study population comprised adolescents meaning the findings may not be applicable to older or younger demographics.

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Cerebral Palsy in Infancy: Targeted activity to optimize early growth and development.

**Roberta B. Shepherd (ed), 2014, Elsevier Churchill
Livingstone, Sydney, ISBN 978-0-7020-5099-2, hardcover,
339 pages**

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The contributors to this book are both extensive and impressive; each contributing their expertise, experience and research to collectively present a powerful, exciting and informative text vital for all paediatric physiotherapists working with children who have cerebral palsy (CP). The text supports the concept of early intervention being promoted as best practise for children with neurological conditions by presenting the theoretical basis and discussing the research evidence that informs this thinking.

The book is divided into 5 parts. Part 1 'The Changing face of intervention in infants with cerebral palsy' sets the tone of the text with a brief historical context which leads into discussion on understanding weakness due to impaired muscle activation and lack of motor control; advances in diagnosis, brain plasticity, motor development and active learning and skill acquisition. Following on is Annotation A 'Aspects of motor training' where Shepherd discusses therapy practices steeped in the current research of motor development with the aim of achieving functional independence.

Part 2, entitled 'Neuromotor plasticity and development', discusses the corticospinal tract, its development and its plasticity. These chapters work through research that describes the functional and anatomical evidence to support shaping of plasticity by activity. There are significant changes seen in neurological development over the early years and the relationship of how this is modified by experience and timing is summarised. This reinforces that early intervention along with enriched environments will impact upon neurological lesions as seen in Cerebral Palsy.

William Little in 1861 named what equates to diplegia cerebral palsy – Little disease. Part 3 gives specific insight

into the neuromusculo-skeletal impairments, adaptations and functional implications of having a disorder of the development of movement and posture. Understanding the responses in muscles and the adaptive changes, impairments and functional limitations for children with CP assists with the planning of appropriate interventions. Annotation B discusses 4 studies of passive mechanical properties of muscle that shows significant changes in young children with CP. Further detailed chapters are each devoted to 'spastic paresis', changes in skeletal muscle and the consequential effects on early muscle development. Enhancing muscle growth and function from capitalising on the plasticity of skeletal muscle through early intervention certainly raises the prospect of improved outcomes.

Part 4 describes assessment and diagnosis of early CP which has been enhanced by the use of Precht's Method on the qualitative assessment of general movements for prediction rather than waiting for later declaration. Damiano discusses the possible explanations for the 'disconnect' between lack of evidence supporting positive changes versus those expected to be due to maturation; and explores the links between psychological benefits and independent mobility.

The concluding part (5) of this book gives detailed practical information, photographs and discussion on lower limb performance, treadmill training, upper limb interventions, constraint induced therapy and bimanual training. The last chapter raises the idea of how technology can be utilised to initiate and support diagnosis, provide monitoring and assist with treatment. Nielsen suggests technology may replace and help maximise use of human resources.

The format of this book makes it a very useable text both for extending knowledge of evidence and enhancing practice. It is divided into 5 parts with a number of sub sections, all of which are well indexed and comprehensively referenced. The evidence and discussion are thought provoking providing a valuable platform for physiotherapists working in paediatrics.

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