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PHYSIOTHERAPY NEW ZEALAND
Kōmiri Aotearoa

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My Final Editorial: Whānau Centred Care in Dementia

In 2017 I was fortunate to attend the Australian Physiotherapy Association conference in Sydney. One of the keynote speakers was a professional speaker, Michael McQueen (McQueen, 2018). Michael spoke to the theme of the conference, that of 'Momentum', and said: "*Enduring success and growth for any business today is dependent on building and maintaining unstoppable momentum*"; basically continuing in the same old rut can lead to stagnation and demise. Eight years into my role as Editor of the New Zealand Journal of Physiotherapy, I have reflected on this. The Honorary Editorial Committee has achieved much in this time. We now have a steady flow of submissions enabling three robust issues per year and, as per our mantra, we have assisted and supported many new and emerging writers to publish. We are now Scopus listed. During this time, journal publishing has advanced into the digital world. Eight years ago terms such as Digital Object Identifier System (doi), Publons, Impact Factors, Citations, and H-indexes were mystifying and incomprehensible, now they are part of normal academic-speak. Our journal is not immune to such progress, but to ensure that it continues to be successful we need to maintain our momentum, we need to ensure freshness of ideas and approaches. So with this in mind, I have decided to step down as Editor. This then is my final Editor's editorial. I will thus take the liberty of focusing on a topic dear to my heart, that of carers (informal, unpaid) and support workers (formal, paid) working in the area of dementia care. In this editorial I will propose that physiotherapists need to support, assist and work alongside carers and support workers to achieve best outcomes for persons living with dementia. Physiotherapists working in dementia need to do so within a model of Whānau Centred Care.

Colleagues and I have been researching in this field. In one of our qualitative studies, a support worker in home-based elder care was asked about working with other members of the health care team, for example, physiotherapists. She responded: "*They look at us as if we're just cleaners, they come in, like I've got the uniform, I've got the big badge and I can do this, and oh you've got the vacuum or the duster in your hand*." (George, Hale, & Angelo, 2016, p9). As a physiotherapist, this was disappointing to hear. And led to our team asking how we can value carers and support workers in elder care for the vital work that they do.

I have argued in the past that as physiotherapists we enable healthy and engaging lives through movement and support, advice and encouragement and that ongoing support of our patients is not only a common ingredient to all physiotherapy interventions but a key one (Hale, 2016). In this editorial I wish to extend this argument to physiotherapists supporting not only patients but also the wider whānau, and in particular support workers and carers, and the particular importance of this in dementia care.

Dementia is an overall term that describes a group of symptoms associated with a decline in memory or other thinking skills severe enough to reduce a person's ability to perform everyday activities (Alzheimer's Association, 2018). Worldwide in 2050, 131.5 million people are predicted to live with dementia (Brookmeyer, Johnson, Ziegler-Graham, & Arrighi, 2007). So into the future, dementia care is likely to be 'bread and butter' work for physiotherapists. Physiotherapy can assist those experiencing dementia to live well, especially by carefully prescribing exercise. Although currently there is no evidence that exercise can prevent or reduce decline in cognitive function (Lamb et al., 2018; Sabia et al., 2017), it is beneficial for many reasons, including for health, falls prevention, to improve or maintain mobility and independence, enhance mood, promote socialisation and reduce pain (Heyn, Abreu, & Ottenbacher, 2004).

Physiotherapists can prescribe exercise programmes and support patients to do them, but in dementia care, most of the support to ongoing involvement in exercise is likely to come from the support worker or the carer. "*Physiotherapy is more than just a sheet of exercises*" is a theme that arose from the Hall, Burrows, Lang, Endacott, and Goodwin (2018) study which explored experiences of people with dementia and their carers of the physiotherapy they received as part of a rehabilitation programme. Participants in this study said that physiotherapists frequently did not think about who should be involved in delivering optimal treatment, and although relatives suggested others, such as day-care services or paid carers, be involved, this was not often endorsed by the physiotherapists. The carer participants felt that being part of physiotherapy delivery was part of their job, and if they were not physically able to assist, that they would want to be part of discussions and decision-making (Hall et al., 2018).

Dementia care includes compensating for diminishing ability to fulfil basic needs; providing assistance in ADL, mobility, safety and function; and prevention, management, or elimination of discomfort (such as pain, constipation, skin deterioration, malnutrition, physical exhaustion, and adverse pharmacological reactions) (Edvardsson, Winblad, & Sandman, 2008; Fazio, Pace, Flinner, & Kallmyer, 2018). But satisfaction of the physical needs can sometimes come at the expense of the psychosocial needs and care can become task oriented and depersonalised. So ensuring the person feels safe and has a sense of belonging and acceptance is crucially important in dementia care; care should thus be person-centred (Edvardsson et al., 2008).

Person-centred care is topical in health care, indeed Physiotherapy New Zealand have just released their model of Person and Whānau Centred Care for physiotherapy in Aotearoa New Zealand (Physiotherapy New Zealand, 2018). Person-centred care is a concept for holistic and individual-centred best-practice care. This notion then leads to the concept of personhood (the quality or condition of being a person). Edvardsson et al. (2008) argue that cognitive decline due to the disease processes of dementia can gradually erode personhood down to nothing. If the person is thought of as an "*empty shell*" or the "*living dead*", social interactions can become unemotional or detached. A belief that "*there is nothing left of the person*" may make the life of the individual with AD seem worthless, which then makes care and the role of the carer meaningless (Edvardsson et al., 2008, p362).

Poulos et al. (2017, p455) proposed the concept of 'reablement' as a means of maximising functional ability to help promote independence in dementia care, of "living well with dementia". This concept requires a collaborative approach both with the person with dementia and with those that support and care for them. This relationship with the person with dementia and their whānau is essential for successful outcome and is central to dementia person-centred care. Thus valuing and respecting the carer and the support worker is crucial to good person-centred dementia care.

Dutton, Debebe, and Wrzesniewski (2012) talk about the concept of felt worth, which they consider a fundamental gauge of social inclusion and respect from others. In the Dutton et al (2012) paper on people who clean hospitals and on the different ways that interactions with others give or deny felt worth, they quote from Perry (1978, p 6): "*Critical activities carried out by people playing support roles in organizations is hidden work (such as rubbish collection; hospital cleaning, support worker) …. base of activity upon which much else must rest. Despite the vaunted technological advances and perhaps even because of them, the lowliest services remain important*". I would argue that enablement in dementia thus needs the 'base worker' for optimal intervention outcomes and this thus requires enabling felt worth or valuing of the support worker and carer.

Kadri et al. (2018) explored how the personhood of support workers of people with dementia can be understood. These authors reported that many care staff are not identified as persons in their own right by their employing institutions and that there is a general lack of acknowledgment of the moral work of caring that occurs within formal care work. Kadri et al. (2018) argue that this then diminishes the multifaceted interactions and relationships of care work into a series of care tasks that impede the delivery of person-centred care. These authors concluded that care staff status as persons in their own right should be explicitly considered in quality standards and supported by employers' policies and practices, not simply for their role in preserving the personhood of people with dementia but for staff's own sense of valued personhood.

Why do physiotherapists need to know this information; why is this a subject of this Editorial? In providing physiotherapy we need to better support and value carers and support workers; value their knowledge, skills, and experience, and work beside them to provide best person-centred care. I use the words 'person-centredness' as opposed to 'patient-centredness' deliberately, the term 'person' denotes a "*holistic humanness and the equal value of individuals*", whereas 'patient' has been described as a "*reductionist, stigmatic term that imputes imperfections or undesired differentness to a person and thereby reduces the humanity of the subject*" (Kitwood, 1997; Edvardsson et al., 2008, p363).

I predict that dementia care may well be part of physiotherapy's 'bread and butter' work in the future. In upskilling ourselves to meet the benefits and challenges of this work, we need to enhance the personhood of both the person experiencing dementia and the people who support and care for them. As physiotherapists, let us not forget to value and respect carers and support workers in dementia care and ensure we work in a model of Whānau Centred Care.

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Simulation as a component of introductory physiotherapy clinical placements

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ABSTRACT

Simulated learning experiences (SLEs) assist students to acquire knowledge and skills and are an effective teaching tool in physiotherapy education. The aim of this project was to explore physiotherapy student attitudes towards SLEs as a preparatory component of an introductory clinical placement. The project was a quasi-experimental, pre/post-test repeated measures design. Participants were second year physiotherapy students (n=57) allocated to a placement which included one week of SLEs and three weeks in a healthcare setting. The SLE week consisted of sessions to develop students' clinical skills in preparation for placement. Data on participant attitudes towards SLEs were collected via anonymous survey before and after the SLE week, and at the completion of the three week clinical placement. Attitudes of respondents (n=43) towards SLEs were significantly more positive at the completion of the SLE week. At the completion of the three week clinical placement, all responses remained more positive than at the commencement of the project, however participant responses were generally less positive than at the conclusion of the week of SLEs. Students valued the use of SLEs in preparing for introductory clinical placements. Simulated learning experiences should be considered as a useful tool for pre-placement preparation for early year physiotherapy.

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Key Words: Physical Therapy, Clinical Education, Simulation

INTRODUCTION

Clinical education in the discipline of physiotherapy refers to dedicated blocks of time where students are immersed in a healthcare setting to gain supervised experience (Lekkas et al., 2007). Clinical education is an important component of entry-level physiotherapy programmes and it is a requirement that students complete a range of clinical placements to graduate as beginning level health practitioners (Crosbie et al, 2002; Lekkas et al., 2007; Stiller, Lynch, Phillips, & Lambert, 2004). Clinical education enables students to consolidate and integrate knowledge gained in academic study and demonstrate the practical skills, attitudes and behaviours necessary for graduate professional practice (Higgs, 1992; Lindquist, Engardt, & Richardson, 2004; McCallum, Mosher, Jacobson, Gallivan, & Guiffre, 2013; Strohschein, Hagler, & May, 2002).

Many physiotherapy programmes introduce students to clinical education in the early years of study. Early year clinical placements aim to provide an introduction to clinical practice and enable the development and demonstration of skills in clinical communication, professional behaviour, working in a multiprofessional team and managing non-complex patients. As students progress into their later years of study, clinical education placements and expectations become more complex and focus on the development of specific clinical expertise and higher order clinical reasoning skills.

The clinical education sphere is becoming increasingly more complex, in part, as a result of changes in the health-care and education sectors (Blackstock et al., 2013; Hall, Manns, & Beaupre, 2015; McMeeken, Grant, Webb, Krause, & Garnett, 2008). Students are expected to 'practise' in higher-risk environments as the medical complexity of patients increases, leading to concerns around patient and student safety (Blackstock et al., 2013). Expanding numbers of entry-level physiotherapy programmes have resulted in an overall increase in student numbers (Hall et al., 2015; McMeeken et al., 2008). Healthcare services' limited capacity to accommodate this increased demand may translate into fewer clinical education opportunities for students. To address these challenges, new models of clinical education, which prepare students to enter challenging clinical environments and ensure students have the required knowledge and skills to maximise available learning experiences, need to be developed. One such model currently being explored in physiotherapy is the integration of simulated learning experiences (SLEs) into traditional clinical education programmes (Blackstock et al., 2013).

Simulated learning experiences are used in healthcare professional education to replicate aspects of real clinical practice and enhance student learning (Gaba, 2004; May, Park, & Lee, 2009; Weller, Nestell, Marshall, Brooks, & Conn, 2012). In healthcare, there have been various forms of SLEs developed and used with varying levels of fidelity, including cardiopulmonary resuscitation dummies, modelled body segments, technologically advanced full body mannequins and actors portraying patient roles (Blackstock & Jull, 2007; Bradley, 2006; Gaba, 2004; May et al., 2009; Weller et al., 2012). High fidelity SLEs that involve patient actors known as simulated patients (SPs), are emerging as an effective teaching tool in physiotherapy education (Blackford, McAllister, & Alison, 2015; Blackstock et al., 2013; Cahalin & Markowski, 2011; Ladyshewsky & Gotjamanos, 1997; Lewis, Bell, & Ashgar, 2008; Pritchard, Blackstock, Nestell, & Keating, 2016; Watson et al., 2012). The purpose of SLEs is to allow students to acquire, consolidate and implement knowledge and practical skills in a safe and supportive environment (Gaba, 2004; Kant & Cooper, 2010; Lasater, 2007; Steadman et al., 2006; Weller et al., 2012). Simulated learning experiences also assist students to develop skills relating to communication, professional behaviour and teamwork (Pritchard et al., 2016; Weller et al., 2012).

Simulated learning experiences in physiotherapy have been used to improve student preparedness for clinical education and facilitate the acquisition of communication, team work and specific technical skills (Blackford et al., 2015; Blackstock et al., 2013; Ladyshewsky & Gotjamanos, 1997; Lewis et al., 2008; Watson et al., 2012). Studies have shown that SLEs may replace traditional placement time without detriment to student attainment of clinical competencies, and enhance confidence levels (Blackstock et al., 2013; Watson et al., 2012). Research into the use of SLEs in physiotherapy clinical education has predominantly involved students in their later years of study, undertaking placements in specific clinical areas such as musculoskeletal outpatients or acute care. There is less evidence to support the effectiveness, or value, of SLEs as part of introductory clinical placements for early year physiotherapy students. Currently, the most applicable model of clinical education using simulated learning experiences for early year physiotherapy students is unknown. Research on the value of SLEs for early year students is needed so that useful and effective models of clinical education can be developed. The aim of this research project was to explore early year physiotherapy students' attitudes towards SLEs as a preparatory component of introductory clinical placement.

METHODS

Study design

The study was a quasi-experimental, pre and post-test repeated measures design. Ethics approval was granted for the study from the University of Newcastle Human Research Ethics Committee (reference number H-2014-0389).

Setting

The Bachelor of Physiotherapy (BPhysio) programme at the University of Newcastle (UON), Australia, is a four year undergraduate entry-level qualification. The programme includes a total of 29 weeks of clinical placement, completed across years two to four. There are 6 block placements and each constitutes a full stand-alone course (subject) with the clinical assessment making up the student's final grade. All second year physiotherapy students undertake an introductory four week full time clinical placement block. These introductory clinical placements are undertaken in various healthcare facilities including public and private hospitals, private practices, aged care and community settings. Students attend this placement with an educator to student ratio between 1:1 and 1:6 as is usual practice in physiotherapy clinical education in Australia. During these placements students are introduced to the role and practice of physiotherapy in the healthcare setting and have their own introductory clinical caseload. Students are responsible, under supervision, for managing patients across the lifespan with a range of medical conditions. They are expected to show basic clinical reasoning and to demonstrate assessment and treatment skills learned during their early years of university study.

Student performance on this introductory placement is assessed by the site clinical educator throughout the placement and formally at completion, using criteria adapted from the National Assessment of Physiotherapy Practice (APP) tool (Dalton, Davidson & Keating, 2011; Dalton, Davidson & Keating, 2012). Students are awarded a mark out of 80 which is converted to a grade out of 100, and must achieve 50% to pass the course. Passing the placement course is a prerequisite for subsequent clinical placements and students are unable to progress through the physiotherapy programme if they do not successfully complete this introductory clinical placement.

Participants and recruitment

Participants were physiotherapy students enrolled in their second year of the BPhysio in 2014 and 2015. Participants in this study were those students allocated to a combined simulation-traditional placement as their second year clinical placement course. Physiotherapy students do not have the opportunity to choose their own clinical placements in second year, however they are permitted to submit preferences for the geographical location of their placement. Therefore in keeping with usual practice, all enrolled students were given all standard placement location options in which combined simulation-traditional placements were included. Students participating in this research project were then allocated to the combined simulation-traditional clinical placement as per the usual process for allocation of physiotherapy clinical placements.

All students who were allocated to the combined simulation-traditional placements (n=57) were invited to participate in the research project and provided with participant information forms prior to the commencement of the project. There were no specific exclusion criteria.

Intervention

Between October 2014 and November 2015 a number of second year placements were modified to incorporate an initial week containing SLEs. Students undertaking these combined placements, instead of completing the usual four week full time clinical placement block, completed one week of SLEs (simulation component) immediately followed by three weeks of full time placement in a healthcare setting (clinical component).

The simulation component of the combined placement was undertaken in a specialised simulation centre with a ratio of one physiotherapy simulation educator to four students. The SLEs consisted of tutorials, practical sessions and interactions with simulated patients to develop students' clinical skills in preparation for placement including medical note reading, professional behaviour, communication, manual handling and simple assessment and interventions. Details of the content and structure of each day of the simulation week are contained in Table 1.

The simulation experience in this project was not intended to be a formal 'standardised' experience, therefore strictly scripted scenarios were not required. Simple clinical scenarios which replicated cases likely to be encountered by second year students during the full time clinical placement weeks (joint arthroplasties, mechanical falls and basic respiratory conditions) were developed by two experienced physiotherapists formally trained in the use of SLEs. Simulated patients (SP) were sourced from a database of trained actors through the University medical school. Prior to the placement, the actors familiarised themselves with the clinical scenarios and were given individual training by the simulation educator.

The student interactions with the SPs included practising patient history taking, physical assessment, simple treatments such as joint range of motion and strengthening exercises, gait and mobility assessment and intervention, and general manual handling skills. The simulation educators were able to 'pause' the interaction at any time to give students on-the-spot feedback. After each scenario was completed, the SPs were instructed to break character and give students individual feedback about their communication, professional behavior and/or manual handling skills during the interactions. Debriefing occurred at the conclusion of each day of simulation (Fanning & Gaba, 2007).

Table 1: Content and structure of the simulation week

Day	Focus	Content and structure
1	i) Introduction and orientation ii) Professional behaviour iii) Gathering relevant medical information	Orientation and introduction Interactive small group tutorial/practical: • Professional behaviour • Familiarisation with medical notes • Practice gathering and summarising a patient's medical history • Preparation to report a patient history
2	i) Delivering a verbal handover and communicating with clinical educator iii) Preparation for patient history taking	Practice delivering a verbal handover Interactive small group tutorial/practical: • Clinical communication and history taking • Planning a subjective history • Preparation for engagement with Simulated Patients (SPs)
3	i) Patient history taking ii) Preparation for physical examination and assessment	History taking practice with SPs Feedback and debrief session Interactive small group tutorial/practical: • Use of medical equipment (eg beds and wall attachments) • Planning assessment/physical examination
4	i) Physical examination and assessment ii) Preparation for treatment implementation and manual handling	Physical assessment practice with SPs Feedback and debrief Interactive small group tutorial/practical: • Treatment planning and implementation • Manual handling
5	i) Treatment implementation and manual handling ii) Preparation for traditional immersion clinical placement	Basic treatment and manual handling practice with SPs Feedback and debrief Interactive small group session: • Preparation for entering the traditional clinical placement setting • Question and answer session

Note: SP, Simulated patients

Following the completion of the week-long simulation component, the students went on to complete three weeks of traditional clinical placement (clinical component) in a healthcare setting.

Survey instrument and data collection process

There was no published survey instrument suitable for data collection in this study population, therefore a purpose designed survey was developed. The survey was intended to collect data on attitudes towards the use of SLEs in early year physiotherapy clinical education. The survey was developed by two experienced physiotherapists, trained in clinical education and simulation delivery.

The written survey consisted of 21 questions in two sections (see Appendix 1). Section one included general participant characteristics and section two canvassed general attitudes towards the use of SLEs as part of early year physiotherapy clinical education and their value in developing physiotherapy skills. Survey questions were mostly in closed categorical or five-point Likert scale form with a free text section provided for participants to add any additional comments.

Participants completed the survey at three time points: prior to the simulation component (Survey 1), at the conclusion of the simulation component (Survey 2) and at the completion of the subsequent three week clinical component (Survey 3). Details of the data collection process are displayed in figure 1.

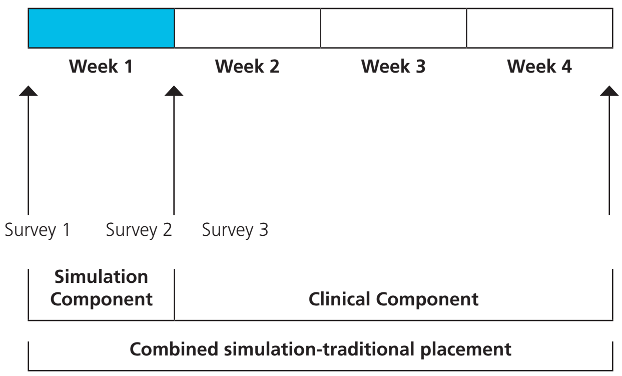

Figure 1: Structure of the combined simulation-traditional placement and data collection process

All surveys were completed anonymously and coded so that responses could be matched across the three time points. Individual responses could not be identified or matched to any participant at any stage of the study.

Data analysis

All data were collated and analysed using the SPSS software (version 23, SPSS Inc Chicago Il.). Participant characteristics and Likert scale responses were all reported using descriptive statistics. Likert scale responses were assigned numerical scores for data analysis (1-5: strongly disagree, disagree, neutral, agree, strongly agree). Analysis involved the comparison of data from Survey 1 and Survey 2 (change following the simulation component) and from Survey 2 and Survey 3 (change following the clinical component). For each Likert scale question, a change score was calculated by subtracting the numerical score for question responses in survey 1 from that of survey 2. The same process was used to calculate individual change scores between survey 2 and survey 3. Change scores were analysed using the sign test to evaluate the occurrence of any significant directional shift (Roberson, Shema, Mundform & Holmes, 1995).

RESULTS

Forty-three participants completed all three surveys. The mean age of respondents was 23 years (SD 6 years), 25 (58%) were female and most (n=42, 98%) had not previously participated in SLEs using SPs.

Simulation Component

General attitudes of respondents towards SLEs and their value in developing physiotherapy skills were significantly more positive at the completion of the simulation component of the combined placement. These results are presented in Tables 2 and 3.

Clinical Component

At the completion of the clinical component of the combined placement, all responses remained more positive than at the commencement of the project, however participant responses were generally less positive than at the conclusion of the simulation component (Tables 4 and 5).

DISCUSSION

The results of this study are an important addition to the growing body of literature related to the use of SLEs in physiotherapy clinical education. To our knowledge, this study is the first to evaluate early year students' attitudes towards SLEs as a preparatory component of an introductory clinical placement. The main findings of this study were that participants strongly valued the SLEs and perceived them as useful in assisting skill development and preparation for clinical placement. This study also found that participants placed slightly less value on the SLEs and their usefulness in some domains of practice after completing three weeks of a traditional clinical placement.

Prior to commencing the combined placement, participants' attitudes towards the use of simulation were largely neutral. The use of SLEs as a component of clinical education in physiotherapy programmes is relatively novel and this research marked the first occasion the University had modified physiotherapy clinical placements to incorporate SLEs. Students involved in this study had not previously participated in SLEs and were unfamiliar with the outcomes of similar projects. This may have resulted in some scepticism towards non-traditional modes of physiotherapy clinical education, including the use of SLEs.

Participant attitudes improved significantly after completing the week of SLEs, and they remained positive at the conclusion of the combined placement. The change in attitudes indicated that the participants valued the SLEs, and considered that they supported the development of knowledge and skills, and increased preparedness for practice in a clinical setting. This was achieved by the provision of an appropriate, well-structured, supportive and realistic simulated learning environment (Gaba, 2004; Issenberg, Mcgaghie, Petrusa, Gordon, & Scalese, 2005). The positive student attitudes following the SLE component are consistent with other research findings of improvements in physiotherapy students' self-rated communication, patient

Table 2: Students' general attitudes towards simulated learning experiences pre- and post- simulation week (n=43)

	Pre-Simulation (Survey 1) n (%)						Post-Simulation (Survey 2) n (%)						
Are simulated learning experiences:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	P value for difference
Valuable in physiotherapy clinical education?	0 (0)	0 (0)	3 (7)	29 (67)	11 (26)	0	0 (0)	0 (0)	0 (0)	0 (0)	43 (100)	0	<0.001
Equivalent to traditional placement?	0 (0)	8 (19)	17 (39)	15 (35)	3 (7)	0	0 (0)	4 (10)	9 (21)	15 (36)	14 (33)	1	<0.001
Useful in preparation for placement?	0 (0)	0 (0)	1 (2)	16 (37)	26 (61)	0	0 (0)	0 (0)	0 (0)	3 (7)	40 (93)	0	0.001
Helpful in developing confidence?	0 (0)	0 (0)	1 (2)	13 (30)	29 (68)	0	0 (0)	0 (0)	0 (0)	1 (2)	41 (98)	1	<0.001
Unrealistic?	2 (4)	24 (56)	14 (33)	3 (7)	0 (0)	0	19 (45)	21 (50)	2 (5)	0 (0)	0 (0)	1	<0.001
A waste of time?	14 (33)	26 (61)	2 (4)	1 (2)	0 (0)	0	30 (70)	12 (28)	1 (2)	0 (0)	0 (0)	0	0.001

Table 3: Students' attitudes towards the value of simulated learning experiences in physical therapy skill development pre-and post-simulation week (n=43)

	Pre-Simulation (Survey 1) n (%)						Post-Simulation (Survey 2) n (%)						
Are simulated learning experiences useful to develop:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	P value for difference
Professional behaviour?	0 (0)	0 (0)	4 (9)	22 (51)	17 (40)	0	0 (0)	0 (0)	0 (0)	7 (16)	36 (84)	0	<0.001
Communication skills?	0 (0)	0 (0)	4 (9)	19 (44)	20 (47)	0	0 (0)	0 (0)	0 (0)	5 (12)	37 (88)	1	<0.001
Skills in gathering medical information?	0 (0)	0 (0)	2 (5)	19 (44)	22 (51)	0	0 (0)	0 (0)	1 (2)	10 (23)	32 (75)	0	0.041
Subjective assessment skills?	0 (0)	0 (0)	1 (2)	22 (51)	20 (47)	0	0 (0)	0 (0)	0 (0)	3 (7)	40 (93)	0	<0.001
Physical assessment skills?	0 (0)	0 (0)	5 (12)	23 (53)	15 (35)	0	0 (0)	0 (0)	1 (2)	10 (23)	32 (75)	0	<0.001
Clinical reasoning skills?	0 (0)	1 (2)	5 (12)	22 (51)	15 (35)	0	0 (0)	0 (0)	1 (2)	20 (47)	22 (51)	0	0.049
Manual handling skills?	0 (0)	0 (0)	4 (9)	25 (58)	14 (33)	0	0 (0)	0 (0)	0 (0)	7 (16)	36 (84)	0	<0.001
Skills in performing practical treatments?	0 (0)	0 (0)	6 (14)	23 (53)	14 (33)	0	0 (0)	0 (0)	0 (0)	8 (19)	35 (81)	0	<0.001

Table 4: Students' general attitudes towards simulated learning experiences post-simulation and post-placement (n=43)

	Post-Simulation (Survey 2) n (%)						Post-Placement (Survey 3) n (%)						
Are simulated learning experiences:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	P value for difference
Valuable in physiotherapy clinical education?	0 (0)	0 (0)	0 (0)	0 (0)	43 (100)	0	0 (0)	0 (0)	0 (0)	11 (26)	32 (74)	0	0.001
Equivalent to traditional placement?	0 (0)	4 (10)	9 (21)	15 (36)	14 (33)	1	2 (4)	6 (14)	10 (23)	14 (33)	11 (26)	0	0.078
Useful in preparation for placement?	0 (0)	0 (0)	0 (0)	3 (7)	40 (93)	0	0 (0)	0 (0)	0 (0)	8 (19)	35 (81)	0	0.180
Helpful in developing confidence?	0 (0)	0 (0)	0 (0)	1 (2)	41 (98)	1	0 (0)	0 (0)	0 (0)	7 (16)	36 (84)	0	0.031
Unrealistic?	19 (45)	21 (50)	2 (5)	0 (0)	0 (0)	1	12 (28)	22 (51)	6 (14)	3 (7)	0 (0)	0	0.04
A waste of time?	30 (70)	12 (28)	1 (2)	0 (0)	0 (0)	0	26 (61)	17 (39)	0 (0)	0 (0)	0 (0)	0	0.508

Table 5: Students' attitudes towards the value of simulated learning experiences in physical therapy skill development post-simulation and post-placement (n=43)

	Post-Simulation (Survey 2) n (%)						Post-Placement (Survey 3) n (%)						
Are simulated learning experiences useful to develop:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing	P value for difference
Professional behaviour?	0 (0)	0 (0)	0 (0)	7 (16)	36 (84)	0	0 (0)	0 (0)	0 (0)	13 (30)	30 (70)	0	0.109
Communication skills?	0 (0)	0 (0)	0 (0)	5 (12)	37 (88)	1	0 (0)	0 (0)	1 (2)	8 (19)	33 (79)	1	0.344
Skills in gathering medical information?	0 (0)	0 (0)	1 (2)	10 (23)	32 (75)	0	0 (0)	0 (0)	1 (2)	10 (23)	32 (75)	0	1.0
Subjective assessment skills?	0 (0)	0 (0)	0 (0)	3 (7)	40 (93)	0	0 (0)	0 (0)	0 (0)	5 (12)	38 (88)	0	0.687
Physical assessment skills?	0 (0)	0 (0)	1 (2)	10 (23)	32 (75)	0	0 (0)	0 (0)	4 (9)	14 (33)	25 (58)	0	0.021
Clinical reasoning skills?	0 (0)	0 (0)	1 (2)	20 (47)	22 (51)	0	0 (0)	0 (0)	5 (12)	19 (45)	18 (43)	1	0.118
Manual handling skills?	0 (0)	0 (0)	0 (0)	7 (16)	36 (84)	0	0 (0)	0 (0)	2 (5)	14 (33)	26 (62)	1	0.001
Skills in performing practical treatments?	0 (0)	0 (0)	0 (0)	8 (19)	35 (81)	0	0 (0)	1 (2)	1 (2)	13 (31)	27 (65)	1	0.065

assessment and management following one week of SLEs (Blackford et al., 2015; Blackstock et al., 2013; Watson et al., 2012). While not formally evaluated as part of this research project, the educators who supervised students who had undertaken the SLE placements also had very positive attitudes regarding the impact of the SLE component on the students' skills and preparedness.

While the SLEs were valued very highly at the conclusion of the simulation component, we found that participants' attitudes were slightly less positive at the completion of three weeks of traditional clinical placement. Although a high fidelity approach was used in this project, physiotherapy practice in a traditional clinical settings has other layers of complexity that cannot always be easily integrated into SLEs. During the time students spent immersed in a traditional setting, they were exposed to the realities of clinical practice, which may have impacted on the perceived value of the SLEs. Simulation is most beneficial when used in conjunction with clinical practice (Kneebone, Scott, Darzi, & Horrocks, 2004) therefore, as the intended purpose was to prepare students for traditional clinical placement rather than to solely replace clinical time, the SLEs and the clinical placement weeks were integrated closely in this project.

In terms of specific clinical skills, students were less positive about the ability of the SLEs to prepare them for tasks such as patient handling, physical assessments and treatments following the three weeks of traditional placement. This is possibly because the SLEs were weighted more towards developing generic professional skills such as written and verbal communication, gathering medical information and professional behaviour. Medical simulation may be limited in its ability to entirely replicate the physical presentation of real patients and in physiotherapy, SLEs may be less suited for the development of certain domains of practice such as treatment and manual handling. Students did practise physical assessment, treatment and general manual handling skills during the simulation component, and had covered these skills in depth in their university coursework, however possibly more of these activities need to be included. Future research should be undertaken to explore the optimal structure and content of SLEs for students at this year level. Research should also include the objective measurement of student outcomes (such as the performance of manual skills) following participation in a placement involving SLEs and to compare those outcomes to similar students participating in a standard traditional placement. It would also be valuable to undertake a more in-depth qualitative exploration of early-year students' perceptions of the utility of SLE and to further investigate why these perceptions may change following immersion in the 'real' clinical environment.

The main limitations of this study were that the survey was self-reported, and was not formally validated. The survey content, however was informed by the current National Physiotherapy Practice Thresholds (The Physiotherapy Board of Australia, Physiotherapy Board of New Zealand, 2017) and based on the domains of the Assessment of Physiotherapy Practice tool (Dalton et al., 2011; Dalton et al., 2012). The survey was developed by two physiotherapists, experienced in clinical education research, and trained in simulation delivery using SPs and was reviewed by an independent physiotherapist with a background in clinical education. Further research to develop and validate a tool which can be used to collect data on attitudes towards the use of SLE is required.

Other limitations were the non-random allocation of participants and the lack of a comparison group. In addition, participants were students enrolled at one University in an undergraduate degree programme and the results may therefore not be generalisable to other physiotherapy programmes with different entry-level structures. Further research on the use of SLEs with early year students in other types of entry-level physiotherapy programmes, using larger sample sizes and including a comparison group, would be beneficial to evaluate the effectiveness of this intervention across populations.

CONCLUSION

This study demonstrated that early year physiotherapy students valued the use of SLEs as a preparatory component of a general introductory clinical placement. Students were most positive about the value of SLEs in assisting the development of their communication skills and professional behaviour. Students considered that participation in the combined placement equipped them to more confidently enter, and engage with, the traditional clinical placement setting. Simulated learning experiences, such as those used in this study, should be considered as a component of effective student preparation for placement and as a useful alternative model of clinical education for early year physiotherapy students.

KEY POINTS

1. Simulated learning experiences (SLEs) have been used to prepare physiotherapy students to safely practise in challenging clinical environments. However, research into the use of SLEs in physiotherapy clinical education has predominantly involved students in specific clinical areas (such as acute care) in their later years of study. The effectiveness and utility of using SLEs as part of introductory clinical placements for early year physiotherapy students is less clear. This study evaluated early-year physiotherapy students' attitudes towards an introductory clinical placement which included a preparatory week of simulated learning experiences.
2. Results of the study indicated that the participating students valued the SLEs and perceived them as useful in assisting their skill development and preparation for clinical placement. Interestingly the students' perceptions of the usefulness of the SLEs was slightly less positive, particularly in some domains of practice, after completing three weeks of a traditional clinical placement.
3. Simulated learning experiences should be considered as a component of effective early-year student preparation for placement and as a useful alternative model of clinical education for early year physiotherapy students.

DISCLOSURES

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PERMISSIONS

Ethics approval was granted for the study from the University of Newcastle Human Research Ethics Committee (reference number H-2014-0389). All participants consented to participate.

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Appendix 1

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Attitudes towards simulated learning experiences in physiotherapy clinical education
Pre-simulation Student Survey

Feedback about the student experience of simulated learning experiences in physiotherapy clinical education is very important. Thank you for completing the following survey about your combined simulation placement. Do not write your name on this survey however write your unique research code in the box below. This code will be given to you at the start of the placement.

Research Code:

Section 1: Information about you.

1. Which year of the physiotherapy program are you in?
   ☐ Year One ☐ Year Two ☐ Year Three ☐ Year Four

2. What is your gender?
   ☐ Female ☐ Male

3. How old are you? ____________ years

4. Have you undertaken tertiary study prior to entering the physiotherapy program?
   ☐ No Yes, please specify ____________________

5. Have you previously participated in simulation education using actors (standardised patients)?
   ☐ No ☐ Yes

6. Have you previously participated in simulation education using mannequins (Dummies)?
   ☐ No ☐ Yes

7. Was simulation one of your five placement preferences?
   ☐ No ☐ Yes

Section 2: Attitudes towards simulated learning experiences

1. Please place a cross or a tick in the box that best indicates whether you agree or disagree with the following statements.

Simulated learning experiences...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Are valuable in physiotherapy clinical education	☐	☐	☐	☐	☐
Are equivalent to traditional placement in the clinical setting	☐	☐	☐	☐	☐
Are useful in preparation of students for clinical placement	☐	☐	☐	☐	☐
Help to develop student confidence for clinical placement	☐	☐	☐	☐	☐
Are not realistic	☐	☐	☐	☐	☐
Are a waste of time that I could be spending in the clinical setting	☐	☐	☐	☐	☐
Assist students to develop professional behaviour	☐	☐	☐	☐	☐
Assist students to develop confidence and skills in communicating with patients	☐	☐	☐	☐	☐
Assist students to develop knowledge and skills in gathering medical information	☐	☐	☐	☐	☐
Assist students to develop subjective assessment skills	☐	☐	☐	☐	☐
Assist students to develop physical assessment skills	☐	☐	☐	☐	☐
Assist students to develop their clinical reasoning	☐	☐	☐	☐	☐
Assist students to develop manual handling skills	☐	☐	☐	☐	☐
Assist students to develop confidence and skills in performing practical treatment techniques	☐	☐	☐	☐	☐

2. Do you have any other comments about your perceptions or attitudes towards simulated learning experiences (SLE) in physiotherapy clinical education

Patient-perceived barriers and enablers to adherence to physiotherapist prescribed self-management strategies

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ABSTRACT

The objectives of this study were to describe patient-reported adherence to physiotherapist-prescribed self-management strategies; and the perceived barriers and enablers to adherence to each strategy. Patients attending physiotherapy private practices (n=4) were observed during their consultation. Patients prescribed one or more self-management strategies received a follow-up telephone interview within 10-14 days of the observed consultation and were asked to self-report their level of adherence and their perceived barriers and/or enablers to each prescribed strategy. Results indicated that patients (n=108) reported receiving 177 strategies and being fully adherent to 36% (95% CI: 29-44%) of these strategies. Patient-reported adherence barriers (n=113) and enablers (n=172) were coded using a modified version of the World Health Organisation five dimensions of adherence. Frequently reported barriers included social/economic-related (n=52; 46%) such as being too busy, and patient-related (n=29; 26%) including being too tired/lack of motivation. Frequently reported enablers included therapy-related (n=71; 41%) such as “the strategy was easy to complete”, and condition-related (n=45; 26%) including “that the strategy helped to manage symptoms”. Thus, patient adherence may be aided by ensuring that: the strategy is less complex; it does not cause pain; it isn’t time consuming; and it leads to an improvement in condition-related symptoms.

Peek, K., Carey, M., Mackenzie, L., Sanson-Fisher, R. (2018). Patient-perceived barriers and enablers to adherence to physiotherapist prescribed self-management strategies. New Zealand Journal of Physiotherapy 46(3): 105-112. doi:10.15619/NZJP/46.3.03

Key Words: Physiotherapy, Compliance, Self-care, Exercise, Advice.

INTRODUCTION

Physiotherapist-prescribed self-management strategies refer to specific actions given to the patient for them to implement at home (away from the supervised environment) in order to manage their condition. Strategies may include the prescription of an exercise programme, advice to complete a functional activity (such as walking) or to refrain from a specific activity (such as playing basketball), the use of a brace, and non-pharmacological pain interventions such as ice or heat (Liddle, Baxter, & Gracey, 2009; Page, Hinman, & Bennell, 2011; Peek, Sanson-Fisher, Mackenzie, & Carey, 2015, 2016). Physiotherapist-prescribed self-management strategies have been shown to be as effective as physiotherapist provided treatment resulting in potential cost savings for both the patient and the health care system (Novak, 2011) as well as increasing the flexibility of treatment options. Successful self-management requires a partnership in which the physiotherapist supports the patient to take responsibility for the management of their symptoms at home, away from the physiotherapy clinic (Matthews et al., 2015).

The effectiveness of evidence-based self-management strategies has reportedly been related to patient adherence (Kolt & McEvoy, 2003; Peek, Sanson-Fisher, Mackenzie, & Carey 2015, 2016). A systematic review on adherence to therapeutic splint wear in adults with acute upper limb injuries reported that poor adherence to splinting can lead to worse outcomes for the patient such as delayed recovery or increased risk of surgical intervention (O’Brien, 2010). Similarly, a randomised controlled trial of 150 patients with hip and/or knee osteoarthritis reported that adherence to recommended home exercises and being more physically active were significantly associated with better patient outcomes related to pain and function (Pisters, Veenhof, Schellevis, et al., 2010). However, rates of adherence to physiotherapist-prescribed self-management strategies have ranged from 44-56% of patients completing a home-based pelvic floor exercise programme every day (Sacomori, Berghmans, Mesters, de Bie, & Cardoso, 2015) to 70-78% of patients with hip and/or knee osteoarthritis completing a home exercise and walking programme (Pisters, Veenhof, de Bakker, Schellevis, & Dekker, 2010).

Patient adherence has been reported as a multidimensional phenomenon determined by the interplay of five factors, which have been termed by the World Health Organisation (WHO) as the five dimensions of adherence (Sabaté, 2003). These five dimensions, which include social/economic-related, condition-related, therapy-related, healthcare team and system-related, and patient-related factors, aim to dispel the belief that patients are solely responsible for following prescribed self-management strategies (examples of the five dimensions are included in Figure 1). They also reflect an understanding of how multiple factors can influence a patient's behaviour and their capacity to adhere to treatment (Sabaté, 2003). Barriers to patient adherence to home-based exercise for patients with musculoskeletal conditions reported in a systematic review included the presence of pain, low self-efficacy, depression, anxiety, and poor social support (Jack, McLean, Moffett, & Gardiner, 2010). However, it has been reported that some patients demonstrate an ongoing commitment to their self-managed exercise programme in spite of these barriers (Robinson, Newton, Jones, & Dawson, 2014), and that on the whole, patients want to adhere but that they often have difficulty integrating the required behaviours into their daily routines (Bassett, 2015).

Enhancing physiotherapists' understanding of patient-perceived barriers and enablers to adherence may assist physiotherapists and their patients in developing collaborative self-management treatment plans in which these barriers may be better managed. For example, patients may be more likely to adhere to self-managed strategies which are easier and more convenient to complete (DiMatteo, Haskard-Zolnierek, & Martin, 2012) such as one simple exercise versus ten more complex ones; or a strategy prescribed to provide pain relief such as the use of heat or ice (French, Cameron, Walker, Reggars, & Esterman, 2006). One qualitative study cited the most common enablers to adherence to a regular self-managed exercise programme as: an established daily structure that incorporated exercise, anticipated positive feelings associated with exercise, and accountability to others (McArthur, Dumas, Woodend, Beach, & Stacey, 2014). However, the majority of studies which have reported barriers to patient adherence to self-management strategies prescribed by physiotherapists have related to exercise only (Campbell et al., 2001; Lui & Hui, 2009; McArthur et al., 2014). If physiotherapists can understand the nature of patient reported barriers and enablers to self-management more generally, this may inform clinical decision-making to promote long-term patient adherence, which may ultimately improve patient treatment outcomes to a range of home-based strategies.

The objectives of this study were to describe patient-reported levels of adherence to physiotherapist-prescribed self-management strategies; and patient-perceived barriers and enablers to adherence to each prescribed strategy.

METHODS

Study Design

A cross-sectional study design was utilised whereby patients, who were observed (by a research physiotherapist) to receive at least one self-management strategy prescribed by their physiotherapist, were later contacted to complete a telephone interview. During the interview participants were asked to name each strategy that was prescribed to them during the observed consultation, self-report their level of adherence to each strategy and describe their reasons for this level of adherence. Ethics approval for this research project was granted through the University of Newcastle (Australia), Human Research Ethics Committee (no: H-2015-0030). Data were collected between May and October 2015.

Setting

This study was undertaken in four physiotherapy private practices in Australia (two in South Australia and two in New South Wales).

Participants

Physiotherapists: Practising physiotherapists were recruited via the website of the peak professional organisation which represents the interests of physiotherapists within Australia: Australian Physiotherapy Association (available at: http://www.physiotherapy.asn.au/apawcm/controls/findaphysio.aspx.). This method of recruitment has been used in previous research as an alternative approach now that accessing mailing lists through the Physiotherapy Board of Australia (national registration authority) is no longer permitted (Peek, Carey, Sanson-Fisher, & Mackenzie, 2017). Physiotherapists listed within 50km radius of two large cities were emailed an initial invitation to discuss participation in this study. Physiotherapists were invited to contact the research team to arrange a face-to-face meeting with the study's primary researcher (a physiotherapist with 18 years of clinical experience). The face-to-face meeting provided an opportunity to further discuss study participation and to gain consent from the physiotherapist and practice manager/owner. Additional physiotherapists employed within each practice were also invited to attend this meeting and were provided with the opportunity to participate. Physiotherapists were eligible to participate if they worked in private practice and saw a general case mix of adult patients.

Patients: Eligible patients included those: aged 18 years and older, physically and mentally able to give informed consent, and who had sufficient English proficiency to complete a telephone interview.

A consecutive sample of patients were approached by the study's primary researcher prior to their attendance for an initial or follow-up consultation with a participating physiotherapist. Written and verbal information was provided to potential patient participants regarding the study's aims and methods before requesting written consent to participate. Patients were also asked to provide their telephone number and preferred contact time in order to complete a follow-up telephone interview with the same researcher within 10-14 days of the observed consultation. A consecutive sample of patients was recruited to try to minimise recruitment bias.

Observational data collection

The study's primary researcher observed one physiotherapist-patient consultation per consenting patient. An observation coding checklist was specifically designed, and pilot tested for this study by a team of physiotherapists and health behaviourists and was used to record the number and type of self-management strategies prescribed to each patient during the observed consultation as well as details related to the nature of the injury patients were attending for treatment. For this study, a self-management strategy included any strategy that the physiotherapist specifically gave to the patient to complete independently at home, such as exercise, a brace to wear or ice pack. Specific definitions for each self-management strategy were determined a priori. For example: exercise was only listed as a self-management strategy if the physiotherapist prescribed the patient with a specific movement action to complete at home such as squats, biceps curls or hamstring stretch. If the physiotherapist recommended physical activity such as swimming or walking this was included under advice. Education was considered to be an intervention to aid adherence rather than a self-management strategy and therefore was not recorded.

Patient telephone interview

The patient telephone interview was conducted within 10-14 days of the observed consultation. This timeframe was selected to hopefully allow the patient sufficient time to have practised each strategy more than once but not so long that the patient might have difficulty recalling the observed consultation. The telephone interview included demographic questions regarding the patient's age and gender.

Patients were then asked the following question:

1. 'Please tell me the name/s of any self-management strategy that you were given in the consultation that was observed by the researcher only' (open ended)

Next, patients were given a study definition of adherence:

'With regard to adherence:

- Complete adherence means that you completed all (100%) of the strategy as given to you by your physiotherapist.
- Partial adherence means that you completed:
  - o Most (>50%) of the strategy as given to you by your physiotherapist, or,
  - o Some (<49%) of the strategy as given to you by your physiotherapist
- And non-adherence means that you did not do any (0%) of the strategy as given to you by your physiotherapist in the observed consultation'

Patients were then asked:

2. 'Over the last seven days, can you tell me your level of adherence to <name of strategy as reported in question 1>' (response options: all, most, some, none).
3. 'What are the main reasons that you gave this answer?' (Open ended).

Questions 2 and 3 were repeated for each strategy as reported by the patient in response to question 1.

Data analysis

Data analysis was conducted using the statistical software package, Stata® 14 (Texas, USA). Descriptive statistics were used to describe physiotherapist and patient characteristics as well the number of patients prescribed with at least one self-management strategy and patient-reported level of adherence.

A simplified quantitative content analysis, a social science methodology which focuses on patterns in the content of communication (Potter & Levine-Donnerstein, 1999), was used to analyse the patient-perceived reasons for their self-reported level of adherence using a modified version of the WHO five dimensions of adherence (Sabaté, 2003). The WHO classified factors associated with adherence into five dimensions related to social/economic-related, condition-related, therapy-related, healthcare team and system-related, and patient-related which we have adapted using physiotherapy specific examples as shown in Figure 1. The WHO five dimensions of adherence

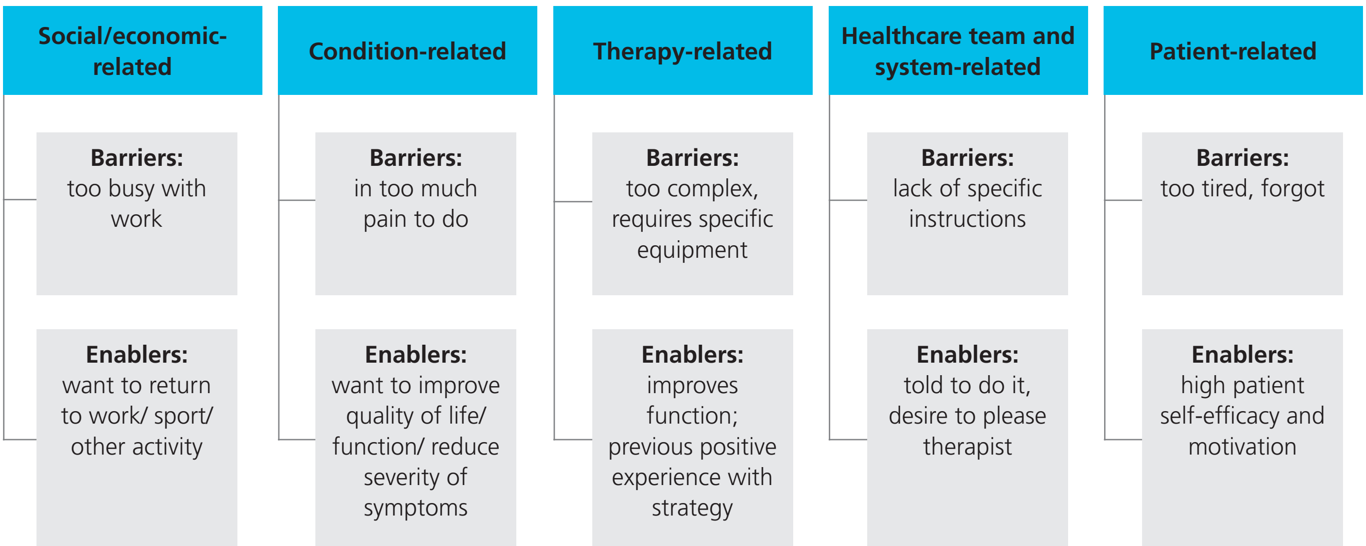

Figure 1: Modified version of the WHO five dimensions of adherence

were used for coding in an attempt to standardise the factors associated with adherence. A coding guideline was developed whereby the definitions and coding criteria for each of the five dimensions of adherence was stated. Each patient-reported reason was first analysed and then single coded by the first author as to whether the reason was a barrier or enabler to adherence and then recorded against one of the five dimensions using a quantitative-coding sheet. Frequencies and percentages were calculated for reported barriers and enablers.

RESULTS

Demographics

Physiotherapists: From five emailed invitations, four physiotherapists contacted the study's primary researcher to schedule a face-to-face meeting. This led to the recruitment of 14 physiotherapists from four separate practices within South Australia (n=6) and New South Wales (n=8). Of these 14 physiotherapists, six (43%) were male and 12 (86%) received their physiotherapist qualification in Australia.

Patients: Of the 119 patients screened for eligibility, 114 eligible patients were approached to discuss participation (reasons for ineligibility included: insufficient English to be able to give consent n=1; younger than 18 years n=4). In total, 113 patients consented to be observed during their physiotherapy consultation (consent rate 99%). Of the 113 observed physiotherapist-patient consultations, 108 patients were observed to receive at least one self-management strategy and were scheduled for telephone interview. The mean age of patient participants was 52 years (range 25-95). Of the 108 participants, 77 (68%) were female. All patient participants attended for physiotherapy treatment of a musculoskeletal condition involving the upper limb (n=21), spine (n=82) or lower limb (n=10).

Patient reported adherence to the physiotherapist-prescribed strategies.

Patients (n=108) reported being prescribed 177 self-management strategies (mean = 1.64 strategies per patient). Prescribed self-management strategies included exercise (n=101), specific advice (n=52), heat packs (n=11), ice (n=5), removable brace (n=2), lumbar roll (n=5) and self-taping (n=1). In total, patients reported being completely adherent to 64 strategies (36% (95% CI: 29-44%); mostly adherent to 62 strategies (35% (95% CI: 28-43%); somewhat adherent to 35 strategies (20% (95% CI: 14-26%) and non-adherent to 16 strategies (9% (95% CI: 2-9%) in the seven days prior to the telephone interview. Table 1 shows the level of patient-reported adherence per type of prescribed strategy.

Patient-perceived barriers and enablers to adherence.

For each self-management strategy patients were asked to report the main reasons for their reported level of adherence. This resulted in the coding of a total of 113 perceived barriers and 172 perceived enablers to adherence which were then coded using the modified five dimensions of adherence (Sabaté, 2003), Table 2.

The most frequently described dimension of adherence-barrier was social/economic related with being 'too busy' reported for 49 (43%; 95% CI: 34-53%) individual self-management strategies. Other frequently reported dimension-barriers were patient-related (too tired or lack of motivation), and condition-related (not doing the strategy when patients were in pain), Table 2.

The most frequently reported dimension of adherence-enabler was therapy-related with 'ease to complete the strategy' being commonly reported (n=54; 31%; 95% CI: 25-38%). Other frequently reported dimension-enablers were condition-related (the strategy helped manage long-term symptoms related to the patient's condition), and healthcare team and system-related (being told to complete the strategy by their physiotherapist), Table 2.

DISCUSSION

Given the frequency of self-management strategy prescription in physiotherapy private practice, physiotherapists should consider the assessment of patient adherence to optimise the effectiveness of each home-based treatment strategy. In our study, 36% of strategies were self-reported as being completely adhered to, similar to percentages reported in earlier research (Alexandre, Nordin, Hiebert, & Campello, 2002; Schneiders, Zusman, & Singer, 1998). The percentage of each prescribed

Table 1: Level of patient-reported adherence per type of prescribed self-management strategy

Name of Self-Management Strategy	Number (%) of patients self-reporting each level of adherence per prescribed strategy			
	All	Most	Some	None
Exercise (n=101)	42 (41%)	27 (27%)	19 (19%)	13 (13%)
Advice (n=52)	6 (12%)	31 (60%)	15 (29%)	0
Heat (n=11)	6 (55%)	4 (36%)	1 (9%)	0
Ice (n=5)	1 (20%)	4 (80%)	0	0
Removable Brace (n=2)	2 (100%)	0	0	0
Lumbar roll (n=5)	2 (40%)	0	0	3 (60%)
Self-taping (n=1)	1 (100%)	0	0	0

Table 2: Patient perceived barriers and enablers to adherence to physiotherapist-prescribed self-management strategies in the past seven days using the adapted WHO five dimensions of adherence.

	Social/economic-related	Condition-related	Therapy-related	Healthcare team and system-related	Patient-related
Barriers n=113	• Too busy with additional commitments at home/work (n=49) • Work is too stressful (n=3)	• In too much pain in general to complete strategy (n= 12) • Don't complete strategy if pain is not present (n=3)	• The strategy takes too long to do (n=4) • Not convenient to complete strategy every day (n=7) • Strategy causes pain (n=1) • Need additional equipment to complete strategy (n=3)	• Need further advice from physiotherapist (unsure what to do) (n=2)	• Too tired/lack of motivation (n=21) • Forgot (n=6) • I don't like doing the strategy (n=2)
Total:	n=52, 46%	n=15, 13%	n=15, 13%	n=2, 2%	n=29, 26%
Enablers n=172	• Need to return to work/ activity (n=5)	• Strategy helped manage long-term condition-related symptoms (n=42) • Strategy helped prevent further issues (n=2) • Improved sleep (n=1)	• Easy to do the strategy (n=54) • Provided instant pain relief (n=7) • Convenient, didn't take much time to complete (n=6) • Previous positive experience of the strategy (n=4)	• Physiotherapist told me to do it (n=21)	• Motivated to get better quickly (n=13) • Want an active role in treatment (n=11) • Strategy was part of my routine (n=3) • Sick of being injured (n=3) • Understand importance of strategy related to improving outcomes (n=1)
Total:	n=4, 2%	n=45, 26%	n=71, 41%	n=21, 12%	n=31, 18%

strategy which was patient-reported as being completely adhered to ('all') varied from 12% for advice, 42% for exercise, and 100% for removable braces and self-taping (although the last two strategies were infrequently prescribed compared with exercise and advice). Furthermore, only initial short-term adherence (10-14 days) was assessed in our study, subsequent levels of patient adherence could be even lower as adherence has been shown to decline over time (Picorelli, Pereira, Pereira, Felicio, & Sherrington, 2014). Therefore, physiotherapists should incorporate methods which aid patient adherence to self-management as strategies can only be effective if patients do them.

Social/economic and patient-related factors were the most frequently perceived barriers to adherence

The most frequently described dimensions of adherence-barriers in our study were related to social/economic and patient-related factors such as being too busy or too tired/lack of motivation. This finding supports a number of qualitative studies related to self-management strategies, in particular home-based exercise programmes (Campbell et al., 2001; Medina-Mirapeix, Escolar-Reina, Gascón-Cánovas, Montilla-Herrador, & Collins, 2009). It has been reported that when adults perceive their own level of activity as being sufficient, they are less likely to change their behaviour (Visser, Brychta, Chen, & Koster, 2014). In addition, patients who were poor adherers in earlier research often did not consider that their injury was serious (Bassett, 2015). It may be that patients who reported being too busy or too tired/ lack of motivation to adhere to prescribed self-management strategies were in fact not willing to prioritise their time as they did not feel that it was important to complete their prescribed strategy either due to being sufficiently active (in the case of prescribed exercise) or that their injury was not serious enough to warrant additional self-care.

Condition-related, therapy-related and healthcare team and system-related factors were the most frequently perceived enablers to adherence

The most frequently reported dimension of adherence-enabler was that the strategy helped the patient to manage the symptoms related to their condition, such as improvement in mobility or function (condition-related). Therefore, physiotherapists may be able to aid patient adherence by ensuring that the prescribed self-management strategy is perceived by the patient as having a direct positive effect on their symptoms through the use of appropriate objective outcome measures. A recent systematic review reported on 14 different validated measures for assessing the effectiveness of a self-management strategy in patients with chronic pain which included scales on self-efficacy, coping, pain, attitude and activation (Banerjee, Hendrick, Bhattacharjee, & Blake, 2016). Other dimension-enablers included the relative ease to complete the strategy (therapy-related), which may reflect why some patients reported higher levels of adherence to heat packs and removable braces than exercise. Another enabler was that the physiotherapist told the patient to do it (healthcare team and system-related). A recent qualitative study described some patients as feeling accountable to their physiotherapist and not wanting to let them down, which led to an increase in patient motivation to adhere to their home programme (Hinman, Delany, Campbell, Gale, & Bennell, 2016). However, this enabler may only improve short-term adherence while patients still have contact with their physiotherapist (Melander Wikman & Fältholm, 2006). Therefore, whilst acknowledging the influential role the physiotherapist may have in their patient's self-management, it may be more advisable to explore more patient-centred enablers which facilitate the active role and responsibilities of the patient, to effect long-term change in patient adherence behaviour (Kåringen, Dysvik, & Furnes, 2011). Physiotherapists may play a role in promoting long-term adherence by actively listening to the patient's beliefs about their condition, treatment approaches, and previous experiences with self-management strategies in order that a more tailored and patient-centred strategy is prescribed in the first instance (Peek et al., 2016a). The implementation of peer support groups or follow up phone calls may also encourage patient adherence.

Patients perceived more enablers than barriers to adherence

Patient-reported reasons for their level of adherence to each strategy were more often coded as enablers (n=172 reasons) than barriers (n=113 reasons). The frequency with which enablers were identified may indicate a willingness of patients to become actively involved with their treatment and self-management, which supports earlier results from qualitative studies (Robinson et al., 2014; Stenner, Swinkels, Mitchell, & Palmer, 2016).

Clinical implications

Cognitive behavioural theory suggests that there are a range of factors that can affect a patient's adherence-related behaviour, including individual knowledge, attitudes, beliefs, as well as physical and environmental factors (McGrane, Cusack, O'Donoghue, & Stokes, 2014). There were a number of patient-perceived barriers to adherence related to social/economic and patient-related factors such as being too busy or too tired/ lack of motivation. Therefore, before prescribing strategies to their patients, it might be useful for physiotherapists to ask their patients about their ability or intentions to adhere to self-management so that any barriers can be discussed. Techniques such as motivational interviewing should be considered to assess a patient's readiness for change (Barron, Moffett, & Potter, 2007). Furthermore, patient adherence may be promoted by the belief that the self-management strategy will be effective as well as the belief that the patient is capable of following the requirements of the strategy (Medina-Mirapeix et al., 2009; Picorelli et al., 2014). Therefore, physiotherapists should seek to enable patient adherence through education and enhancing patient self-efficacy (Wesch et al., 2012) via best-practice communication which is purposeful, goal orientated and based on research from empirical studies, practitioner experience and theoretical paradigms (Chan & Clough, 2010; Hiller, Guillemin, & Delany, 2015; Isaac & Franceschi, 2008). One established model of communication is the patient-centred model which emphasises the need to gather information and tailor self-management strategies according to the patient's needs, which may ultimately lead to improved patient outcomes through sustained adherence (Hiller et al., 2015). Physiotherapists should feel assured that time spent designing, prescribing and actively monitoring self-management strategies is time well spent (Novak, 2011).

Limitations

Given that participants were recruited from just four physiotherapy private practices, results are unlikely to be generalisable to all physiotherapy patients. Nevertheless, the high consent rate achieved (99%) indicates that results are likely to be representative of patients attending those practices. However, cultural barriers to adherence were not explored in this study as none were reported by the participants, which may be reflective of this particular patient sample and may not be the case if this study were repeated in a different country or geographical location.

This study only assessed short-term adherence for patients attending for physiotherapy of musculoskeletal conditions. However, we did not collect data related to specific injury characteristics other than body region. Further studies assessing long-term adherence, and considering self-management of acute compared with chronic conditions, would be a useful addition to the literature. As this study was not powered to examine whether the type of self-management strategy or patient characteristics were associated with the reported barriers and enablers, this remains an area for future research.

CONCLUSION

Patients reported more enablers than barriers to adherence implying a willingness to play an active role in their self-management programme. The results indicate that adherence may be aided in the following ways: making the strategy less complex, ensuring it does not cause pain, that it is not time consuming, and that it can lead to an improvement in condition-related symptoms. It is also recommended that physiotherapists adopt a patient-centred approach to communication using shared decision making when discussing self-management strategies with their patients. The identification of barriers and enablers to physiotherapist-prescribed self-management strategies provides insight into how physiotherapists might manage issues surrounding adherence in the future leading to the optimisation of patient adherence and thus improved treatment outcomes.

KEY POINTS

1. Patients (n=108) reported receiving 177 physiotherapist-prescribed self-management strategies including exercise, advice and use of heat packs.
2. Patients self-reported being completely adherent to 36% of prescribed strategies.
3. Patient adherence may be aided by: making the strategy less complex, ensuring it does not cause pain, that it isn't time consuming, and that it can lead to an improvement in condition-related symptoms.
4. Physiotherapists should ask their patients about their ability or intentions to adhere to a prescribed strategy early on during the prescription process so that any barriers to adherence can be discussed and potentially mitigated.

DISCLOSURES

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Early mobilisation of patients in the acute hospital setting following aneurysmal subarachnoid haemorrhage – a survey of current physiotherapy practice

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ABSTRACT

Aneurysmal subarachnoid haemorrhage is a catastrophic form of stroke. There is very limited literature to guide physiotherapists on the type and timing of mobility interventions that should be provided during the acute phase. The aim of this study was to determine the current practices of physiotherapists in early mobilisation of patients with aneurysmal subarachnoid haemorrhage. A purpose-designed electronic survey was distributed to 71 physiotherapists in hospitals that specialise in the management of aneurysmal subarachnoid haemorrhage throughout Australia and New Zealand. A response rate of 80% was obtained (n=57). Prior to the aneurysm being repaired, the most common practice reported by physiotherapists was not to mobilise patients (41%). Once the aneurysm was repaired, mobility goals increased with >80% of physiotherapists reporting goals of sitting on the edge of the bed or step transferring to a chair day one post repair. Physiotherapists reported that vasospasm, delayed cerebral ischaemia, recent further bleed, hypotension or the use of high level of noradrenaline would prevent them from mobilising patients. Only four respondents reported that they had a mobilisation protocol for aneurysmal subarachnoid haemorrhage patients at their hospital. Further research is required into the safety, timing and efficacy of early mobilisation practices in the management of aneurysmal subarachnoid haemorrhage patients.

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Keywords: Physiotherapy, Subarachnoid haemorrhage, Physical therapy modalities, Intensive care, Survey

INTRODUCTION

Subarachnoid haemorrhage (SAH) accounts for approximately 5% of all strokes, with 85% of SAHs resulting from aneurysm rupture (Luoma & Reddy, 2013). Aneurysmal subarachnoid haemorrhage (aSAH) is a catastrophic event, with mortality rates being reported as high as 39 – 67% (The ACROSS Group, 2000; Nieuwkamp et al., 2009). Aneurysms are thought to form due to haemodynamic stress at cerebral arterial bifurcations leading to a dilatation of the vessel wall (Raya & Diringer, 2014). Aneurysmal subarachnoid haemorrhage commonly occurs in people aged 45 - 64 years old, when patients are leading productive and independent lives (Lai & Morgan, 2012). The potential physical, cognitive and psychosocial deficits commonly associated with aSAH often prevent patients returning to their previous level of function, severely impacting on their long-term quality of life (Saciri & Kos, 2002).

Patients admitted with aSAH are frequently faced with a complicated recovery period in hospital, which involves prolonged monitoring. Common complications following aSAH include re-bleeding, vasospasm and delayed cerebral ischaemia (DCI) (Diringer et al., 2011; Suarez, 2015). Currently, there is very limited literature to guide physiotherapists on the timing and type of mobility interventions that should be provided during the acute period following the bleed. Furthermore, progressing patients through higher levels of mobilisation and the effects on cerebral perfusion are not known. Although early mobilisation guidelines are not integrated into the current recommendations from the Neurocritical Care Society (Diringer et al., 2011) and American Heart Association Stroke Council (Connolly et al., 2012), there has been recent evidence demonstrating that it is safe and feasible (Karic et al., 2015; O'Shea & Stiller, 2016; Olkowski et al., 2013). The aim of this study was to determine the current practices of physiotherapists in early mobilisation of patients with aSAH and to report physiotherapists' perceived risks and barriers to early mobilisation.

METHODS

Ethical approval for the study was obtained through relevant human research ethics committees.

A purpose-designed electronic survey was undertaken. The survey was designed to determine current early mobilisation practices following aSAH as there were no validated tools for benchmarking mobilisation in this setting. The survey questions were developed collaboratively by the investigators, who had extensive knowledge and clinical experience in aSAH from medical or physiotherapy backgrounds in tertiary hospital settings. For the purpose of this study, mobilisation was defined as sitting on the edge of the bed, sitting out of bed, step transferring or ambulation. This questionnaire comprised of 36 questions and was divided into three parts – Part A General questions, Part B - ICU related questions, and Part C - Neurosurgery ward specific questions. (See Appendix 1). The survey was pilot-tested by seven senior physiotherapists from two major acute hospitals in Victoria and Queensland. Feedback on the survey was obtained regarding question design, structure and content. As a result of the feedback, minor changes were made.

All respondents were asked to respond to questions in Part A. Physiotherapists then had the option of answering questions based on their main area of clinical practice, which could include ICU only, neurosurgical wards only, or both ICU and ward questions. The questions sought information regarding demographic characteristics of the respondents, characteristics of the physiotherapy service, potential risks to mobility, the timing, frequency and type of mobility and exercise interventions provided to patients and perceived barriers to mobility.

The survey was administered between August 2017 and January 2018. It was distributed to 39 hospitals in Australia and New Zealand that specialise in the management of aSAH via dedicated neurosurgical services, with potential sites identified from previous research (Udy et al., 2017). Physiotherapy managers in each centre were contacted via email and requested to forward the contact details of their senior physiotherapists in ICU and neurosurgery who were involved in the care of aSAH patients at their institution. Through this process, the survey was distributed electronically via SurveyMonkey (SurveyMonkey Inc.) and included the study invitation and information sheet. Completion of the online survey was considered consent to participate. Participants were able to withdraw any information provided at any time. Individual hospitals and participants were de-identified for analysis.

Statistical Analysis

The majority of the data was in the ordinal or nominal form and analysed in Excel (Microsoft Corporation). Open question data were analysed and grouped according to themes.

RESULTS

Response Rate

A total of 71 physiotherapists from 26 sites were identified and electronic access to the survey was provided. Figure 1 illustrates the flow of participants through the study. The response rate was 80% (n=57/71), however five participants only partially completed Part A of the survey. Thirty-three physiotherapists indicated they had ICU experience and completed Part B of the survey, and 35 had ward experience and were able to complete Part C. Results are provided as the number and percentage of total respondents to each question.

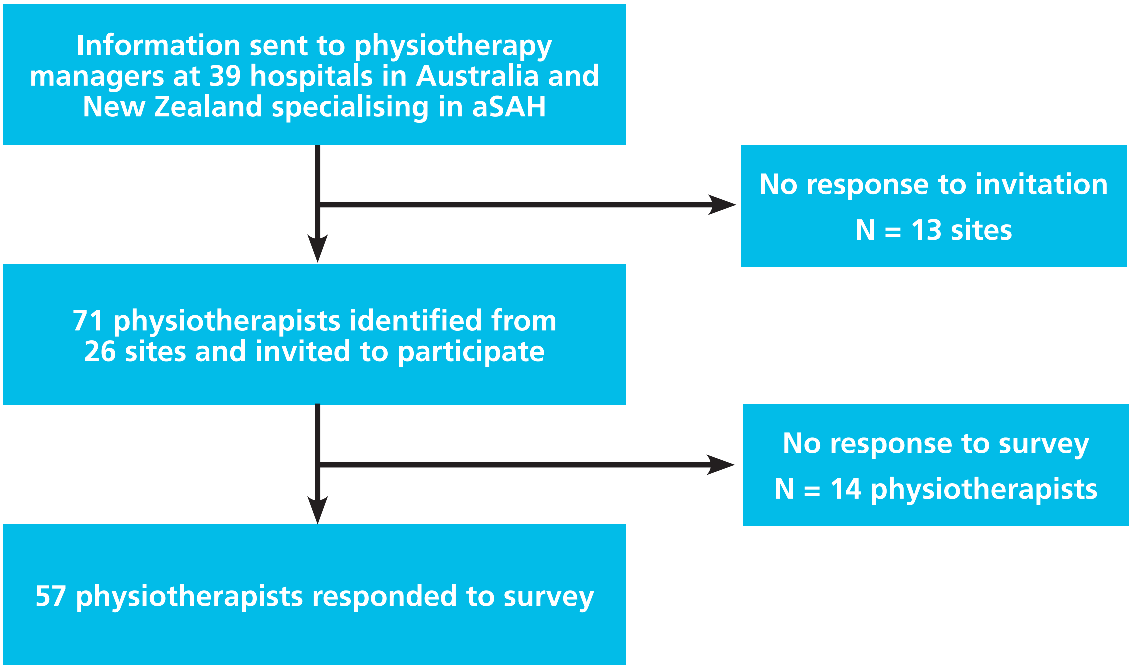

Figure 1: Flow of participants through study

Characteristics of respondents and hospitals

Table 1 summarises the characteristics of the respondents. The majority of respondents (n=51/57, 89%) were from Australia and six (11%) were from New Zealand. Level of experience is shown in Table 1 with 74% of respondents being experienced physiotherapists with five or more years of experience working with aSAH patients. The vast majority of respondents worked in a public hospital setting (n=52/57, 91%) with the remainder working in a private hospital setting.

The two most frequently used aSAH grading scales were reported to be the World Federation of Neurosurgeons scale (Rosen & Macdonald, 2005) (n=29/57, 51%) and the Fisher scale (Rosen & Macdonald, 2005) (n=20/57, 35%). Thirty-nine percent (n=22/57) of physiotherapists reported that they were unsure of which aSAH grading scale was used at their hospital.

Mobilisation prior to repair of the ruptured aneurysm

Prior to the aneurysm being repaired, the most common practice reported by physiotherapists was not to mobilise patients (41%, Figure 2). Sitting up in bed was reported by some respondents (30%). Forty percent of physiotherapists on the ward would initiate sitting up in bed without medical consultation, this was also reflected in the ICU setting (37% of responses). However, mobilisation at higher levels had a greater requirement for gaining medical approval. For example, on the ward approval from the neurosurgical team was required when sitting on the edge of bed (78%), performing step transfers (86%) and walking (100%). In ICU, physiotherapists indicated they rarely commenced higher levels of mobilisation without the approval of a doctor with the neurosurgeons being more commonly consulted than the senior ICU doctors (64% versus 36%).

Mobilisation after repair of the ruptured aneurysm

The timing of mobilisation of aSAH patients after a ruptured aneurysm has been repaired is summarised in Figure 3. For all sitting activities and step transfers to a chair, the majority of physiotherapists (>80%) reported mobilising patients the first day after a ruptured aneurysm has been secured. A decline was seen for the goal of ambulation, with only 68% reporting this as being achieved day one post repair.

Type and frequency of mobility interventions

Only four respondents indicated that they had a mobilisation protocol for aSAH patients at their hospital. The majority of ICU physiotherapists (n=26/33, 79%) reported that patients with moderate to severe functional limitations would routinely be seen once a day in the ICU setting for mobilisation. The frequency of daily reviews appeared lower for patients with moderate to severe functional limitations who were on the

Table 1: Characteristics of the respondents

	Response	n (% of total)
Location of work	VIC	17 (30)
(n = 57)	TAS	3 (5)
	NSW	13 (23)
	QLD	7 (12)
	WA	3 (5)
	ACT	2 (4)
	SA	5 (9)
	NT	1 (2)
	NZ	6 (11)
Clinical experience in the	< 1 year	2 (4)
management of aSAH	1-4 years	13 (23)
(n = 57)	5-10 years	24 (42)
	> 10 years	18 (32)
Practice setting	Neurosurgery wards only	20 (35)
(n = 57)	General ICU only	24 (42)
	Neurosciences ICU only	1 (2)
	General ICU and neurosurgery wards	7 (12)
	Neurosciences ICU and neurosurgery wards	5 (9)

Notes: ICU, Intensive Care Unit; aSAH, aneurysmal subarachnoid haemorrhage; VIC, Victoria; TAS, Tasmania; NSW, New South Wales; QLD, Queensland; WA, Western Australia; ACT, Australian Capital Territory; SA, South Australia; NT, Northern Territory; NZ, New Zealand

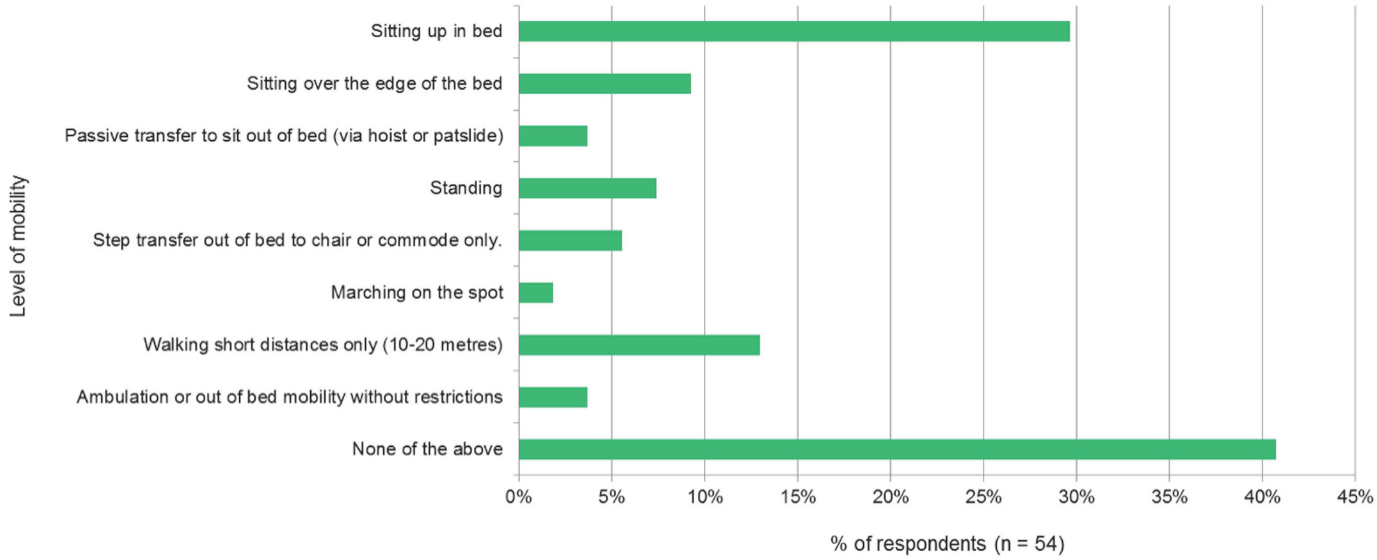

Figure 2: Level of mobility physiotherapists reported to be achieved prior to the ruptured aneurysm being repaired either by surgical clipping or endovascular coiling

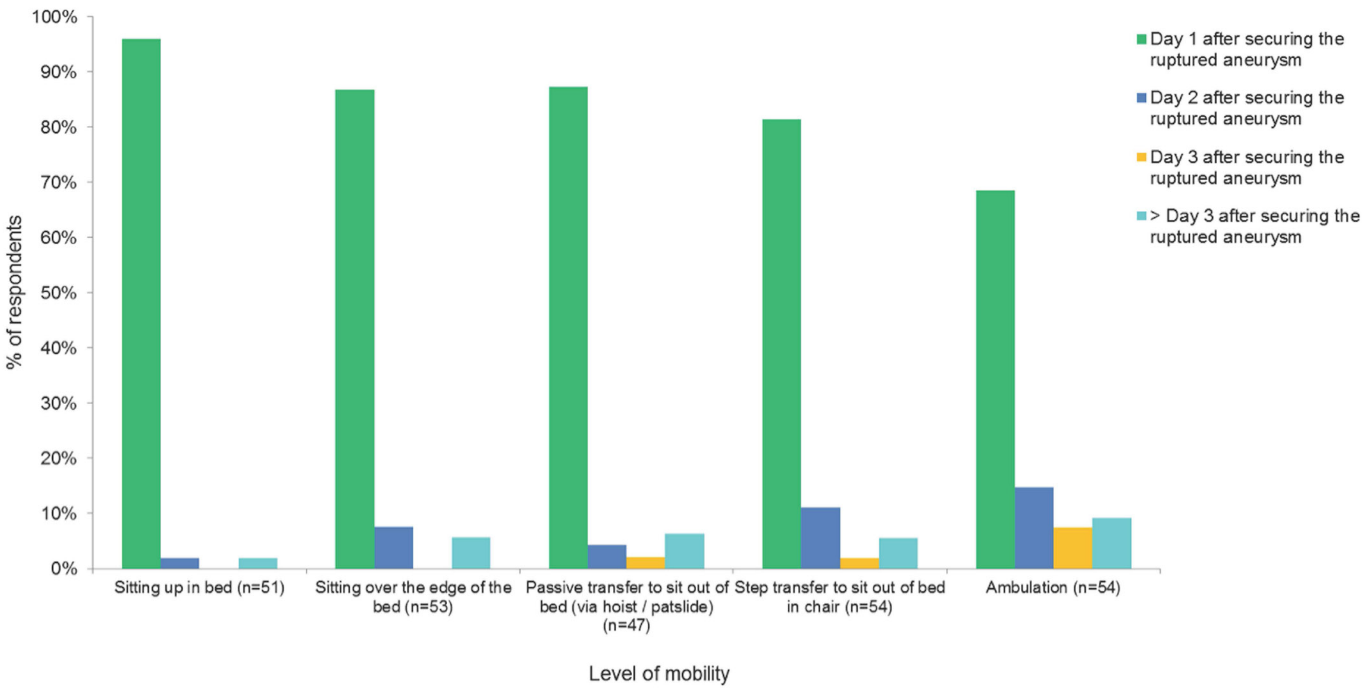

Figure 3: The first day aSAH patients were reported to be mobilised after the ruptured aneurysm has been repaired

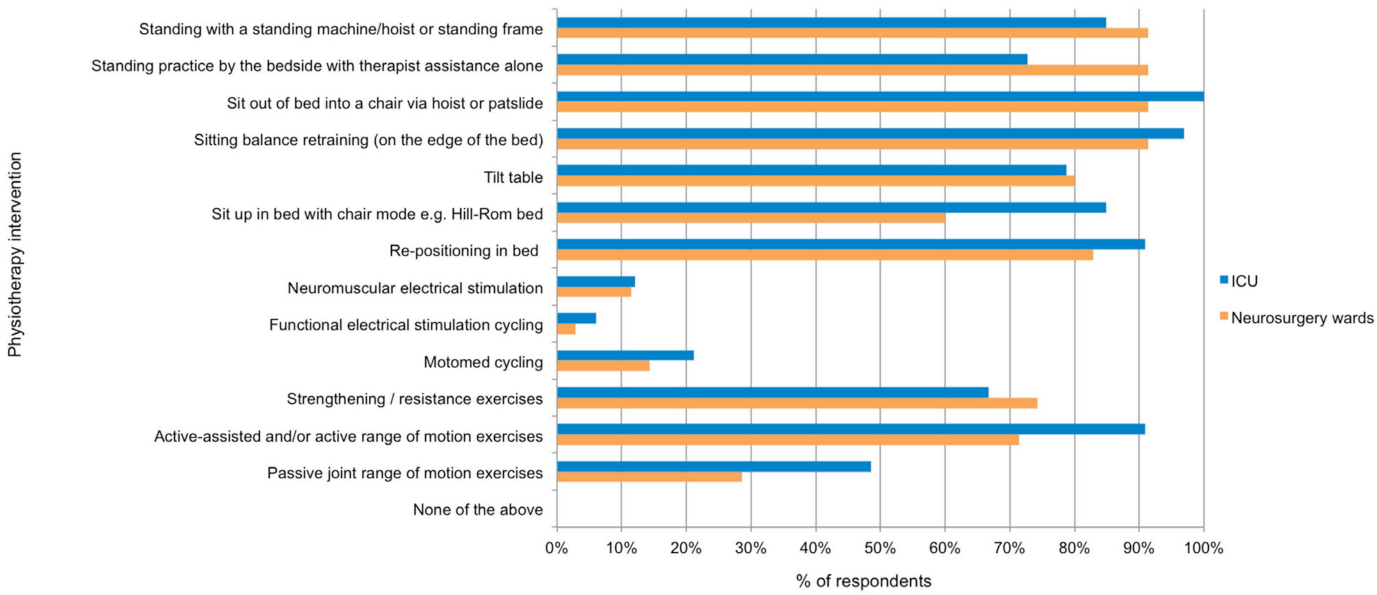

Figure 4: Physiotherapy interventions reported to be provided to aSAH patients with moderate to severe functional limitations in the ICU and neurosurgery ward settings

ward (n=16/35, 46%) and patients with mild or no functional limitations who were in ICU (n=14/33, 42%) or the ward (n=11/35, 31%).

The types of physiotherapy interventions provided to aSAH patients with moderate to severe functional limitations in both the ICU and ward settings are summarised in Figure 4. In ICU, the most frequently reported type of physiotherapy interventions provided to patients with mild or no functional limitations included ambulation practice (n=32/33, 97%) and standing or dynamic balance practice (n=24/33, 73%). The most commonly reported interventions provided to these patients in the neurosurgery ward setting were similar, with 91% (n=32/35) undertaking ambulation practice and 89% (n=31/35) standing or dynamic balance practice.

Monitoring during mobilisation and perceived risks

The majority of physiotherapists reported that they would typically monitor systolic blood pressure (n=51/52, 98%), level of consciousness (n=50/52, 96%), headache (n=47/52, 90%), heart rate (n=46/52, 88%), percutaneous oxygen saturations (n=44/52, 85%) and upper and lower limb strength (n=37/52, 71%) as patients were moved into more upright positions.

In regard to neurological risks to mobilisation (refer to Table 2), the majority of physiotherapists reported that they would prefer patients to remain in bed when vasospasm is present (n=38/51, 75%), DCI (n=36/50, 72%) or there has been a recent further bleed (n=41/52, 79%). There were very few physiotherapists that reported that they were happy to perform mobilisation when there was recent confirmation of vasospasm (12% or less), acute clinical signs of DCI (16% or less), recent further bleed (8% or less) or recent seizures (10% or less).

The three most frequently reported factors that would lead to the clinical decision of the physiotherapist not to clamp the extraventricular drain (EVD) for mobilisation were new signs of neurological deterioration (n=48/52, 92%), medical clearance from either neurosurgeon or intensivist not being given (n=48/52, 92%) and if intracranial pressure was greater than 20mmHg (n=42/52, 81%). Physiotherapists also frequently reported that high amounts of blood draining from the EVD (n=40/52, 77%) or large amounts (>15 millilitres/hour) of cerebral spinal fluid (CSF) being drained per hour (n=40/52, 77%) would also prevent them mobilising patients.

Both ICU and ward-based physiotherapists answered separate questions in relation to cardiovascular risks to mobilisation relevant to their work setting (refer to Table 3 and Table 4). The vast majority of both ICU (n=29/33, 88%) and ward (n=33/35, 94%) physiotherapists were happy to ambulate patients if the blood pressure was autoregulating and at the desired target pressure. ICU physiotherapists reported that they preferred patients to remain in bed with minimal activity when the following factors were present: noradrenaline greater than 20mcg/min to maintain blood pressure above the set target (n=24/32, 75%), oral nimodipine recently administered and blood pressure was below desired target pressure (n=25/33, 76%), uncontrolled hypertension requiring antihypertensives (n=25/33, 76%) and hypotension with mean arterial blood pressure less than 65mmHg (n=28/32, 88%). The majority of ward physiotherapists reported that the presence of the following factors would prevent them from mobilising patients: uncontrolled hypertension requiring antihypertensive medications (n=25/35, 71%) or hypotension with mean arterial blood pressure less than 65mmHg (n=30/35, 86%).

Institutional barriers to mobilisation

Frequent barriers to mobilisation of aSAH patients within the ICU and neurosurgery ward settings are summarised in Table 5. Barriers to mobilisation were reported to be most common in patients with moderate to severe functional limitations with physiotherapists citing insufficient staffing and limited appropriate seating as the most frequent barriers in both the ICU and ward settings.

Table 2: Level of mobility ICU and ward physiotherapists confident to undertake in the context of neurological risks

Neurological factors	Number (%) of respondents						
	Rest in bed/ minimal activity	Sitting up in bed/ head of bed elevated	Sitting over the edge of the bed	Passive transfer to chair*	Step transfer to chair	Ambulating	Total
Recent confirmation of vasospasm	38 (75)	26 (51)	6 (12)	5 (10)	5 (10)	2 (4)	51
Acute clinical signs of delayed cerebral ischaemia	38 (72)	28 (56)	8 (16)	6 (12)	5 (10)	5 (10)	50
New cerebral infarct	32 (63)	27 (53)	17 (33)	12 (24)	9 (18)	8 (16)	51
Recent further bleed	41 (79)	23 (44)	4 (8)	4 (8)	3 (6)	1 (2)	52
Low GCS score without sedation	28 (54)	32 (62)	25 (48)	27 (52)	2 (4)	0 (0)	52
Heavily sedated	32 (62)	32 (62)	3 (6)	8 (15)	1 (2)	0 (0)	52
Severe aSAH (e.g. Fisher Scale 3-4, WFNS 4-5)	25 (48)	26 (50)	26 (50)	29 (56)	15 (29)	14 (27)	52
High risk vasospasm period (up to day 14) with no clinical signs	17 (33)	29 (56)	26 (50)	25 (48)	31 (60)	33 (63)	52
Nausea and vomiting	26 (50)	36 (69)	19 (37)	15 (29)	21 (40)	13 (25)	52
Recent seizures (e.g. < 4 hours)	36 (69)	29 (56)	5 (10)	4 (8)	3 (6)	0 (0)	52
Cognitive / behavioural issues	14 (27)	29 (56)	32 (62)	28 (54)	29 (56)	36 (69)	52
Presence of decompressive craniectomy surgery	14 (27)	32 (62)	33 (63)	30 (58)	31 (60)	40 (77)	52
Severe headache	34 (65)	35 (67)	11 (21)	11 (21)	9 (17)	3 (6)	52
Mild headache	14 (27)	29 (56)	34 (65)	28 (54)	35 (67)	33 (63)	52
Invasively mechanically ventilated	25 (49)	32 (63)	19 (37)	27 (53)	10 (20)	7 (14)	51

Notes: GCS, Glasgow Coma Scale; aSAH, aneurysmal subarachnoid haemorrhage; WFNS, World Federation of Neurological Surgeons Scale
* via hoist or patslide

Table 3: Level of mobility ICU physiotherapists confident to undertake in the context of cardiovascular risks

Cardiovascular factors	Number (%) of respondents						
	Rest in bed / minimal activity	Sitting up in bed/ head of bed elevated	Sitting over the edge of the bed	Passive transfer to chair*	Step transfer to chair	Ambulating	Total
BP is autoregulating and is at the desired target pressure	8 (24)	19 (58)	20 (61)	18 (55)	21 (64)	29 (88)	33
Noradrenaline <5mcg/min to maintain BP above set target	10 (30)	19 (58)	17 (52)	17 (52)	19 (58)	14 (42)	33
Noradrenaline 5-10mcg/min to maintain BP above set target	12 (36)	22 (67)	15 (45)	14 (42)	13 (39)	6 (18)	33
Noradrenaline 11-20mcg/min to maintain BP above set target	20 (61)	24 (73)	4 (12)	6 (18)	3 (9)	2 (6)	33
Noradrenaline >20mcg/min to maintain BP above set target	24 (75)	16 (50)	2 (6)	4 (13)	1 (3)	1 (3)	32
IV nimodipine recently or currently being administered	19 (58)	22 (67)	14 (42)	15 (45)	11 (33)	6 (18)	33
Oral nimodipine recently administered and BP is at/above desired target pressure	15 (45)	22 (67)	15 (45)	17 (52)	15 (45)	13 (39)	33
Oral nimodipine recently administered and BP is below desired target pressure	25 (76)	18 (55)	3 (9)	3 (9)	0 (0)	2 (6)	33
Uncontrolled hypertension requiring anti-hypertensives	25 (76)	18 (55)	3 (9)	6 (18)	1 (3)	0 (0)	33
Hypotension with mean arterial BP <65mmHg	28 (88)	17 (53)	0 (0)	4 (13)	0 (0)	1 (3)	32

Notes: BP, blood pressure
*via hoist or patslide

Table 4: Level of mobility ward physiotherapists confident to undertake in the context of cardiovascular risks

Cardiovascular factors	Number (%) of respondents						
	Rest in bed / minimal activity	Sitting up in bed/ head of bed elevated	Sitting over the edge of the bed	Passive transfer to chair*	Step transfer to chair	Ambulating	Total
BP is autoregulating and is at the desired target pressure	9 (26)	19 (54)	19 (54)	18 (51)	21 (60)	33 (94)	35
Oral nimodipine recently administered and BP is at / above desired target pressure	15 (43)	18 (51)	16 (46)	13 (37)	13 (37)	17 (49)	35
Oral nimodipine recently administered and BP is below desired target pressure	21 (60)	17 (49)	12 (34)	5 (14)	6 (17)	5 (14)	35
Uncontrolled hypertension requiring anti-hypertensives	25 (71)	15 (43)	6 (17)	4 (11)	5 (14)	2 (6)	35
Hypotension with mean arterial BP <65mmHg	30 (86)	13 (37)	5 (14)	2 (6)	1 (3)	1 (3)	35

Notes: BP, blood pressure
*via hoist or patslide

About two thirds of the respondents (n=36/52, 69%) reported that physiotherapists are not able to clamp the EVD in their institution, with the remainder (n=16/52, 31%) reporting that physiotherapists were able to clamp the EVD but with close liaison or supervision by nursing staff.

For patients with decompressive craniectomies, only 10% of physiotherapists (n=5/52) reported that they would commence mobility without a helmet. Approximately a third of physiotherapists (n=19/52, 37%) reported that mobility would commence only once a helmet was fitted and 35% (n=18/52) reported that a helmet was preferable but mobility could commence prior if there were other issues such as swelling or wound breakdown that would prevent its application.

DISCUSSION

This is the first study that has explored the decision making and mobilisation practices of physiotherapists from across multiple centres for patients with aSAH. In this sample of Australian and New Zealand centres, we found that few had established mobility protocols to guide mobilisation practices for patients with aSAH. Prior to an aneurysm being secured, physiotherapists were reluctant to initiate any level of mobility, except for sitting up in bed. As the risk of rebleeding from a ruptured cerebral aneurysm is very high, particularly during the initial period following the bleed, urgent medical management involves identifying the source of the bleed and repair of the ruptured aneurysm either by surgical clipping or endovascular coiling (Connolly et al., 2012; Diringer et al., 2011). To date, there is insufficient evidence to suggest that bedrest reduces the risk of mortality associated with rebleeding (Ma et al., 2013). This rebleeding risk and associated high risk of mortality are likely to explain the reluctance of physiotherapists to mobilise patients prior to the ruptured aneurysm being repaired. Almost all physiotherapists reported requiring neurosurgeon clearance if mobilisation were to occur prior to definitive management of the aneurysm. A conservative approach to mobilisation in this period may also be led by the symptoms patients often present with, including photophobia, severe headaches, neurological deficits, nausea and vomiting.

This study found that the majority of physiotherapists were happy to commence all levels of mobility the first day after the ruptured aneurysm had been secured. A strong drive for early mobilisation has evolved recently within the ICU environment (Tipping et al., 2017) with potential benefits demonstrated. However, recommendations for early mobilisation of aSAH patients are limited and potential harm has been found with early mobilisation of patients with stroke. The AVERT trial (Bernhardt et al., 2015) looked at early mobilisation of patients with stroke within 24 hours of stroke onset and found that it was associated with poorer functional outcomes at three months post-stroke. However, the AVERT trial did not include aSAH patients, or those in the ICU setting. There have been several small studies that have found early mobilisation to be safe and feasible in patients following aSAH in the ward (Karic et al., 2017; Karic et al., 2015) and ICU settings (O'Shea & Stiller, 2016; Olkowski et al., 2013). Although these studies found a very low incidence of adverse events associated with early mobilisation, patients demonstrating a

Table 5: Frequent* barriers to early mobilisation in the ICU and neurosurgery ward settings reported by physiotherapists

Barriers	Number (%) of respondents	
	ICU responses (n = 33)	Neurosurgery ward responses (n = 35)
Insufficient staff to assist with mobilising patients with moderate to severe functional limitations	12 (36)	19 (54)
Insufficient staff to assist with mobilising patients with mild or no functional limitations	6 (18)	5 (14)
Insufficient staffing to monitor a high falls risk patient when sitting out of bed	13 (39)	12 (34)
Limited access to appropriate seating/chairs to enable patients with moderate to severe functional limitations to sit out of bed	10 (30)	14 (40)
Limited access to appropriate seating/chairs to enable patients with mild or no functional limitations to sit out of bed	4 (12)	1 (3)
Limited access to transferring equipment (e.g. hoists, standing machines or patslides) to enable patients with moderate to severe functional limitations to sit out of bed.	2 (6)	1 (3)
None of the above	14 (42)	8 (23)
Other (included limited gym space, lack of mobility protocol, lack of standardisation of practice between neurosurgeons, rehabilitation patients deprioritised)	2 (6)	5 (14)

Notes: * Frequent is defined as a barrier at least every second day

deterioration in neurological status or signs of vasospasm on screening were not mobilised. There have also been studies indicating early mobilisation to be associated with improved functional outcomes in older adults with low Hunt and Hess grades (Shimamura et al., 2014) and in a mixed intracerebral haemorrhage and aSAH patient population (Rand & Darbinian, 2015), however, when Karic and colleagues (2016) examined the long-term effect of early rehabilitation, they found that there was no significant difference in functional outcomes at one year when an early mobilisation and control group were compared. It did however find that early mobilisation increased the chance of a good functional outcome in patients with aSAH who had high severity scores (WFNS grade 3-5).

Vasospasm of the cerebral blood vessels occurs in approximately two thirds of patients with aSAH between days three to 14 post-bleed (Macdonald, 2013). Around half of patients with vasospasm go on to develop a clinically detectable neurological deterioration termed DCI as a result of cerebral ischaemia (Connolly et al., 2012; Dabus & Nogueira, 2013). Cerebral infarction can occur as a result of vasospasm and DCI, and is strongly associated with poor functional outcomes (Frontera et al., 2009; Kreiter et al., 2009; Vergouwen et al., 2011). Medical treatment aims to provide early detection and prevention of cerebral ischaemia to reduce the risk of cerebral infarction (Diringer et al., 2011). From this study, it appears that overall, physiotherapists view the neurological complications of vasospasm and DCI as a contraindication to mobility.

Physiotherapists were also reluctant to mobilise patients if blood pressure was below the set target, patients were on a high level of noradrenaline or in the presence of uncontrolled hypertension. This was also reflected in reported practice where almost all (98%) physiotherapists monitored systolic blood pressure as patients were moved into more upright positions. Despite this apprehension to mobilise patients with these risk factors, one prospective interventional study found that the risk of severe clinical vasospasm was significantly reduced with early mobilisation (Karic et al., 2017). This study did however report an increased use of intraarterial nimodipine to treat symptomatic vasospasm in the early mobility group. Another study by Riordan et al. (2015) also found that early mobilisation and mild exercise reduced the odds of patients developing symptomatic cerebral vasospasm. However, patients were analysed retrospectively from patient charts.

Patients admitted with aSAH often have delays in mobilisation due to poor neurological status, awaiting definitive management of the aneurysm or due to aSAH associated symptoms such as headache. It is well known from the literature that prolonged bedrest results in a number of complications that include reduced cardiac output, reduced vascular tone and venous pooling (Lee et al., 2010; Lee et al., 2014). These lead to a reduced ability to respond appropriately to orthostatic changes as patients move into more upright positions and could counteract the medical efforts to prevent DCI and cerebral ischaemia. Previous studies have looked at the effect of elevating the head of the bed in aSAH patients and found no significant change to cerebral flood flow (Blissitt et al., 2006; Kung et al., 2013). However the effects of higher levels of mobility such as sitting over the edge or standing on cerebral perfusion have not been investigated. The lack of evidence presents a dilemma to clinicians, in balancing the effects of immobility with the risk of secondary brain damage.

In this study, there were a number of potential institutional barriers to early mobilisation reported. Hospital practices that include fitting of helmets for patients following craniectomy surgery and the requirement of nursing staff to clamp the EVD may contribute to delays in mobilisation of patients in both the ward and ICU environments. In a study by Koo et al. (2016), the lack of hospital protocols and guidelines acted as a barrier to early mobilisation in the intensive care setting. In the current study, nearly all physiotherapists reported that they did not have mobility protocols at their hospital and this along with lack of evidence could have attributed to physiotherapists' reluctance to mobilise patients in the setting of perceived neurological and cardiovascular risks. Frequent barriers to mobilisation were most commonly reported in patients with moderate to severe functional impairments and similar to other studies were found to be due to insufficient staffing and lack of appropriate seating (Appleton et al., 2011; Koo et al., 2016).

There are several limitations to this study. Firstly, while we had 57 participants, these physiotherapists came from a smaller number of centres overall (26 of 39 neurosurgical centres). Therefore, more than one physiotherapist working in the same area at each hospital may have responded to the survey. However with the lack of mobility protocols in hospitals it is expected that individual physiotherapists within the same unit may have responded differently to the survey questions. Secondly, the survey is subject to responder bias and therefore a more accurate measure of current practice would be gained through an observational cohort study of patients with aSAH. Lastly, approximately two thirds of respondents answered either the ICU specific (Part B) or the neurosurgery ward specific questions (Part C), and hence not all respondents completed the entire survey due to the majority of physiotherapists having clinical expertise in only one of these clinical service areas.

This study provides important insight into reported early mobilisation practices of patients with aSAH and may enable physiotherapists to benchmark their practice against other specialised centres. This study has highlighted the need for further research into the timing and type of early mobilisation that is most effective in patients with aSAH. Furthermore, the effect of different levels of mobilisation on cerebral perfusion and neurological complications needs to be urgently investigated particularly in patients at high risk.

CONCLUSION

Physiotherapists in specialised centres reported early mobilisation of patients with aSAH once the ruptured aneurysm was repaired. However there are key perceived risks that prevented physiotherapists from mobilising patients that include vasospasm, DCI, recent further bleed, blood pressure below the set target, uncontrolled hypertension and high levels of noradrenaline to maintain set blood pressure targets. There was variability in the type and frequency of exercises provided to stable patients with aSAH and there were also differences when comparing the ward and ICU settings. Insufficient staffing and limited access to appropriate seating were frequent barriers to mobilisation in patients with moderate to severe functional limitations. Furthermore, almost all physiotherapists reported that they did not have mobilisation protocols at their hospital. This study has highlighted the need for further research into the safety, timing and efficacy of mobility practices in the management of patients with aSAH particularly during the high-risk vasospasm period. This will enable the development of clear mobility protocols that can be used to guide best practice within Australian and New Zealand hospitals.

KEY POINTS

1. Physiotherapists reported that they did not mobilise patients if the ruptured aneurysm had not been repaired.
2. Almost all physiotherapists reported that they mobilise patients the first day after the ruptured aneurysm has been repaired.
3. Physiotherapists were concerned about mobilising patients if the following factors were present: vasospasm, delayed cerebral ischaemia, recent further bleed, hypotension or the use of high levels of noradrenaline.
4. The vast majority of physiotherapists reported that they did not have a mobilisation protocol at their hospital.

DISCLOSURES

No funding was obtained for this study. The authors declare no conflicts of interest.

PERMISSIONS

Ethics approval was obtained from the Alfred Health Ethics Committee (project 331/17) and South Eastern Sydney Local Health District Ethics Committee (project 17/LPOOL/437) as a low risk project.

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APPENDIX 1

SURVEY TO PHYSIOTHERAPISTS

PART A

1. Please indicate which geographical location you work in.
   - VIC
   - TAS
   - NSW
   - QLD
   - WA
   - ACT
   - SA
   - NT
   - NZ
2. How many years of experience do you have in the physiotherapy management of patients admitted with acute aSAH?
   - <1year
   - 1-4 years
   - 5-10 years
   - >10 years
3. Can you estimate approximately how many patients with aSAH you would manage as part of your average monthly caseload?
4. Which aSAH grading scales are used at your hospital?
   - The Fisher Scale
   - The Modified Fisher Scale
   - The Hunt and Hess Scale
   - The World Federation of Neurosurgeons Classification (WFNS) Scale
   - I am unsure
   - Other
5. Please indicate which setting/s best describes where you mainly practice.
   - Neurosciences / Neurosurgery Ward
   - Dedicated Neurosciences / Neurosurgery ICU
   - General ICU with Neurosciences / Neurosurgery casemix
6. Which best describes the hospital facility you work in?
   - Public Hospital
   - Private Hospital
   - Public and private facility combined
7. Please indicate below which of the following mobility items would be a common goal for aSAH patients to achieve before the aneurysm is 'secured' (either by clipping or coiling).
   - Sitting up in bed
   - Sitting over the edge of the bed
   - Passive transfer to sit out of bed (via hoist or patslide)
   - Standing
   - Step transfer out of bed to chair or commode only
   - Marching on the spot
   - Walking short distances only (e.g. 10-20m to/from bathroom)
   - Ambulation or out of bed mobility without restrictions
   - None of the above
   - Other

8. In relation to a patient who is neurologically and cardiovascularly stable, please indicate which day would typically be the first to mobilise a patient after the aneurysm has been 'secured' (either by clipping or coiling).

	Day 1 after securing the ruptured aneurysm	Day 2 after securing the ruptured aneurysm	Day 3 after securing the ruptured aneurysm	> Day 3 after securing the ruptured aneurysm
Sitting up in bed	○	○	○	○
Sitting over the edge of the bed	○	○	○	○
Passive transfer to sit out of bed (via hoist / patslide)	○	○	○	○
Step transfer to sit out of bed in chair	○	○	○	○
Ambulation	○	○	○	○

If > day 3 please indicate the reason:

9. Thinking about neurological precautions to mobility after the ruptured aneurysm has been secured, please indicate the mobility interventions you would be happy to undertake given the following factors.

	Rest in bed / minimal activity	Sitting up in bed / head of bed elevated	Sitting over the edge of the bed	Passive transfer to chair via hoist or patslide	Step transfer to chair	Ambulating
Recent confirmation of vasospasm on radiographic images / Transcranial dopplers	☐	☐	☐	☐	☐	☐
Acute clinical signs of delayed cerebral ischaemia	☐	☐	☐	☐	☐	☐
New cerebral infarct	☐	☐	☐	☐	☐	☐
Recent further bleed	☐	☐	☐	☐	☐	☐
Low GCS score without sedation	☐	☐	☐	☐	☐	☐
Heavily sedated	☐	☐	☐	☐	☐	☐
Severe aSAH (e.g. Fisher 3-4, WFNS 4-5)	☐	☐	☐	☐	☐	☐
High risk vasospasm period (up to day 14) with <u>**no**</u> clinical signs	☐	☐	☐	☐	☐	☐
Nausea and vomiting	☐	☐	☐	☐	☐	☐
Recent seizures (e.g. < 4 hours)	☐	☐	☐	☐	☐	☐
cognitive / behavioural issues	☐	☐	☐	☐	☐	☐
Presence of decompressive craniectomy surgery	☐	☐	☐	☐	☐	☐
Severe headache	☐	☐	☐	☐	☐	☐
Mild headache	☐	☐	☐	☐	☐	☐
Invasively mechanically ventilated	☐	☐	☐	☐	☐	☐

10. Which of the following parameters do you typically monitor when moving patients into upright positions?

- Systolic blood pressure
- Mean arterial pressure
- Cerebral perfusion pressure
- Heart rate
- Respiratory rate
- Sp02
- Level of consciousness / alertness
- Intracranial pressure
- Upper &/or lower limb strength
- Cranial nerve function
- Sensation (e.g. numbness, altered sensation)
- Vision
- Headache
- None of the above
- Other

11. In patients with an EVD in situ, would any of the following factors prevent you from clamping the EVD for mobility?

- High amounts of blood draining from the EVD
- Large amounts of CSF being drained per hour (e.g. >15ml/hr)
- Level of EVD recently raised / challenged
- If measured, intracranial pressures of 15-20mmHg
- If measured, intracranial pressures of > 20mmHg
- New signs of neurological deterioration
- Presence of hydrocephalus on brain imaging
- Senior neurosurgeon or intensive care doctor have not given clearance to clamp the EVD
- None of the above
- Other

12. In the setting that you work, are physiotherapists able to clamp the EVD?

- No. Physiotherapists do not clamp the EVD.
- Yes. Physiotherapists clamp the EVD relatively independently.
- Yes. Physiotherapists clamp the EVD, but in close liaison/supervision of nursing staff.
- Only senior / experienced physiotherapists clamp the EVD in close liaison / supervision of nursing staff.

13. For patients who have had a decompressive craniectomy, when can mobility commence?

- Mobility occurs only once a helmet is fitted and able to be worn
- Mobility with a helmet is preferred, but may commence prior if issues such as swelling or wound breakdown prevents its application
- Mobility commences without a helmet
- Other

14. Do you feel that you have the local experience and expertise to answer questions specific to physiotherapy services for aSAH in the ICU environment?

- Yes
- No

15. Do you have an aSAH physiotherapy mobility protocol?

- Yes
- No

PART B

16. Of the following, which best describes the physiotherapy referral process you have in place for patients admitted to ICU with aSAH?
    - Every patient is seen by physiotherapy
    - Only patients that are referred by medical staff are seen by physiotherapy
    - Only patients that are referred by nursing staff are seen by physiotherapy
    - Only patients that are referred by medical and nursing staff are seen by physiotherapy
    - Patients are screened by a physiotherapist and seen if indicated
    - Other
17. Do patients with aSAH who are in ICU have access to a weekend service?
    - Yes
    - No
18. If yes, what best describes the weekend service provided?
    - Prioritised weekend services according to set criteria, mainly for maintaining respiratory care
    - Prioritised weekend service according to set criteria, mainly targeting rehabilitation of patients
    - Reduced service over weekend, with normal access to physiotherapy on Saturday at levels similar to the services offered Monday to Friday
    - No change in services, same access to physiotherapy on Saturday and Sunday as services offered Monday to Friday
    - Other
19. For each mobility item, please indicate the accepted level of authorisation required to undertake the activity before the aneurysm is secured in your setting. You can select more than one option for each mobility item.

	If the Neurosurgeon clears this pre-operatively	If the Senior Intensive Care Doctor clears this pre-operatively	Physiotherapist may initiate this without consultation
Sitting up in bed	☐	☐	☐
Sitting over the edge of the bed	☐	☐	☐
Passive transfer to sit out of bed (via hoist / patslide)	☐	☐	☐
Step transfer to sit out of bed	☐	☐	☐
Marching on the spot	☐	☐	☐
Walking short distances only (e.g. 10-20m to/from bathroom)	☐	☐	☐
Ambulation or out of bed activity without restrictions	☐	☐	☐

20. Thinking about precautions to mobility after the ruptured aneurysm has been secured, please indicate the mobility interventions you would be happy to undertake given the following factors.

	Rest in bed / minimal activity	Sitting up in bed / head of bed elevated	Sitting over the edge of the bed	Passive transfer to chair (patslide/ hoist)	Step transfer to sit out of bed	Ambulating
Blood pressure is autoregulating and is at the desired target pressure	☐	☐	☐	☐	☐	☐
Noradrenaline **<5mcg/min** to maintain BP above set target	☐	☐	☐	☐	☐	☐
Noradrenaline **5-10mcg/min** to maintain BP above set target	☐	☐	☐	☐	☐	☐
Noradrenaline **11-20mcg/min** to maintain BP above set target	☐	☐	☐	☐	☐	☐
Noradrenaline **>20mcg/min** to maintain BP above set target	☐	☐	☐	☐	☐	☐
IV nimodipine recently or currently being administered	☐	☐	☐	☐	☐	☐
Oral nimodipine recently administered and blood pressure is **at or above** desired target pressure	☐	☐	☐	☐	☐	☐
Oral nimodipine recently administered and blood pressure is **below** desired target pressure	☐	☐	☐	☐	☐	☐
Uncontrolled hypertension requiring anti-hypertensives	☐	☐	☐	☐	☐	☐
Hypotension with mean arterial blood pressure <65mmHg	☐	☐	☐	☐	☐	☐

21. For patients with moderate to severe functional limitations, please indicate which physiotherapy interventions are typically provided in the ICU setting?

- Passive joint range of motion exercises
- Active-assisted and/or active range of motion exercises
- Strengthening/resistance exercises
- Motomed cycling
- Functional electrical stimulation (FES) cycling
- Neuromuscular electrical stimulation (NMES)
- Re-positioning in bed (e.g. side-lie positioning, sitting up)
- Sitting up with chair mode e.g. Hill-Rom bed
- Tilt table
- Sitting balance retraining (on the edge of the bed)
- Sit out of bed in a chair either by hoist or patslide
- Standing practice by the bedside with therapist assistance alone
- Standing with a standing machine/hoist or standing frame
- None of the above
- Other

22. For patients that are cardiovascularly and neurologically stable with no signs of respiratory compromise, how many mobility sessions do patients with moderate to severe functional limitations routinely receive per week?

- More than twice a day
- Twice a day

- Once a day
- Every second day
- Twice a week
- Once a week
- Less than once a week
- Other

23. For patients with mild or no functional limitations please indicate what interventions are typically provided in the ICU setting.
    - Passive joint range of motion exercises
    - Bed-based active range of motion exercises
    - Strengthening/resistance exercises
    - Motomed cycling
    - Functional electrical stimulation (FES) cycling
    - Neuromuscular electrical stimulation (NMES)
    - Seated upper limb and lower limb AROM exercises
    - Standing upper limb and lower limb AROM exercises
    - Standing / dynamic balance practice
    - Ambulation practice
    - None of the above
    - Other
24. For patients that are cardiovascularly and neurologically stable with no signs of respiratory compromise, how many mobility sessions do patients with mild or no functional limitations routinely receive per week?
    - More than twice a day
    - Twice a day
    - Once a day
    - Every second day
    - Twice a week
    - Once a week
    - Less than once a week
    - Other
25. Please indicate whether you feel access to the following are a frequent barrier to mobilising patients in your unit after aSAH. Frequent is defined as a barrier at least every second day.
    - Insufficient staff to assist with mobilising patients with moderate to severe functional limitations
    - Insufficient staff to assist with mobilising patients with mild or no functional limitations
    - Insufficient staffing to monitor a high falls risk patient when sitting out of bed
    - Limited access to appropriate seating/chairs to enable patients with moderate to severe functional limitations to sit out of bed
    - Limited access to appropriate seating/chairs to enable patients with mild or no functional limitations to sit out of bed
    - Limited access to transferring equipment (e.g. hoists, standing machines or patslides) to enable patients with moderate to severe functional limitations to sit out of bed.
    - None of the above
    - Other
26. Do you feel that you have the local experience and expertise to answer questions specific to physiotherapy services for aSAH in the neurosurgical ward environment?
    - Yes
    - No

PART C

27. Of the following, which best describes the physiotherapy referral process you have in place for patients admitted to the neurosurgical ward not ICU with aSAH?
    - Every patient is seen by physiotherapy
    - Only patients that are referred by medical staff are seen by physiotherapy
    - Only patients that are referred by nursing staff are seen by physiotherapy
    - Only patients that are referred by medical and nursing staff are seen by physiotherapy
    - Patients are screened by a physiotherapist and seen if indicated
    - Other
28. Do patients with aSAH who are on the neurosurgical wards (not ICU) have access to a weekend service?
    - Yes
    - No
29. If yes, what best describes the weekend service provided?
    - Prioritised weekend services according to set criteria, mainly for maintaining respiratory care
    - Prioritised weekend service according to set criteria, mainly targeting rehabilitation of patients
    - Reduced service over weekend, with normal access to physiotherapy on Saturday at levels similar to the services offered Monday to Friday
    - No change in services, same access to physiotherapy on Saturday and Sunday as services offered Monday to Friday
    - Other
30. For each mobility item, please indicate the accepted level of authorisation required to undertake the activity before the aneurysm is secured in your ward setting.

	If the Neurosurgeon clears this pre-operatively	Physiotherapist may initiate this without consultation
Sitting up in bed	☐	☐
Sitting over the edge of the bed	☐	☐
Passive transfer to sit out of bed (via patslide / hoist)	☐	☐
Step transfer to sit out of bed	☐	☐
Marching on the spot	☐	☐
Walking short distances only (e.g. 10-20m to/from bathroom)	☐	☐
Ambulation or out of bed activity without restrictions	☐	☐

31. Thinking about precautions to mobility after the ruptured aneurysm has been secured, please indicate the mobility interventions you would be happy to undertake.

	Rest in bed / minimal activity	Sitting up in bed / head of bed elevated	Sitting over the edge of the bed	Passive transfer to chair (patslide/ hoist)	Step transfer to sit out of bed	Ambulating
Blood pressure is autoregulating and is at the desired target pressure	☐	☐	☐	☐	☐	☐
Oral nimodipine recently administered and blood pressure is **at or above** desired target pressure	☐	☐	☐	☐	☐	☐
Oral nimodipine recently administered and blood pressure is **below** desired target pressure	☐	☐	☐	☐	☐	☐
Uncontrolled hypertension requiring anti-hypertensives	☐	☐	☐	☐	☐	☐
Hypotension with mean arterial blood pressure <65mmHg	☐	☐	☐	☐	☐	☐

32. For patients with moderate to severe functional limitations, please indicate which physiotherapy interventions are typically provided in the neurosurgical ward not ICU setting?

- Passive joint range of motion exercises
- Active-assisted and/or active range of motion exercises
- Strengthening/resistance exercises
- Motomed cycling
- Functional electrical stimulation (FES) cycling
- Neuromuscular electrical stimulation (NMES)
- Re-positioning in bed (e.g. side-lie positioning, sitting up)
- Sitting up with chair mode e.g. Hill-Rom bed
- Tilt table
- Sitting balance retraining (on the edge of the bed)
- Sit out of bed in a chair either by hoist or patslide
- Standing practice by the bedside with therapist assistance alone
- Standing with a standing machine/hoist or standing frame
- None of the above
- Other

33. For patients that are cardiovascularly and neurologically stable with no signs of respiratory compromise, how many mobility sessions do patients with moderate to severe functional limitations routinely receive per week?

- More than twice a day
- Twice a day
- Once a day
- Every second day
- Twice a week
- Once a week
- Less than once a week
- Other

34. For patients with mild or no functional limitations please indicate what interventions are typically provided in the neurosurgical ward not ICU setting?

- Passive joint range of motion exercises
- Bed-based active range of motion exercises
- Strengthening/resistance exercises
- Motomed cycling
- Functional electrical stimulation (FES) cycling
- Neuromuscular electrical stimulation (NMES)
- Seated upper limb and lower limb AROM exercises
- Standing upper limb and lower limb AROM exercises
- Standing / dynamic balance practice
- Ambulation practice
- None of the above
- Other

35. For patients that are cardiovascularly and neurologically stable with no signs of respiratory compromise, how many mobility sessions do patients with mild or no functional limitations routinely receive per week?

- More than twice a day
- Twice a day
- Once a day
- Every second day
- Twice a week
- Once a week
- Less than once a week
- Other

36. Please indicate whether you feel access to the following are a frequent barrier to mobilising patients in your unit after aSAH.

- Insufficient staff to assist with mobilising patients with moderate to severe functional limitations
- Insufficient staff to assist with mobilising patients with mild or no functional limitations
- Insufficient staffing to monitor a high falls risk patient when sitting out of bed
- Limited access to appropriate seating/chairs to enable patients with moderate to severe functional limitations to sit out of bed
- Limited access to appropriate seating/chairs to enable patients with mild or no functional limitations to sit out of bed
- Limited access to transferring equipment (e.g. hoists, standing machines or patslides) to enable patients with moderate to severe functional limitations to sit out of bed.
- None of the above
- Other

Discerning the contribution of balance and mobility to ambulatory activity in community-dwelling octogenarians: A preliminary report

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ABSTRACT

Adults are encouraged to maintain levels of physical activity throughout their life span. This study describes gait performance and ambulatory activity (as a key component of physical activity) in 15 community-dwelling octogenarians and examines the association between activity measured continuously for 5 days with a tri-axial accelerometer and clinical measures of balance and functional mobility. Outcomes represented macro features of ambulatory activity and included volume, pattern and variability of activity. Micro gait outcomes were derived from each walking bout and represented 14 discrete spatio-temporal characteristics of gait. Participants walked a median of 9,294 steps/day (range 5,121-18,231). For macro outcomes, the strongest associations were established for Timed up and Go (TUG) single and dual task times and mean bout length (r_s = -.66, p = 0.006, and -.68, p = 0.005 respectively; Spearman's rho), and TUG dual task and accumulation of walking bouts (alpha) (α) (r_s = -.67, p = 0.006). For micro outcomes, there was a positive correlation between step velocity and the Activities Balance and Confidence Scale (r_s = .67 p = 0.006), and a negative correlation between step velocity and TUG single task (r_s = .71, p = 0.003). TUG dual task showed a positive association with step time asymmetry (r_s = .65 p = 0.008) and swing time asymmetry (r_s = .66, p = 0.004). For this group of active octogenarians, associations between ambulatory activity and functional mobility were stronger than for balance.

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Key Words: Older adults, Ambulatory activity octogenarians, Physical activity, Balance, Gait

INTRODUCTION

Older adults are encouraged to retain an active lifestyle, and the health benefits of physical activity do not appear to diminish across the life span. Research in very senior adults supports the importance of continued activity into advanced years (Stessman, Hammerman-Rozenberg, Cohen, Ein-Mor, & Jacobs, 2009; Yates, Djoussé, Kurth, Buring, & Gaziano, 2008). Significant associations have been reported in octogenarians for physical activity and lower levels of disability (Activityhor et al., 2014; Stessman et al., 2009); and between physical activity and white matter integrity (Burzynska et al., 2014; Tian et al., 2015). However, clinical predictors of activity in this age group are less well defined than its benefits. Identifying those who will achieve greater levels of activity and gain from the experience is clinically challenging. Physical activity is multifaceted and embedded in a complex interplay of behavioural, cultural and social drivers which cannot be measured by single assessments in the laboratory or clinic.

Recent advances in wearable sensor technology go some way towards ameliorating the problem. Body worn sensors enable continuous measurement of activity in an unobtrusive and broadly acceptable way, and are superior to questionnaires which are blunt instruments prone to bias and inaccurate recall (Forsén et al., 2010). Data from wearable sensors typically focus not only on the volume of activity such as daily step count or minutes per day active but also more nuanced measures such as accumulation of activity bouts and variability of bout distribution (Del Din et al., 2017). Together these features have been described as the 'macro' level of activity. A further advantage of wearable sensors is that detailed gait characteristics (features such as step length, step variability, step asymmetry) can be measured simultaneously, producing data with more ecological validity than that collected in the clinic or laboratory where assessments are independent of context and influenced by test protocol and attentional drive (Del Din, Godfrey, Galna, Lord, & Rochester, 2016; Giannouli, Bock, Mellone, & Zijlstra, 2016; Robles-García et al., 2015; Weiss et al., 2013). These detailed features comprise the 'micro' level of gait.

Research examining the relationship between clinical measures of balance, mobility and physical activity measured by accelerometry in octogenarians is limited. Previous studies indicate there is little relationship between activity volumes and physical performance measures. Hall et al. (2017) found weak to moderate associations between daily step count and physical performance measures (usual gait speed, chair stands and 6-minute walk) for those aged 80 – 90+. Others found either weak or no correlation between volumes (daily step count, walking duration or activity bout lengths) and measures of balance (Berg Balance Scale) and mobility (Short Physical Performance Battery, chair stands, Timed Up and Go, Four Square Step and Dynamic Gait Index) for those aged 70 – 80+ (van Lummel et al., 2015; Weiss et al., 2013). Stronger associations were reported for selected micro gait characteristics and physical performance measures in a study comparing physical activity in fallers and non-fallers (Weiss et al., 2013).

Studies to date do not include a detailed clinical assessment of balance, balance self-efficacy, or a comprehensive range of 'free-living' micro gait characteristics. The question warrants further investigation to more fully inform clinical practice. This study examines the association between balance performance, balance self-efficacy, functional mobility, and physical activity in community-dwelling people over 75 years of age. We derived 'macro' gait characteristics (volume counts, pattern and distribution of ambulatory activity) and 'micro' gait characteristics (14 spatio-temporal gait characteristics) from body-worn sensor data worn continuously for five days. In this study we measure ambulatory activity as a core component of physical activity. The term physical activity comprises multiple features of which walking, gardening and swimming are the most popular for this age group (Ministry of Health, 2013).

METHODS

Participants

Fifteen healthy, community-dwelling older people with an age range of 78-90 years (84.7 SD 3.8 years), volunteered for this study. Exclusion criteria were those with a neurological condition (e.g., Parkinson's disease, stroke), cognitive impairment (e.g., dementia), cardiothoracic or orthopaedic conditions affecting mobility, walking, or safety, and poor English affecting one's ability to give informed consent. Ethical approval was obtained from the AUT Ethics Committee (AUTEC reference number 17/312) and all participants provided written consent.

Equipment

Participants wore a single tri-axial accelerometer-based body-worn sensor for 5 days (Axivity AX3, York, UK), secured on the lower back at the fifth lumbar vertebrae (L5) using double-sided tape, and covered with Hypafix (BSN Medical Limited, Hull, UK). Participants were advised to continue with their usual everyday activities other than swimming. The sensor was programmed to sample at a frequency of 100 Hz (range ±8 g).

Clinical measures

Age, sex, weight, and height and falls history over the previous 12 months were obtained. Due to the small sample size we did not collect ethnicity data.

Balance and mobility measures

Balance confidence (self-efficacy) was measured using the Activities-specific Balance Confidence (ABC) Scale, a 16-item self-report questionnaire that asks participants to rate their balance confidence whilst performing activities (Powell & Myers, 1995). To increase relevance, item 16 was changed from rating confidence when walking on icy sidewalks to rating confidence when walking on slippery sidewalks (Mak, Lau, Law, Cheung, & Wong, 2007). Balance performance was measured using the 14-item Mini-BESTest, which assesses anticipatory postural transitions, postural responses, sensory orientation, and dynamic gait (Franchignoni, Horak, Godi, Nardone, & Giordano, 2010). Functional mobility was measured using the Timed Up and Go test (TUG) (Podsiadlo & Richardson, 1991), which incorporates rising from a chair, a turn, and a short walk under single and dual task conditions.

Physical activity (micro and macro) measures

Macro and micro outcomes have been described elsewhere (Del Din et al., 2017; Del Din, Godfrey, Galna, et al., 2016). Macro characteristics include volume, pattern and variability of ambulatory activity. Volume was quantified as total daily step count. Pattern was quantified as number of daily walking bouts (minimum bout length defined as three steps), the mean length of walking bouts (s), and alpha (α) as the distribution of ambulatory bouts (a lower α indicates that the distribution is derived from a greater proportion of longer bouts). Bout length variability was described as the within subject variability of bout length. A high variability indicates a more varied pattern of walking (Chastin & Granat, 2010; Del Din et al., 2017; Lord et al., 2011).

Micro (spatio-temporal) outcomes included 14 gait characteristics which conform to a validated model of gait (Lord, Galna, & Rochester, 2013; Lord et al., 2012). Mean values were calculated for step time, stance time, swing time, step length and step velocity. Standard deviation from all steps was calculated to determine step time variability. Step time asymmetry was calculated as the absolute difference between consecutive left and right steps. The validated algorithms used for gait detection and data segmentation techniques have been described in full previously (Del Din, Godfrey, & Rochester, 2016; Godfrey, Del Din, Barry, Mathers, & Rochester, 2014).

Data Processing and Analysis

Raw data were uploaded to an encrypted, secure platform (eScience Central online facility maintained by Newcastle University, UK) for storage and blinded processing (Simpson et al., 2017). Data were analysed using MATLAB (version 2015a), and reported in Microsoft Excel (Version 2016). Descriptive statistics for participant characteristics and activity outcomes were reported as means, standard deviations (SD), medians and inter-quartile range (IQR). Scores from the ABC Scale, the Mini-BESTest and the TUG were correlated with macro and micro outcomes using Spearman's rho (r_s). In view of multiple testing, a p value of 0.01 was considered significant. Data were analysed using SPSS Version 25.

RESULTS

All participants who volunteered for the study were recruited. The participants' ABC Scale, Mini-BESTest scores and TUG scores are described in Table 1, and indicate a highly-functioning group of older adults. Only two participants reported a fall within the past 12 months, with one person reporting a total of three falls.

Table 2 describes macro characteristics for all participants, and Table 3 describes spatiotemporal gait characteristics for all participants. Ambulatory activity for these mostly octogenarians was high, with similar values for all participants apart from one highly active individual, who walked on average over 18,000 steps a day, and was active for 237 minutes of the day. Participants walked with an average gait speed of 1.01 ms^{-1} which is comparable to age-referenced data (Beauchet et al., 2017). TUG single task scores were comparable to those reported for non-fallers (Weiss et al., 2013), although balance confidence scores were considerably higher (80% compared with 53% confidence).

For macro outcomes there were moderate, negative correlations between mean bout length and TUG single and dual task times (r_s = -.66, p = 0.006, and -.68, p = 0.005 respectively), suggesting those with more proficient mobility walked for longer bouts. There was also a moderate positive correlation between alpha (α) and TUG dual task (r_s = -.67, p = 0.006), indicating that people with better TUG (lower scores) undertook a greater proportion of longer walking bouts. There was no correlation between total volume of ambulatory activity (number of steps, total time walked or percentage of walking time) and physical performance measures.

Table 1: Participant characteristics

Characteristic	Mean (SD)	Median (IQR)	Range
Personal characteristics			
Male/female (4:11)			
Age (years)	84.7 (3.8)	84.0 (82.0 - 89.0)	78.0 – 90.0
Weight (kg)	63.7 (9.4)	61.7 (56.4 – 69.9)	50.1 – 85.4
Height (cm)	160.1 (9.5)	158 (153 - 164)	147 – 180
Fallen within last 12 months yes/no (2:13)			
Number of falls	2.0 (1.4)	2.0 (1.0 – 2.0)	1.0 – 3.0
Balance			
ABC Scale (%)	80.2 (18.5)	84.4 (67.8 – 98.1)	35.8 – 99.4
Mini-BESTest (0 - 28)	19.1 (3.4)	19.0 (16.0 - 22.0)	13.0 – 25.0
Functional Mobility			
TUG single	10.2 (2.3)	10.0 (9.0 - 12.0)	6.0 - 15.0
TUG dual	17.6 (7.2)	14.0 (12.0 - 25.0)	9.0 - 31.0

Notes: ABC Scale, Activities Balance and Confidence Scale; TUG, Timed up and Go test

Table 2: Free-living macro gait characteristics for all participants

	Mean (SD)	Median (IQR)	Range
Number of steps per Day	9522 (3148)	9294 (7273 - 10594)	5121 - 18231
Total Walking Time per Day (min)	138.9 (42.2)	130.5 (113.4 - 164.7)	71.5 – 237.6
Percentage Walking Time	9.6 (2.9)	9.0 (7.8 – 9.0)	5.0 - 16.0
Bouts per Day	633.0 (175.0)	569.0 (515.0 - 569.0)	571.0 - 922.0
Mean Bout Length (sec)	13.1 (1.6)	13.0 (11.9 – 14.2)	10.3 - 16.8
Variability (S_2)	0.755 (0.04)	0.762 (0.73 - 0.77)	0.68 – 0. 85
Alpha (α)	1.66 (0.04)	1.65 (1.64 - 1.69)	1.62 - 1.74

Notes: SD, standard deviation; IQR, inter-quartile range

Table 3: Free-living micro gait characteristics for all participants

Gait characteristic	Mean (SD)	Median (IQR)	Range
Pace			
Step Velocity (m/s)	1.01 (0.09)	1.01 (.92 – 1.08)	0.87 – 1.16
Step Length (m)	0.57 (0.03)	0.56 (0.54 - 0.60)	0.50 – 0.67
Swing Time Var (s)	0.13 (0.01)	0.13 (0.12 – 0.14)	0.11 – 0.15
Variability			
Step Velocity Var (m/s)	0.33 (0.03)	0.32 (0.30 – 0.37)	0.27 – 0.39
Step Length Var (m)	0.14 (0.01)	0.14 (0.13 – 0.14)	0.13 – 0.15
Step Time Var (s)	0.16 (0.02)	0.16 (0.15 – 0. 17)	0.13 – 0.18
Stance Time Var (s)	0.17 (0.02)	0. 12 (0.16 - 0.19)	0.14 – 0.19
Rhythm			
Step Time (s)	0.59 (0.03)	0.59 (0.57 – 0.61)	0.56 – 0.64
Swing Time (s)	0.45 (0.03)	0.45 (0.43 – 0.48)	0.42 – 0.51
Stance Time (s)	0.74 (0.03)	0.75 (0.71 – 0.76)	0.69 – 0.78
Asymmetry			
Step Time Asy (s)	0.10 (0.01)	0.09 (0.09 – 0.11)	0.08 – 0.13
Swing Time Asy (s)	0.09 (0.01)	0.09 (0.08 – 0.09)	0.07 – 0.11
Stance Time Asy (s)	0.10 (0.01)	0.10 (0.09 – 0.10)	0.08 – 0.12
Postural Control			
Step Length Asy (m)	0.09 (0.01)	0.88 (0.08 – 0.10)	0.08 - 0.11

Notes: SD, standard deviation; IQR, inter-quartile range; Var, Variability; Asy, Asymmetry

For micro outcomes there were correlations between gait speed (step velocity) and the ABC Scale and TUG single task (r_s = .68, *p* = 0.006; r_s = .72, *p* = 0.003 respectively), suggesting those with more balance confidence and proficient mobility walked more quickly. TUG dual task showed a positive association with step time asymmetry (r_s = .65, *p* = 0.008) and swing time asymmetry (r_s = .66, *p* = 0.004) suggesting participants with poorer dual task capacity walked with a more asymmetric gait. There were no correlations between ambulatory activity and the Mini-BESTest, or between macro and micro features of ambulatory activity.

DISCUSSION

This preliminary study examined the relationship between ambulatory activity and clinical measures of balance and functional mobility in a group of older, community-dwelling adults. A key finding was that functional mobility measures, namely single and dual task TUG rather than balance performance or balance self-efficacy, were significantly associated with more sustained bouts of walking and a more flexible pattern of activity. These findings support the analysis of activity outcomes beyond volume metrics; namely, the pattern and variability of walking bouts (Del Din et al., 2017). These more nuanced metrics showed that participants with good functional mobility were able to walk for longer bouts and with a more flexible pattern of activity.

The lack of association between volumes of activity and physical performance measures concurs with earlier reports (van Lummel et al., 2015; Weiss et al., 2013). Others have found associations between laboratory-based gait speed measures (Giannouli et al., 2016; Hall et al., 2017) (which we did not measure) and step count, although comparisons are limited due to methodological differences.

Our findings for gait asymmetry are challenging to interpret in this non-pathological cohort, but may reflect a more general, age-related deficit that influences temporal but not spatial features of gait. It may also indicate that activity comprised of mostly indoor walking, including asymmetrical events such as turning. Further work on a larger sample will help clarify this association and its relevance. The lack of association between gait variability and physical performance measures was also surprising, given the prominent contribution of variability to older adult gait and to falls risk (Ayoubi, Launay, Annweiler, &

Beauchet, 2015; Hausdorff et al., 2017). However, interpretation of gait variability is difficult because it may represent different constructs. On the one hand, increased gait variability may denote pathology (Ayoubi et al., 2015) or it may reflect adaptive strategies required for moving about complex environments and for minimising falls risk (Brodie, Lord, Coppens, Annegarn, & Delbaere, 2015). Gait variability also responds preferentially to the environment in which it is measured. Del Din et al. (2017) reported an effect of pathology and falls status on 'free living' gait variability not evident in clinical or laboratory data. Analysis on a larger sample will enable a more discrete interpretation of these features.

Providing a context for activity measured in this study was not possible, and it is conjecture as to how much time was spent walking outdoors versus indoors. Some indication can be derived from bout length (a longer bout length is indicative of outdoor walking). The average bout length in our study was 13.1 seconds, considerably shorter than that reported for a cohort of 70 year old adults of 18.6 seconds (Del Din et al., 2017), despite a comparable number of bouts per day (633 in our study compared with 602 in the latter study).

Lack of association between the Mini-BESTest and any activity or gait characteristics was surprising, given the comprehensive clinical assessment of balance the Mini-BESTest provides. This may be partly due to the items on the scale which represent different constructs of balance, rather than a singular construct such as balance self-efficacy which is reflected by the ABCs. Finally, given the sample size, we cannot generalise these results to a larger population.

Future research

We aim to extend this study to include 50 participants, of similar age. The methodology will be highly comparable but will include a standardised cognitive test to enable stronger inferences concerning the role of cognition to PA.

CONCLUSION

This study describes levels of ambulatory activity in a high functioning group of octogenarians and provides insights into the clinical features associated with activity. Functional mobility under dual task conditions but not balance was associated with activity. Results suggest that TUG dual task may be a useful clinical tool when assessing activity in older people. Future research will extend these findings. Studies to date do not include a detailed clinical assessment of balance, balance self-efficacy, or a comprehensive range of 'free-living' micro gait characteristics. The question warrants further investigation to more fully inform clinical practice.

KEY POINTS

1. High levels of ambulatory activity were evident for this group of community-dwelling octogenarians.
2. Functional mobility rather than balance was associated with activity.
3. Metrics that describe the pattern of ambulatory activity provide a more nuanced analysis than volume metrics.

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Latissimus dorsi avulsion, with coupled teres major injury, in a professional football goalkeeper: case report

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ABSTRACT

Significant upper limb injuries are rare in professional football [soccer]. Latissimus dorsi avulsion injury is particularly rare in sport of all types, with limited published information informing optimal management. A 35 year-old male professional football goalkeeper sustained, via a non-contact ball throwing mechanism, a latissimus dorsi avulsion and partial teres major tendon tear during competitive matchplay. He undertook a conservative rehabilitation programme, emphasising progressive mechanical loading, in order to return to full function and competition. The player successfully returned to unrestricted training at 32 days post-injury and returned to play at 38 days post-injury. At 12 months post-injury he had suffered no injury recurrence and remains playing at the same competition level. Latissimus dorsi avulsion is an uncommon injury, with accurate diagnosis requiring both a high level of clinical suspicion coupled with diagnostic imaging. Despite the severity, this injury may be amenable to conservative management in even elite athletes with high functional demands. The following case outlines such a management approach successfully utilised with a professional football goalkeeper.

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Key words: Shoulder, Soccer, Rehabilitation, Tendon

INTRODUCTION

Whilst injuries are common in professional football [soccer], upper limb injuries are infrequent, with significant non-contact upper limb injuries rare (Carling, Orhant, & LeGall, 2010; Ejnisman et al, 2016). Latissimus dorsi avulsion injury is particularly rare in sport of all types, with limited published information informing recognition and optimal management. This case report documents an unusual injury involving latissimus dorsi tendon avulsion, with combined teres major injury, in a professional footballer and the conservative management approach utilised to rehabilitate him to full function and competition. The patient provided informed consent for presentation of case information herein.

CASE DESCRIPTION

The player was a 35 year-old male, right-hand dominant goalkeeper, with over 17 years of professional playing experience. He was on no regular medication and was asymptomatic preceding injury.

He experienced acute right posterior shoulder pain following an overarm throw, occurring in the 25th minute of a domestic league match. He was unable to continue and thus removed from play. Acute sideline management consisted of sling immobilisation and ice application (15 minutes/hour) until conclusion of the match (Bleakley et al, 2011).

Relevant past history included bilateral articular-surface partial supraspinatus tendon tears, previously managed with ultrasound-guided subacromial corticosteroid injection and rotator cuff strengthening exercise. This had been asymptomatic for the previous 3 years.

Detailed testing was conducted post-match [Table 1, Figure 1], leading to initial hypothesis of latissimus dorsi and/or posterior rotator cuff musculotendinous strain. Sling immobilisation and regular ice application were continued, with diagnostic imaging arranged for the following day.

Table 1: Summary of initial post-match examination

Test	Findings
Observation	Unremarkable
Sh AROM	Grossly intact, but slow elevation Pain HBB, EOR ER
RSC	Sh ER: R 4+/5 power (2/10 pain); L 5/5 Sh IR: R 5/5 power (6/10 pain); L 5/5 Sh Extension (30°F): pain-inhibited
Palpation	Painful about area marked in Figure 1
Special tests	Belly press: painful, nil lag HBB lift-off: painful, able to perform

Notes: Sh, shoulder; AROM, active range of movement; RSC, resisted static contraction; EOR, end of range; ER, external rotation; IR, internal rotation; HBB, hand-behind-back

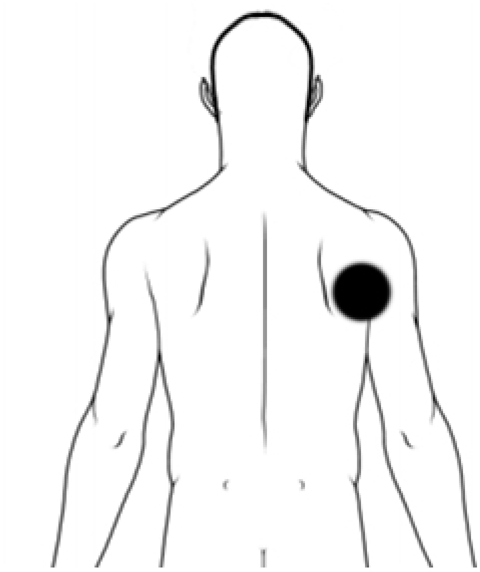

Figure 1: Body Chart

Investigations

Ultrasound imaging was initially performed, which demonstrated no acute changes compared to previous studies. Given clinical suspicion of injury, Magnetic Resonance Imaging [MRI] was subsequently performed. This demonstrated full-thickness tear of the latissimus dorsi insertion, with 6mm avulsion of the tendon from the anteromedial humeral cortex [Figure 2]. No marrow oedema within the proximal humerus or scapula, nor significant oedema extending into the latissimus dorsi muscle belly, was identified. Near-complete teres major tendon tear was also identified, with fluid tracking along the medial humerus and extending posteriorly deep to the posterior deltoid muscle.

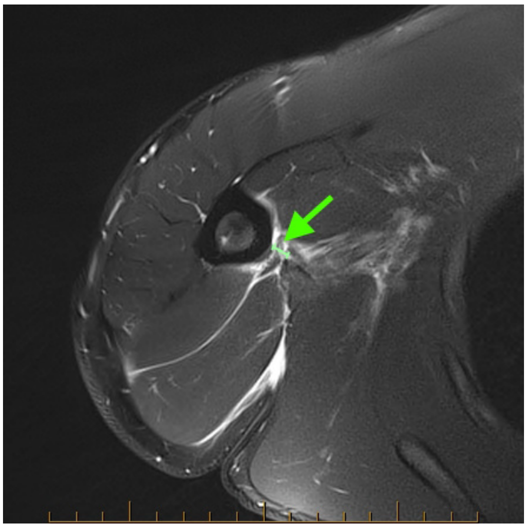

Figure 2: Magnetic Resonance Imaging of latissimus dorsi tendon lesion (arrow), with avulsion from anteromedial humeral cortex highlighted (line).

Due to the rare and significant nature of the injury, specialist orthopaedic opinion was sought. At this time, the player displayed full shoulder range of movement [ROM], intact axillary nerve function and reported significant reduction of pain. Due to signs of rapid clinical improvement and reported comparable outcomes of surgical and conservative management, recommendation was made to manage the player non-operatively (Schickendantz, Kaar, Meister, Lund, & Beverley, 2009). A return to play timeframe of 4-6 weeks was estimated based on previous case reports (Fysentzou, 2016; Maciel, Zogaib, de Castro Porchini, & Ejnisman, 2015) and rate of clinical improvement thus far.

Rehabilitation

A progressive criterion-based rehabilitation programme was devised [Appendix 1], which was considered to give the best opportunity to safely expedite return to play if appropriate, based on successful completion of prerequisite phases.

Shoulder immobilisation was continued initially to protect the affected area, whilst minimising loss of general conditioning where possible. The player's usual pre-morbid lower limb resistance training exercises not involving weight holding (eg leg press, calf raise) were continued from day 3 post-injury, whilst stationary cycling was used to maintain aerobic fitness.

Expediting resumption of running and kicking loads was considered important to maintain football-specific conditioning; however, reproducing the athlete's pain was deemed likely with these activities due to their associated arm swing. In order to facilitate early resumption, player-rated pain score of 2/10 was defined as the threshold between 'acceptable' pain reasonably expected with activity, versus 'unacceptable' pain suggestive of excessive and potentially injurious tissue loading. This pain-monitoring approach has been successfully utilised in tenopathology management elsewhere (Littlewood, Malliaras, Mawson, May, & Walters, 2013; Silbernagel, Thomee, Eriksson, & Karlsson, 2007). However, lower pain thresholds were used in this case due to greater pathology severity.

Isotonic exercise (Phase 3) was commenced on successful completion of light isometric exercise, with inner- and mid-range positions used initially to minimise excessive stretch on the musculotendinous unit. Commensurate with light resisted rehabilitation exercises in inner- and mid-range positions being performed, simple non-overhead/limited-reach catching drills were introduced at this time to maintain skilled task performance. Phase 4 exercises represented a progression of mechanical loading via both increase of resistance applied and work performed in outer-range positions of the musculotendinous unit. Similarly, fieldwork rehabilitation was progressed by progressing ball handling/catching drills into overhead positions. Overarm throwing was not permitted in this phase.

Upper limb plyometric and power tasks (Phase 5) were subsequently introduced; which represented not only increased mechanical load to develop musculotendinous capacity, but an essential rehabilitation task given the player's need to use his upper limbs in landing tasks and resisting high-speed shots. Example exercises utilised in all rehabilitation phases are listed in Appendix 2. As part of the introduction of power and plyometric tasks, controlled throwing and diving exercises were introduced in this phase under physiotherapist supervision. Goalkeeping drills involving diving were performed with coaching staff at a later stage (Phase 6), with throwing tasks still limited in both number and distance [Table 2].

In addition to successful completion of modified training and high-load rehabilitation exercise, shoulder extension strength values of 90% or greater compared to the player's unaffected side, as measured by handheld dynamometry, were used as a criterion for return to unrestricted training (Phase 7) [Table 3]. Successful completion of a minimum of one week's full unrestricted training was set as a criterion to achieve before return to play.

Table 2: Fieldwork throwing programme

Days post injury	Throwing programme
17	2 x 5 reps, short, DA
18	Nil
19	1 x 5 reps, medium, DA 2 x 5 reps, short, DA
20	Nil
21	1 x 8 reps, medium, DA 2 x 5 reps, short, SA
22	2 x 5 reps, short, SA
23	Nil
24	1 x 5 reps, short, SA 2 x 5 reps, medium, SA
25	3 x 3 reps, short, DA
26	3 x 5 reps, medium, SA
27	Nil
28	3 x 3 reps, short, DA 2 x 3 reps, medium, SA 1 x 3 reps, long, SA
29	Nil
30	3 x 5 reps, short, DA 2 x 3 reps, medium, SA 1 x 3 reps, long, SA
31	Nil
32	Return to full unrestricted training

Notes: Short, 0-15m; Medium, 15-30m; Long, 30+m; DA, double-arm; SA, single-arm

OUTCOMES

The player returned to full unrestricted training 32 days post-injury and successfully completed a full competitive match at 38 days post-injury. He completed eight consecutive further competitive matches in the same season without issue, before transferring to another club at the end of the season. At 12 months post-injury, he remained participating regularly in the same professional league, reporting satisfaction with his level of shoulder function and no recurrence of injury.

Table 3: Shoulder extension strength over time

Days post injury	Sh E (90°F*) (kg)	Sh E (30°F*) (kg)
14	18.0 (75%)**	16.0 (76.19%)
19	23.0 (85.82%)	19.9 (86.14%)
26	22.4 (87.84%)	22.1 (87.00%)
31	25.0 (98.03%)	22.7 (90.8%)
60	27.1 (103.05%)	22.7 (96.19%)

Notes: Sh, shoulder; E, extension; F, flexion.
* Tested isometrically at 90° and 30° shoulder flexion positions.
** Percentage relative to unaffected limb in parentheses.

DISCUSSION

Few reports of latissimus dorsi tendon avulsion, with or without teres major involvement, exist, highlighting the rare nature of this injury. In a sporting context, the existing literature typically pertains to throwing or overhead athletes, notably baseball pitchers (Ellman et al, 2013; Nagda et al, 2011; Park, Lhee, & Keum, 2008; Schickendantz et al, 2009). Whilst uncommon, the true incidence of injury may not be fully appreciated given the moderate functional limitations encountered in this and other reported cases (Fysentzou, 2016; Maciel et al. 2015). In the absence of imaging to confirm diagnosis, such limitations may be attributed to less significant pathology.

Latissimus dorsi is a powerful extensor, adductor and internal rotator of the shoulder, with an extensive origin about the thoracolumbar spine and iliac crest (Fysentzou, 2016; Henry & Scerpella, 2000; Schickendantz et al, 2009). Fibres of latissimus dorsi traverse the axilla to insert into the proximal humerus at the lesser tuberosity and medial aspect of the bicipital groove (Fysentzou, 2016; Henry & Scerpella, 2000; Schickendantz et al, 2009). Teres major performs similar functions and can have confluent fibres with latissimus dorsi at the humeral aspect (Maciel et al, 2015; Malcolm, Reinus, & London, 1999).

Whilst both conservative and surgical management approaches have been described, insufficient evidence exists to define one as superior. It has been suggested that surgical management may be preferable in professional athletes owing to their greater functional demands and the potential for residual strength deficits with conservative management, however these concerns are not supported by the available literature (Ellman et al, 2013; Henry & Scerpella, 2000; Le et al, 2009; Lim, Tilford, Hamersly, & Sallay, 2006). Surgical management has been reported to typically result in return to full sporting function at 6 months (Ellman et al, 2013; Park et al, 2008), whereas with conservative management such timeframes have been reported to vary widely between five weeks and 10 months (Fysentzou, 2016; Schickendantz et al, 2009).

Only two comparable injuries in football have previously been reported, both involving goalkeepers. Fysentzou (2016) described a complete latissimus dorsi myotendinous junction rupture caused by falling on an outstretched arm, with return to play at five weeks post-injury. Maciel et al (2015) reported a case of isolated teres major tendon rupture caused by overarm throwing; this athlete was able to complete the match in which the injury occurred, before subsequent return to play after 18 days. In both cases, athletes were conservatively managed with rehabilitation programmes consisting of progressive strengthening exercises and graded return to play (Fysentzou, 2016; Maciel et al, 2015). Both authors rate their outcomes as excellent, with no injury recurrence or functional limitation at 12-month follow-up (Fysentzou, 2016; Maciel et al, 2015). Repeat imaging to assess structural healing in both cases was either not performed or inadequately described (Fysentzou, 2016; Maciel et al, 2015).

Whilst conservative management programmes have resulted in favourable outcomes, the scarcity of injury and variation in reported protocols precludes consensus on optimal rehabilitation. The criterion-based rehabilitation programme presented in this case followed the principles of progressive mechanical loading in tenopathology (Cook & Docking, 2015; Galloway, Lalley, & Shearn, 2013; Kjaer, 2014) and examples from other conservatively managed tendon avulsion cases in professional football (Fysentzou, 2016; Gamradt et al, 2009; Maciel et al, 2015; Ueblacker, English, & Mueller-Wohlfahrt, 2016). It is conceded that management principles utilised in this case derive heavily from published tendinopathy management approaches (Cook & Docking, 2015; Galloway, Lalley, & Shearn, 2013; Kjaer, 2014), which may not be fully appropriate in cases of tendon avulsion. Nonetheless, given the success of the application of progressive mechanical loading in this and other cases, we would contend at this time that it appears reasonable to apply such an approach. It is important that progressive loading does not merely refer to increased resistance of load. Application of load at differing tendon lengths and at differing speeds also represented higher loads in this case, influencing the elastic loading properties of the musculotendinous unit and restoring sport-specific function (Galloway et al, 2013).

The potential for structural healing of the avulsed tendon is considered to exist with conservative management, as demonstrated in cases of lower limb tendon avulsion in professional football (Gamradt et al, 2009; Ueblacker et al, 2016). However, this was demonstrated at 12 weeks post-injury via MRI, but not at six weeks (Ueblacker et al, 2016). As such, it is considered unlikely that full structural healing occurred before return to play in this case, with transfer of the player to another club precluding repeat imaging to assess structural healing following extended rehabilitation. Improved dynamometry scores and restoration of sport-specific function in this case are likely in part attributable to the development of synergistic muscles and their function; most notably posterior deltoid and long head of triceps, which are synergists of forceful shoulder extension (Kronberg, Nemeth, & Brostrom, 1990; Landin & Thompson, 2011).

Restoration of functional strength was considered integral and informed rehabilitation progressions. Resisted shoulder extension strength was used as a measure of function of the affected musculotendinous units, with restoration of at least 90% strength relative to the unaffected side serving as one criterion to progress to return to play. This figure was based on similar values being used in return to play decision-making with other common football-related musculoskeletal injury (Heiderscheit, Sherry, Silder, Chumanov, & Thelen, 2010; Kyritsis, Bahr, Landreau, Miladi, & Witvrouw, 2016; Mendiguchia & Brughelli, 2011; van der Horst, Backx, Goedhart, & Huisstede, 2017). Given the player's dominant throwing arm was affected, which would reasonably be expected to be stronger than his non-dominant arm, it can be argued that this value may have been set too low. Nonetheless, the player tolerated full training and matchplay at this level.

Factors contributing to injury remain speculative. Similar to this case, in a series of 10 latissimus dorsi and teres major tears in professional baseball pitchers, all players were asymptomatic preceding injury (Schickendantz et al, 2009). In both previously documented cases in football goalkeepers, players were aged over 30 years (Fysentzou, 2016; Maciel et al, 2015). As such, older age, via either age-related degenerative changes in the musculotendinous unit or greater cumulative exposure to potentially injurious forces, may be a contributor (Fysentzou, 2016; Maciel et al, 2015). Competition level, with respect to the generation of and exposure to higher forces in professional sport, may be a relevant consideration (Schickendantz et al, 2009).

The relevance of past history of shoulder pain and supraspinatus pathology in this athlete as a potential contributor is unclear. Previous injury may have affected shoulder kinematics leading to altered latissimus dorsi and teres major demands, but this remains speculative. Poor-quality tendon structure and failed repair processes are well documented in tenopathology with chronic exposure to excessive loading (Cook & Purdam, 2009; Scott, Backman, & Speed, 2015), however the lack of preceding symptoms diminishes this theory. Past history of corticosteroid injection about the shoulder is noted and whilst its potentially deleterious effect on tendon structure is well-documented, this is considered an unlikely contributor in this case. This is due to the differing location of ultrasound-guided administration (subacromial space) and the lack of repeat corticosteroid injections which may otherwise result in adverse events via cumulative dosage (Coombes, Bisset, & Vicenzino, 2010; Fredberg, 1997; Orchard, 2008).

Significant discrepancy between ultrasound and MRI findings existed. Whilst ultrasound examinations are highly operator-dependent, the anatomical depth of the injury, accentuated by habitus and significant muscular bulk of the player's shoulder, were likely contributors. Whilst ultrasound is still considered valuable in musculoskeletal assessment, particularly with respect to its ability to dynamically identify functional as well as morphological abnormality, the aforementioned case highlights its limitations (Kijowski & De Smet, 2006). It also serves as a reminder for clinicians to consider repeat or alternate investigations if there is a high level of clinical suspicion despite negative imaging results (Kijowski & De Smet, 2006).

CONCLUSION

This case documents unusual injury to the latissimus dorsi and teres major tendons in a professional football goalkeeper and the progressive, criterion-based conservative management programme used to successfully rehabilitate him to full function and competition. Whilst rarely documented, clinicians dealing with overhead and/or throwing athletes should be aware of this pathology when assessing the athlete with acute onset posterior shoulder pain, particularly in light of the relatively mild functional limitations and potential for false negative imaging results with differing modalities.

KEY POINTS

1. Latissimus dorsi avulsion is a rare injury in sport; particularly football [soccer].
2. Initial symptoms may be relatively mild, incommensurate with injury severity.
3. The potential for false negatives with imaging highlights the limitations of different modalities.
4. Despite injury severity, conservative management may be appropriate, even in a high-level overhead athlete.

DISCLOSURES

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APPENDIX 1: Criterion-based rehabilitation programme

PHASE 1 – IMMOBILISATION		
Goals: Prevent worsening of pathology		
Rehab	**Fieldwork/Training**	**Key Criteria to Progress**
Immobilisation (sling/relative rest) LL exercise only	Nil	No pain at rest Minimum 1 week immobilisation
PHASE 2 – ISOMETRIC LOADING		
Goals: Commence light shoulder/UL exercise; resume running within pain limits		
Rehab Exercise	**Fieldwork/Training**	**Key Criteria to Progress**
Isometric shoulder exercise Light non-shoulder-specific UL strength exercise (e.g. bicep, tricep)	Running/Agility: low-speed Kicking: short-distance	Full shoulder ROM < 2/10 pain with running/agility No pain during isometric exercise
PHASE 3 – ISOTONIC LOADING: Simple		
Goals: Commence simple isotonic shoulder exercise		
Rehab Exercise	**Fieldwork/Training**	**Key Criteria to Progress**
Isotonic shoulder exercise (low resistance; inner/mid-range positions) Catching drills (non-overhead)	Running/Agility: progress speed Kicking: short-medium distance Handling/ballwork: non-overhead	< 2/10 pain with resisted exercise < 2/10 pain with increased speed running/agility
PHASE 4 – ISOTONIC LOADING: Advanced		
Goals: Progress resistance of isotonic exercise and into outer-range (on-stretch) positions		
Rehab Exercise	**Fieldwork/Training**	**Key Criteria to Progress**
Isotonic shoulder exercise (increased resistance; include outer-range positions) Body weight-resisted exercise (e.g. DA/SA push-up)	Running/Agility: progress speed ≥ 85% of player maximum Kicking: long distance/goal kicks Handling/ballwork: include overhead positions at low intensity	< 2/10 pain with outer-range resisted exercise Nil pain with simple overhead handling/ballwork
PHASE 5 – PLYOMETRICS + MODIFIED TRAINING		
Goals: Commence plyometric/power exercises, trial modified football training		
Rehab Exercise	**Fieldwork/Training**	**Key Criteria to Progress**
Continue isotonic shoulder exercise. Commence plyometric and power shoulder exercises	Modified football training: No throwing or diving Controlled throwing, diving/return to feet with physio	Strength: resisted extension ≥85% vs unaffected Nil pain with plyometric exercise Nil issues with modified training
PHASE 6 – MODIFIED TRAINING		
Goals: Complete modified football (non-rehab) training with minimal restrictions		
Rehab Exercise	**Fieldwork/Training**	**Key Criteria to Progress**
Continue shoulder exercise (isotonic strength + plyometrics)	Modified football training: Limit throwing distance/repetition	Strength: resisted extension ≥90% vs unaffected Nil issues with modified training
PHASE 7 – RETURN TO PLAY		
Goals: Resume unrestricted training and RTP		
Rehab Exercise	**Fieldwork/Training**	**Key Criteria to Progress**
Continue isotonic shoulder strength exercise Suspend plyometric exercise due plyometric tasks in full training	Full training	Minimum 1 week full training without issue before RTP
Notes: RTP Return to play DA Double-arm	 UL Upper Limb SA Single-arm	 LL Lower Limb

APPENDIX 2: Example rehabilitation exercises by phase

Phase	Exercise	
Phase 2 (Isometric loading)	Sh ER/IR (Sh neutral; Elb 90°F) Sh Ext (Sh neutral; Elb 90°F) *Isometric loading variable; generally 5-10 x 3-5sec*	Sh Add (Sh neutral; Elb 90°F) Scapular retraction
Phase 3 (Isotonic loading: simple)	TB IR/ER (Sh 0°F; Elb 90°F) Closed chain MB circles on wall Standing/inclined wall push-up Side plank on elbow *Isotonic loading variable; generally 2-3 x 6-10 reps*	TB DA Row (Elb 90°F) TB DA Low Row (Sh 45° → 0°F)
Phase 4 (Isotonic loading: advanced)	Cable woodchop (DA → SA) Cable Shoulder ER/IR (Sh 0°F) Cable Shoulder ER/IR (Sh 90°Abd) Prone Push-up; push-up on bosu Standing lat pulldown *Isotonic loading variable dependent on load; generally 3 x 3-8 reps*	SA Pectoral Fly Side-plank on elbow Side push-up MB overhead raises (Sh F, F/Abd) SA Low Row (45°F → 0°F)
Phase 5 (Plyometrics/ Power)	Push-up with clap Push-up with lateral land off box MB throw/catch vs rebounder *Plyometric/power loading variable; generally 1-3 x 3-5 reps*	SA standing lat pulldown – fast speed/low resistance DA standing row – fast speed/low resistance
Phases 6-7	Continue phase 4, 5 exercises	
Notes:	Sh Shoulder Elb Elbow TB Theraband MB Medicine Ball ER External Rotation IR Internal Rotation	F Flexion Abd Abduction Add Adduction Ext Extension DA Double-arm SA Single-arm