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CONTENTS

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Celebrating a shared past, planning a shared future: physiotherapy in Australia and New Zealand

ABSTRACT

The purpose of this historiographical paper is to trace the links between New Zealand and Australia with particular reference to education and the author's engagement with these processes. From the educational beginnings of physiotherapy programmes in Melbourne (1906) and Dunedin (1913) following the formation of the Australasian Massage Association in 1906, the Association branches in New Zealand and Australia soon went their own way. Physiotherapy and its education programmes were strengthened in the poliomyelitis epidemics and the world wars. By the 1980s these programmes were closely integrated with tertiary colleges as well as the universities. The author was a participant in protracted political action by physiotherapists which resulted in a new programme at the University of Melbourne in 1991 and in the review of the programme in Dunedin in 1994. She facilitated educational ties across the Tasman and the formation of the Council of Physiotherapy Deans Australia and New Zealand. The paper supports the conclusion that many aspects of our shared history and growing relationships have been beneficial to education, accreditation and physiotherapy practice in both countries.

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Key words: Physiotherapy, history, education, Australia, New Zealand

Reaching the milestone of 50 years since graduating as a physiotherapist encouraged reflection on my personal history and that of the profession. Nicholls too recently encouraged New Zealand physiotherapists to collect professional history (Nicholls 2007). As the University of Otago celebrated the centenary of physiotherapy in New Zealand in 2013, I will focus on the universities with which I have had my strongest academic links - Melbourne and Otago. Their physiotherapy connections began over a century ago, when our forebears perceived an Australasian association would facilitate physiotherapy's development. Their original goals resonated with my own. This paper traces the formation of the Australasian Massage Association, the beginnings of physiotherapy education in Australia and New Zealand and our coming of age through poliomyelitis epidemics and the rehabilitation of the wounded of the world wars. My involvement with more recent educational challenges and their resolution followed by our increasing collegiality through the Council of Physiotherapy Deans Australia and New Zealand, which I instituted and my facilitation of our accreditation bodies will presage some ideas about a shared future.

We were joined together as part of Gondwana until some 100 million years ago.[1] Our indigenous people have been resident for long periods, Australians for 60,000 years and the Māori for 16 centuries. All through the 17th century European mariners sailed here; Abel Tasman named New Zealand and New Holland and James Cook claimed our countries for Britain's colonial expansion in 1769-1770. In 1788, the first settlers from England reached New South Wales (Grimshaw et al 2006). Medical men and non-medically qualified healers arrived with the early colonists and a century later the *Australasian Medical Directory and Handbook* of 1886 lists 257 practitioners in Australia without medical qualifications. A further 15 were practising in New Zealand. These practitioners included masseuses and masseurs, hydropathists and medical electricians (Martyr 2002, Pensabene 1980, Shaw 2013).

By the end of the century, medical practitioners were enjoying increased prestige with improved education and training, progress in science and less risky surgery (Coleborne and Godtschalk 2013, Pensabene 1980, Raftery 1999). Though much illness was managed within families, medical practice was gaining in respect and many physiotherapists were desirous of collegial relations with orthodox medicine. The *Australian Medical Journal* endorsed advertisements in 1879 and again in 1882 for professionally trained massage practitioners such as Miss Dick's gymnastic school as one: 'to which the profession may confidentially send such of their lady-patients as require the well-considered application of the sort of exercise that is necessary for the recovery of muscles' (1879, 1882). Miss Dick had undertaken the professional training and qualifications to be a teacher of gymnastic exercises. The term physiotherapy had been coined and by the end of the nineteenth century physiotherapy practitioners were using exercise, massage, electrotherapy and hydrotherapy (Korobov 2005).

THE AUSTRALASIAN ASSOCIATION

Unlike the beginnings of Britain's Chartered Society of Physiotherapy, which initially concentrated on massage and was driven by women nurses and midwives, male masseurs predominated amongst those promoting an Australasian association (Nicholls and Cheek 2006, Wicksteed 1948). Alfred Peters, son of a masseur, was born in Newcastle on Tyne in 1871, arriving in Australia in 1887. He established himself quickly as a well-patronised practitioner. He was an Honorary Masseur at the Melbourne, St. Vincent's and the Homeopathic Hospitals. He used the latest therapeutic devices treating notables such as Members of Parliament, famous sportsmen and Anna Pavlova (Liddicutt 1987, Peters 1987). Peters authored books on massage (Edwards 1916,

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[1] We were not always separated by a sea but joined together as part of Gondwana until some 100 million years ago as exemplified by shared plants such as the *Nothofagus*, the beech tree. *Nothofagus* information at en.wikipedia.org/wiki/File:Nothofagus_range_including_New_Caledonia.jpg Accessed 8 March 2013.

Peters 1890, Peters 1892). He participated with Heinrich Best in a 1905 meeting convened by Teepoo Hall. Hall already contributed to the medical establishment, teaching medical students and may have been the group's connection to Dr John Springthorpe (Bentley and Dunstan 2006). Hall and others who trained physiotherapists, were concerned about the state of practice (Australasian Massage Association 1907). They were firm advocates for physiotherapy, which was recognised as an aid to physicians and necessary to effect the work of surgeons. Medical patronage legitimised the physiotherapists, adding to their status and facilitating access to the universities. Hall insisted that 'every patient should be examined by a legally qualified man as a fit subject for massage' (Anon 1896). Eliza McAuley, one of the women physiotherapists, pioneered studying anatomy at the University of Melbourne, teaching students and working at the Melbourne Hospital (Cosh 1987).

On 15th March 1906 the Association was formalised with Edwin Booth from Dunedin present (Australasian Massage Association 1906b). At the next month's meeting Mrs DE Booth, his physiotherapist wife joined (Australasian Massage Association 1906a). The Booths were well-established in Dunedin, favoured by eminent members of the community and treated artists such as Paul Cinquevalli, the Prussian juggler (Australasian Massage Association 1906e). Women like Miss Culling, were also practising (Otage Daily Times 1902)

The new Association, with John Springthorpe from Melbourne as the first president, made significant decisions regarding a uniform system of education and examination and proposals for registration. Teepoo Hall was the Australian secretary and Edwin Booth the New Zealand secretary (Otago Witness 1907). New Zealanders and Australians shared a common heritage, language and lifestyle; many relishing the prestige in being a part of Britain's empire. In the 1880s and early 1890s an Australasian inter-colonial convention preceded the British Parliament passing the Federal Council of Australasia Act 1885 (UK). Sir Henry Parkes spoke at the Tenterfield School of Arts on 24 October 1889 endorsing the federation and the Constitutional Conventions were convened, New Zealand proposing the Commonwealth of Australia in 1891. Initially New Zealanders strongly supported federation but became disillusioned by the reduced autonomy, the geographic distance of the new federal government and a disadvantageous voting system. The Australian Natives Association promoters of the federation hosted the second Constitutional Convention (1897-1898) supported by Sir Edmund Barton. After two referenda, 1898 and 1899, a majority of Australian colonies agreed. The Commonwealth of Australia Constitution Act 1900 (UK) took effect on 1 January 1901 (McQueen 1970). Despite no Australasian federation, links between the two countries remained strong and many Australasian associations developed and continue.

Connections between Australasian physiotherapists strengthened initially. At the first Association Annual General Meeting in Adelaide in 1907, 302 members attended: seven from New Zealand. Continuing education began with the first monthly lecture given by Dr Hugh Murray describing and demonstrating X-rays, including of the chest on a living subject (Australasian Massage Association 1906d, 1906e). Such lectures were printed *verbatim* in the *UNA Journal* provided to members.

> Massage … advanced towards recognition as a profession through skillful association with medical practitioners. By accepting a prescribed, subordinate and largely gendered relationship to orthodox medicine and its practitioners, massage escaped the stigma attendant on and hostility directed towards 'quackery' by the orthodox profession (Martyr 1997).

In Australia State groupings amalgamated within the Association but branches remained in New South Wales, South Australia and Victoria. By 1909, Wellington, Christchurch, Dunedin and Rotorua were organised into Association branches, although soon there were divisions between the centres analogous to that occurring between the Australian States. Peters had already resigned from its Council and continued teaching his own apprentices. In 1916 he established the Victorian Massage Association whose members did not require medical referral (Liddicutt 1987). Despite tensions and differences within the Association, the education principles established at the first meeting were enacted in Melbourne in 1906, Sydney 1907, Adelaide 1908 and in Dunedin in 1913.

THE BEGINNING OF PHYSIOTHERAPY EDUCATION

The Association's Council approved the two-year education programme of the diploma of 'Member of the Australasian Massage Association' (Australasian Massage Association 1906b). At the University of Melbourne, physiotherapy students shared components of their course with medicine (Russell 1977). The Professor of Anatomy, Richard Berry taught anatomy, Professor of Physiology, William Osborn was responsible for physiology. The medical electricity teacher was Dr Hugh Murray, an Edinburgh University medical graduate, holder of an extramural massage certificate from Edinburgh and thus a full Association member. Dr Colin Mackenzie lectured on the Theory and Practice of Massage. A physiotherapist, Lars Grundt, an exponent of Per Henrik Ling, taught medical gymnastics (Australasian Massage Association 1906c). The early students included women and men. Concurrently a modified course was repeatedly run for existing practitioners. Advertising reinforced the importance of qualifications and Association membership. John Springthorpe too promoted the Association at the medical congress in Dunedin in 1907 (Shaw 2013).

Although New Zealand had early physiotherapists like the Booths, and several hospitals taught massage techniques to nurses with Auckland Hospital offering a certificate, those desirous of completing physiotherapy education needed to travel to Australia or England (Shaw 2013). The Australasian links strengthened with Lily Armstrong. She trained in England, promoted the Australasian Association in New South Wales and taught at the University of Sydney from 1907; she gained further experience in England before travelling to New Zealand. Armstrong taught massage, medical gymnastics classes and treated patients in Dunedin Hospital when physiotherapy education began in 1913 at the University of Otago (Shaw 2013). Local medical men Professors John Malcolm and Louis Barnett and the Inspector-General of Hospitals, Dr Thomas

Valentine supported the two-year university and hospital programme based on the 1906 Australasian model. Dr Percy Cameron taught medical electricity, the Edinburgh-trained William Newlands anatomy and Professor Winifred Boys-Smith physiology. Although educational responsibility later transferred to the Otago Hospital Board, agreement continued with the University to teach anatomy and physiology (McMeeken et al 1995). Establishment of the educational programmes ensured that physiotherapists were on hand when poliomyelitis epidemics and world wars necessitated their expertise. The opportunity to contribute to rehabilitation provided a clinical space for physiotherapy to develop where medical practitioners had limited knowledge and fewer skills or time to devote to prolonged rehabilitative treatment.

ADVANCEMENT

Although poliomyelitis cases were reported from the late nineteenth century, Australia's first epidemic was in 1908 and New Zealand's in 1914, with nearly 1000 cases in 1916 (Ross 1993). Epidemics were a scourge in both countries for fifty years until vaccines reduced their incidence. Physiotherapy was the foremost treatment (Mackenzie 1918). The exchanges between countries was exemplified when in 1916 the New Zealand Department of Health brought the physiotherapist Florence Bevilaqua from Australia to train physiotherapists (Bentley and Dunstan 2006). Bevilaqua, who reportedly obtained extraordinarily good results, had been a Melbourne student (Ross 1993). Both countries benefitted from the pioneering work of Colin Mackenzie and physiotherapists, such as Bevilaqua, and particularly Vera Carter, who further developed muscle testing and re-education (Kelsall and McComas 1966). In Melbourne, in 1933 a third year was added to the physiotherapy programme to accommodate muscle testing and re-education.

New Zealand's 1916 epidemic reinforced the need for experienced physiotherapists. Practitioners already in England with the army were sent on courses on electrical treatment and Swedish remedial exercises. Australian physiotherapists had taken such courses during their training and were employing these treatments during their wartime and later practice (Butler 1943). It is difficult for those who did not experience the polio epidemics to understand the fear generated in communities. In Whangarei initially schools were closed when the nearest case was 200 miles away, later if ten miles distant. Eventually schools reopened, but theatres, kindergartens and pools remained closed (Ross 1993). My siblings and I were born following the largest epidemic in Victoria and my physiotherapist mother was treating polio patients whilst kindergarten teachers looked after us. The high levels of independence and autonomy experienced particularly by physiotherapists in the domiciliary polio service, I contend, were major factors in the professionalisation of physiotherapists.

Polio and wartimes were intertwined for physiotherapists. The intervening wars intensified the requirements for physiotherapy and cemented the concepts of rehabilitation and reconstruction (Adam-Smith 1984, Bentley and Dunstan 2006, Butler 1943, Ford 1996, Fussell 1996). World War 1 contributed a shared mythology about the ANZACS and to the development and recognition of physiotherapy. In Australia a public massage scheme raised funds for qualified physiotherapists (The Brisbane Courier 1915). Despite initial reluctance to include physiotherapists, the Medical Corps of both countries soon sought more practitioners from accelerated courses and specialist roles developed (The Sydney Morning Herald 1891, Pickstone 2000). Following their experience with soldiers' horrific injuries, surgeons gained confidence in rectifying problems in civilians. Orthopaedics and plastic surgery, both highly reliant on physiotherapists, expanded following the war (Beasley 2009, Bentley and Dunstan 2006, Butler 1943, Cooter 1993, Tidswell 2009, Wilson 1995).

By World War 2, the need for physiotherapy in acute care and rehabilitation was generally well-recognised and many Australasian practitioners contributed (Adam-Smith 1984, Shaw 2013, Wilson 1995). New Zealand's policy was to return wounded service personnel home and no overseas Corps was formed. The Australian Army Medical Corp's Chief Physiotherapist, Captain Alison McArthur Campbell taught remedial exercise to students from the 1920s, ran a private practice in conjunction with hospital work and was amongst the first women physiotherapists to enlist. She served in Egypt, Libya, Palestine and Australia. Other male and female physiotherapists served in the Pacific theatre and as in New Zealand in repatriation hospitals at home. Pay was a significant issue throughout the war with women earning about 60 per cent of men for identical work (McArthur Campbell 1978, Shaw 2013, Walker 1961, Wilson 1995). Physiotherapists undertook a wide variety of technically difficult work. This included preparation of plaster and application and removal of casts, restoration of function in many medical and surgical conditions, including in thoracic units, plastic surgery, orthopaedic wards, fitting boots, foot care, assessment, splinting and treatment of nerve injuries, long-term rehabilitation in convalescent depots and of seriously affected soldiers, including prisoners of war (Walker 1961). During this war increasing numbers of students required the Dunedin School to expand its clinical sites to Auckland, Wellington and Christchurch. Returning veterans were accepted as students in both countries expanding the demand on clinical placements and the numbers of male physiotherapists (Luke 2013, Luke 1987, Shaw 2013, Wright 1987).

British influence was stronger in Dunedin than in Melbourne, especially from the 1920s onwards when Britain's system of teacher training was adopted (Shaw 2013). A new modern building for the School of Physiotherapy opened in Dunedin in 1946. Although Victorian students also enjoyed university facilities, they languished as guests in hospital departments for physiotherapy teaching. All these graduates though were able to register.

Legislation for registration was first passed in Victoria in 1921 and recognised practitioners from Australia and New Zealand. In the latter country registration was achieved the same year. In New Zealand physiotherapists holding British certificates were able to register (Shaw 2013). The Victorian Act, however, allowed for reciprocity of registration with those trained and registered in the British Empire but not the unregistered British physiotherapists. They could work in hospitals but not private practice (Liddicutt 1987).

The Acts in both countries vested responsibility for the educational programmes in the Registration Boards. Victoria delegated the educational responsibility to the leader of the programme, whilst in New Zealand the Board conducted a State examination (Cosh 2013).

DISJUNCTIONS AND REUNIONS

From positive early beginnings and with practice well-established, the Association's activities were generally State or regionally based and tensions remained in matters such as adoption of a standardised curriculum and admission to membership (Australasian Massage Association 1908, Shaw 2013). In Victoria tensions simmered with two organisations representing physiotherapists, the larger Australasian Physiotherapy Association comprising nearly all the practitioners in the public sector and the smaller Victorian Massage Association predominantly men in private practice. Once the medical referral ethic[2] was rescinded in 1976 the smaller association joined the larger (Peters 1987).

During the hard economic years after World War 1 and the depression, many Australian physiotherapists worked as volunteers in public hospitals and undertook private practice as their main source of income (Cannon 1983, Cannon 1996, Grimshaw et al 2006, Lowenstein 1978). Despite these difficulties congresses took place in Sydney in 1933 and Adelaide in 1936. The challenges and demands of practice and of geographic distance had reduced connections between Australia and New Zealand and discussion regarding New Zealand being effectively reincorporated into the still Australasian association bore no fruit. Subsequently in 1939 Australia replaced 'massage' with 'physiotherapy' and became the Australian Physiotherapy Association (Forster 1969). Nevertheless, educationally the Australasian Massage Association moved along relatively similar paths in Melbourne and Dunedin. As recognition and employment opportunities increased, shortages of physiotherapists continued in both countries. Regardless of heavy workloads, physiotherapists strengthened their professional activities. The New Zealand journal commenced in 1939 and the New Zealand Society of Physiotherapists was firmly established in 1950. The *Australian Journal of Physiotherapy* commenced in 1954.

The education of physiotherapists was at degree level by the 1970s and 1980s. Our physiotherapists were world-leaders particularly in manipulative physiotherapy. Our physiotherapists pioneered independence and autonomy in clinical decisions and patient access. The New Zealanders, Robin McKenzie, Stanley Paris and Australian Geoffrey Maitland are well-known, as is Prue Galley for her ground breaking paper on autonomy (Galley 1975). However few know that physiotherapists in the Victorian Health Department began the reconsideration of the medical referral ethic for membership of the Australian Physiotherapy Association. Elizabeth Fussell was Physiotherapist in Charge (1967-1986) of the itinerant polio service, which became available for people with other neurological conditions. Fussell introduced, in 1972, an independent consultancy for early childhood development assessment. Physiotherapists assessed and referred children to medical practitioners. Fussell realised that under these circumstances her physiotherapists could no longer ethically be members of the Association (Cosh 2013, Fussell 1996); thus setting in train the proposals which, after considerable debate, were recognised by the World Confederation for Physical Therapy (Bentley and Dunstan 2006).[3] In the next decade further significant changes to physiotherapy education occurred in Melbourne and Dunedin.

REVOLUTION

In the 1980s Australia experienced a major upheaval in tertiary education (O'Neill and Meek 1994). The Federal Government considered that higher education and Australia would benefit from fewer and larger tertiary institutions (Dawkins 1987a, Dawkins 1987b, Dawkins 1988). Government set minimum institutional sizes and used financial incentives to drive mergers with 19 universities and over 40 Colleges of Advanced Education amalgamated into a Unified National System comprising 35 universities (Harman 2002).

A proposed amalgamation between Lincoln Institute of Health Science and La Trobe University preceded the educational reforms. The Victorian School of Physiotherapy was based at Lincoln, although anatomy was still taught at the University of Melbourne. The merger proposal concerned physiotherapists (McMeeken 1987). Whilst physiotherapists were instrumental in forming Lincoln, they considered their influence had diminished; they were not consulted regarding the amalgamation and were at risk of submergence into a generic health profession (Australian Physiotherapy Association 1987). Despite physiotherapy's concerns both Federal and State governments supported the flagship amalgamation.

I was a member of the Australian Physiotherapy Association's Campaign Committee formed to oppose the amalgamation. The Association's *The Future Direction of Physiotherapy Education and Practice* guided intense political lobbying from 1987 to 1990 (Australasian Massage Association 1987). This included meetings with Vice Chancellors of all Victorian Universities and Federal and State politicians. Letters assailed politicians and media were targeted. Hundreds of physiotherapists and current students staged a march through the city of Melbourne

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[2] In the reports of meetings of the new Australasian Massage Association in 1906 the requirement for treatment only to be undertaken on medical referral was frequently stated. In the report in the UNA nurse's journal of 30.5.1907 p35 at the first Annual General Meeting on 25.4.1907 it was stated "it was made a condition of membership that no member should act in a professional capacity, except under medical direction or supervision, and that no member should prescribe remedies for the cure of disease unless a registered medical practitioner".

[3] Australia debated this first ethical principle in the early 1970s and rescinded it from the Federal Constitution of the Australian Physiotherapy Association in 1976. Such a change had been debated elsewhere but Australia was the first country to formally make the change, three Australian members raised the matter of autonomous, primary contact practice at WCPT in 1978. Not all WCPT members agreed and I understand there was even talk of expulsion of Australia (Patricia Cosh Interview 25.2 2013). Finally the WCPT meeting accepted the Australian proposal that the issue of primary contact status be interpreted in each country according to their own standards.

culminating in speeches at Parliament House. After three years of meetings and intense lobbying, in July 1990, Federal and State Governments capitulated with a compromise solution to begin a new physiotherapy programme at the University of Melbourne. Following my initial secondment to the University to develop the curriculum, consult on the building and equipment and appoint staff, I was appointed as the Foundation Professor and Head commencing a new School of Physiotherapy at the University of Melbourne in 1991. In the early 1990s there were also difficulties regarding physiotherapy education in New Zealand where physiotherapists wanted to be responsible for their own body of knowledge; to have degree-based education and access to their own research and higher coursework degrees.

Across the Tasman Australian physiotherapy Schools were offering degrees (Chipchase et al 2006). With the New Zealand Physiotherapy Board entry-level practitioner competency document developed, in 1991, the four-year Bachelor of Physiotherapy commenced jointly within Otago Polytechnic and the University of Otago. This arrangement created problems of academic philosophy, communication, content and timetabling. Universities found physiotherapy students attractive with the high course demand and entry scores. The Faculty of Medicine at Melbourne then had the highest percentage of physiotherapists doing research higher degrees and the University of Otago had also commenced formal postgraduate programmes under the leadership of Dr Robyn Grote.

In Dunedin debate simmered regarding the conjoint undergraduate physiotherapy programme as physiotherapists watched the outcome of the Campaign in Melbourne. In 1994 Dr Graeme Fogelberg, Vice-Chancellor of the University of Otago commissioned Emeritus Professor Thomas O'Donnell as Chairman, Mr Michael Lamont and me, to review the arrangements for providing the Bachelor of Physiotherapy. We were to consider all aspects of the undergraduate course, the provisions and opportunities for research and for postgraduate academic and professional training. We were to make recommendations to the University concerning appropriate ways of addressing any issues and to consider their financial implications. Following wide consultation we recommended that the University of Otago become responsible for all physiotherapy programmes within a new University School of Physiotherapy. This school should review the curriculum and with the University plan staff development (McMeeken et al 1995). As in Victoria, many Dunedin physiotherapists considered they had returned to their *alma mater* where they had made many lifelong connections with their later medical colleagues and where they had studied the biomedical sciences, physiology, pathology and most particularly anatomy.

The study of human anatomy has had a long and turbulent history, but the politics of anatomy are equally intriguing. It was centre stage in arguing for Australasian physiotherapy education within the universities a century ago and a key focus of the political agenda for physiotherapy returning to the founding universities in the 1990s. As knowledge has increased, the attention paid to subjects in previous decades has changed; however, anatomy has remained central (McMeeken et al 2005, McMeeken 1998, McMeeken 2007, Nicholls et al 2009). Did the mystique of anatomy, its privileged knowledge, which we share, and the status associated with our medical links and their power some of the reasons for physiotherapists wanting recognition in the universities? Perhaps all of these are reasons, but the universities were courting physiotherapists too! With the formal reintroduction of physiotherapy into the universities, those of us on the academic and clinical staff were absorbed in developing and implementing new curricula and establishing strong Clinical Schools to integrate clinical education with the academic components of our programmes. With my opportunity to undertake a forensic review of the undergraduate and postgraduate physiotherapy programmes in Dunedin and the responsibility of introducing these programmes at Melbourne, I was struck by the similarity of our academic demands and the politics of education and health and considered there was much we could learn from one another and the more established schools.

RECONNECTING

In 1994 I proposed that the Heads of all the Schools of Physiotherapy in Australia and New Zealand meet twice yearly to develop educational and research alliances, for mutual support, to discuss the politics of the time, particularly as they related to education and health, and to act as appropriate in a collegial and collective fashion (Council of Physiotherapy Deans Australia and New Zealand 2013). As an example of the breadth of topics, those discussed at a 1994 meeting included community expectation of accountability and accreditation of physiotherapy academic programmes, discharge and readmission policies in hospitals and of critical immediacy the challenges of infection control when HIV/AIDS testing and activities by positively diagnosed students and staff were under debate. We agreed on advice for our prospective students. Other curriculum matters considered included cardiothoracic teaching, clinical education management, approaches to Honours programmes and student research projects. We explored strategies for offering postgraduate clinical specialisms, (thus initiating the first postgraduate coursework Masters) whilst ensuring adequate support for PhD candidates. We shared multimedia information and discussed the degree of independence for new graduates and an internship year. Physiotherapy competencies and their use in curricula and potential accreditation were debated. There was no enthusiasm for a common curriculum and we agreed that diversity sowed the seeds of innovation. We saw it as our role to liaise with external groups and to publically demonstrate accountability, leading to a comprehensive benchmarking study (Higgs and McMeeken 1997a, Higgs and McMeeken 1997b, Higgs and McMeeken 1997c). Evaluation of student outcomes from the perspective of the graduates and their employers was raised and later developed into survey tools used by our universities and subsequently required by accrediting authorities – the first in the health sciences to do so. As the number of Australian universities offering physiotherapy programmes grew from six in 1991 to 17 in 2013 additional new Heads joined the group (Council of Physiotherapy Deans Australia and New Zealand 2013). With few very experienced physiotherapy faculty members, the group has provided collegial support and corporate knowledge. My intent was to ensure this group had a political profile for physiotherapy education. Now the Council of Physiotherapy Deans Australia and New Zealand continue to meet twice each year, maintain political advocacy for physiotherapy research and education and are mutually supportive. As the Head of a physiotherapy school, for an extended period, I represented all the Heads on the Australian Physiotherapy Council.

The Australian Physiotherapy Council has the responsibility for accreditation of Australian physiotherapy programmes. During my long involvement with the Council, since its responsibilities for programme accreditation began in 1996, my Council colleagues and I fostered further opportunities for collaboration with New Zealand. The trans Tasman Mutual Recognition Agreement of 1997 between our Governments has facilitated intercountry mobility of physiotherapists and from the mid 2000s our registering and accreditation authorities have formed sustained linkages with the purpose of sharing knowledge and expertise. Under the Agreement, physiotherapists with full registration and a current practising certificate of the Physiotherapy Board of New Zealand can apply for General Registration to the Physiotherapy Board of Australia but must apply to the Australian Physiotherapy Council for a skills assessment if they wish to migrate (Physiotherapy Board of Australia 2012, Bureau of Statistics 2009). The Intergovernmental Agreement, whilst strengthening working relationships between our organisations, has presented problems, particularly for New Zealand when international physiotherapists gain registration in New Zealand and then promptly translate across the Tasman avoiding Australia's more costly process and depriving New Zealand of much needed physiotherapists (Australian Council of Physiotherapy Regulating Authorities 2003, New Zealand Society of Physiotherapy 2008).

A SHARED FUTURE

Since the initial exchanges between Australia and New Zealand and particularly in the last two decades shared research, educational and professional activities have grown (Crosbie et al 2002). In 2007, Professors Mark Henaghan and Helen Nicholson, Messrs Martin Chadwick and Brett Woodley and I were pleased to undertake a review of the School of Physiotherapy at the University of Otago and note,

> Its continued evolution to an academic department with vibrant research, learning and teaching which attracts both local and international coursework and research students and furthermore for the local profession … for the generous way in which they work with the Physiotherapy School (Henaghan et al 2007).

There are many opportunities for future alliances with increased educational harmony, research collaboration, cooperation on accreditation and registration matters and joint political advocacy. The challenges and tyranny of distance faced a century ago have disappeared with ease of travel for face-to-face meetings and electronic communications.

I would encourage closer collaboration in further development of specialisation. The Australian Physiotherapy Association first proposed specialisation in 1954 and the Australian College of Physiotherapists was inaugurated in 1971. Roberta Shepherd and Barry Stillman were awarded the first Fellowships by original contribution in 1977, followed by Geoffrey Maitland, Jeanne-Marie Ganne and Janet Carr (Australian College of Physiotherapists 1969-1980). This occurred when postgraduate diplomas (1974) and physiotherapy undergraduate degrees (1977) commenced. Later fellowship by specialisation in orthopaedics (manipulative and sports), neurological, cardiothoracic, obstetrics and gynaecological and paediatrics were available, first awarded in manipulative physiotherapy in1984, to Patricia Trott, Brian Edwards and Geoffrey Maitland. The New Zealand Physiotherapy Society was similarly debating issues of professional development and a New Zealand College commenced in 1993 (New Zealand College of Physiotherapy 2013).

Uptake of specialisation was slow in Australia until recently when a new three-tier process was introduced, increasing numbers substantially (Australian College of Physiotherapists 2013). I contend that it is timely for shared specialist disciplinary colleges, as foreshadowed by the specialist Sports physiotherapy groups collaborating. The Royal Australasian College of Physicians is responsible for training, educating, and representing over 9,000 physicians and paediatricians in Australia and New Zealand. This is one example of many specialist Australasian health and medical discipline alliances. We set the scene in this part of the world with an Australasian association to represent our members. Is it timely to reconsider strengthening our ties further as we address the opportunities and challenges of this millennium?

KEY POINTS

- Australian and New Zealand physiotherapists agreed on their educational and professional requirements in 1906.
- Since the 1990s the association between the two countries has been strengthened through political action, the Council of Physiotherapy Deans Australia and New Zealand, accreditation and registration processes.
- Further collaboration such as in specialisation is encouraged.

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CONFLICT OF INTEREST

There are no conflict of interest issues in this research.

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Activity patterns in people with neurological conditions

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ABSTRACT

Walking is often impaired following a neurological insult; however, little is known how daily activity patterns are affected. The aims of this pilot study were to describe activity patterns of individuals with neurological conditions and examine the relationship between activity patterns and clinical walking tests. Twenty-two participants with neurological conditions were recruited and fitted with a StepWatch to record all steps taken over seven days. Daily activity patterns were compared to a sample of healthy adults and the relationship between clinical walking tests and activity patterns was evaluated. The activity patterns of adults with neurological conditions were similar to healthy adults with a high frequency of low numbers of steps in a row, interspersed with short rest periods. However, a greater proportion of activity bouts involved short duration activity (<30seconds) in people with neurological conditions (71% of all bouts) when compared to healthy individuals (60% of all bouts). Adults with neurological conditions had significantly different daily activity patterns (average steps, $p<0.001$; average minutes of activity, $p<0.001$; total number of activity bouts, $p<0.001$; variability of activity, $p<0.001$) to healthy adults and older adults with functional limitations. Because walking bouts are shorter and more frequent, it could be inferred adults with neurological conditions do not cover as much distance as healthy adults. The only significant correlation between clinical walking tests and activity patterns was between the Rivermead Mobility Index and average daily steps ($r=.45$; $p<0.01$). The findings from this study may assist in the development of more specific walking rehabilitation, including retraining acceleration and deceleration together with the ability to cover distances required for functional community ambulation.

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INTRODUCTION

Walking is an important aspect of independent functioning needed for many activities of daily living and community participation. It is therefore important that walking can be quantified to determine an individual's functional walking ability. This is generally achieved by using objective (e.g. six minute walk test and self selected gait speed tests) and self-reported (e.g. ABILOCO and Rivermead Mobility Index) tests in a clinical setting.

Recently, accelerometry, such as the StepWatch Activity Monitor™ (StepWatch) (Orthocare Innovations, Prosthetics Research Study, Seattle, WA, USA), has been used to quantify aspects of walking ability over extended periods of time in real world environments. The StepWatch is a valid and reliable tool (de Bruin et al 2008) which records information about the quantity and rate of stepping, together with more specific aspects of walking activity over a period of time, including total steps, steps in a row, walking bout durations and rest period durations (Coleman et al 1999, Storti et al 2008).

The StepWatch is worn on one leg and has an inbuilt custom sensor to detect acceleration, position and timing to determine one step. The sensitivity of the StepWatch means it can be used to assess slow or altered gait patterns in populations known to have impaired walking abilities (Busse et al 2009, Mudge and Stott 2009).

Although activity monitors are typically used to provide information about total steps and cadence, they can provide more information about overall activity patterns. However, to date, only two studies have used the StepWatch to quantify and describe specific aspects of walking and activity patterns in this way (Cavanaugh et al 2007, Orendurff et al 2008).

Orendurff et al (2008) investigated the length of walking bouts in time, number of sequential steps and rest periods of ten healthy, sedentary employed adults (aged 36.6 SD 14.8 years) in an urban environment during normal daily living. The study found that 60% of all walking bouts lasted for 30 seconds or less and walking bouts of two minutes or more occurred only one percent of the time. Forty percent of all walking bouts entailed fewer than 12 sequential steps and 75% of all walking bouts had fewer than 40 sequential steps. Rest periods were typically very short; 50% were 20 seconds or less (Orendurff et al 2008). In summary, the study found that healthy individuals take part most frequently in walking bouts comprised a low number of steps, in short duration, interspersed with short rest periods.

Cavanaugh et al (2007) collected StepWatch data over six days in thirty healthy younger adults (aged 36.6 SD 2.6 years), twenty-eight healthy retired older adults (aged 83.7 SD 2.3 years) and twelve older adults (aged 79.3 SD 4.5 years) with functional limitations. All participants lived in the community. Average daily values for number of steps, number of minutes spent active, number of activity bouts, variability of minute to minute activity and randomness of minute-to-minute activity fluctuations were calculated. Healthy older adults had a lower number of activity bouts than younger adults. Older adults with functional limitations had lower numbers of steps, number of active minutes, number of activity bouts and variability when compared to healthy younger adults. This study revealed that activity bouts, activity duration, step count and variability decrease with age and functional limitation (Cavanaugh et al 2007).

Although activity patterns have been explored in healthy individuals and older adults with functional limitations, activity patterns of individuals with neurological conditions have not been described. It is known that individuals with neurological conditions often experience reduced or impaired walking ability (Pearson et al 2004), however, little is known about whether this change alters daily activity patterns in those with a neurological condition. It is also not clear how these activity patterns relate, if at all, to clinical outcome measures. Significant relationships between the two may provide clinicians with further insight into an individual's mobility outside a clinical environment.

The aim of this study was to describe the daily activity patterns of individuals with neurological conditions, in particular, walking bout duration, sequential step count and rest period duration. A further aim of the study was to examine the association between activity patterns and clinical walking tests and also to compare the activity patterns of individuals with neurological conditions to those of healthy adults from previously reported studies (Cavanaugh et al 2007, Orendurff et al 2008).

METHODS

The study was approved by the Institutional Ethics Committee (EA1_0408) and informed consent was given by each participant. Participants were recruited through community support organisations and private rehabilitation clinics for convenience. The inclusion criteria were a diagnosis of a neurological condition for more than six months, the ability to walk independently with or without the use of a walking aid and aged over 18 years. Participants were excluded if they had Parkinson's disease or other conditions resulting in inconsistent step length from step to step, which could lead to an inability to calibrate the StepWatch. People with other health conditions known to alter or limit normal activity patterns were also excluded (e.g. cardiorespiratory disease).

Participants took part in a one hour session at a university to administer the following tests: The Rivermead Mobility Index (RMI) (Collen and Wade 1991), Activity-specific Balance Confidence Scale (ABC) (Powell and Myers 1995), ABILOCO (Caty et al 2008), the six minute walk test (Flansbjer et al 2005), self-selected and fast gait speed tests (Bohannon 1992). A StepWatch was calibrated and attached to each participant's less affected ankle and tested at fast, self-selected and slow gait speeds to check calibration and recalibrate if needed until 100% accurate at these speeds. The StepWatch was set to record all steps taken by the less affected leg in ten-second intervals, 24 hours a day, for seven consecutive days. An explanation regarding care of the StepWatch was provided, together with instructions on how the monitor was to be worn. On completion of the seven days, if any data from the StepWatch were missing, the StepWatch was re-calibrated and worn by the participant for additional days to complete seven days of monitoring.

The StepWatches were collected from participants at the end of the monitoring period and the data downloaded to the StepWatch software. Daily average walking bout duration, sequential step count, rest period duration, minutes of activity, number of activity bouts, variability of activity and total step count were calculated for each participant.

A walking bout was defined as a period of time in which sequential steps occurred in subsequent ten-second intervals, consistent with Cavanaugh et al (2007). A walking bout ended when no steps were recorded in the subsequent ten-second interval. A rest period was defined as a period of time in which no steps occurred in the prior or subsequent ten-second interval. An error was considered when only one step (a singleton) was recorded in a ten-second interval, when no prior or subsequent steps appeared in an adjoining ten-second interval. Therefore, all singletons were removed and two foot-offs of the same foot (4 SD 1 steps) was the lowest step count included in the calculations. Variability of activity was defined as the dispersion or spread of activity and was calculated based on minutes of activity and divided by the coefficient of variation (CV = 100 x standard deviation/mean) (Cavanaugh et al 2007).

The data calculated were then compared with that of previously reported healthy adults (Orendurff et al 2008). Permission was granted and raw data obtained for the comparison of younger adults, older adults and older adults with functional limitations (Cavannagh et al 2007). The calculated data were also compared with the clinical walking tests.

Statistical Analysis

The Kolmogorov–Smirnov test was used to test variables for normality. The level of association between the variables was investigated using the Spearman rank correlation coefficient for variables without a normal distribution, and the Pearson correlation coefficient for variables following a linear distribution, with significance accepted at the 0.05 level. The correlation coefficients were interpreted as 0.90, very high; 0.70 to 0.89, high; 0.50 to 0.69, moderate; 0.30 to 0.49, low; and less than 0.29 as little, if any correlation (McDowell 2006). Calculations were performed using SPSS, Version 17.0. Kruskal Wallis one-way analysis was used to test for similar medians among differing samples in data not normally distributed and one way ANOVA for normally distributed data.

RESULTS

Twenty-two adults with a neurological condition were recruited. The data from one participant was excluded as it was incomplete, leaving data from 21 participants for analysis. Individual participant information is shown in Table 1. The results of the clinical walking tests and self report questionnaires were not normally distributed and are reported in Table 2.

Daily activity

The comparison of data obtained from adults with neurological conditions from this study and Cavanaugh et al's (2007) data of younger adults, older adults and older adults with functional limitations is shown in Table 3. The differences in the means showed significant differences in the daily activity patterns

Table 1: Individual Participant Information

Age	Sex	Ethnicity	Neurological Condition	Mobility Aid	Height (cm)
48	F	European NZ	Myotonic Dystrophy	Nil	173
43	F	European/ British	Cerebral Palsy	Nil	166
44	F	Chinese	Spinal Cerebellar Ataxia	Nil	148
48	F	European NZ	SCI (T5)	SPS, Frame, W/Chair	163
61	M	European NZ	MS	SPS, Frame, W/Chair	175
36	M	European NZ	GBS	Nil	178
60	F	European NZ	MS	Frame in community	160
48	M	European NZ	Stroke	Nil	174
43	M	Maori Chinese	Stroke	Nil	171
61	M	European NZ	Stroke	Nil	167
57	F	European NZ	Stroke	SPS	163
21	M	European NZ	SCI (C2)	Nil	174
43	F	European NZ	MS	Nil	165
40	M	European NZ	MS	Nil	181
77	M	European NZ	Stroke	Nil	177
25	F	European NZ	SCI (C6/7)	SPS	176
71	M	European NZ	Stroke	Nil	177
81	F	European NZ	Stroke	Nil	163
53	F	Chinese/Hong Kong	Stroke	Quad Stick	153
62	F	Maori	Stroke	SPS indoor, w/frame outdoor	166
19	M	NZ European/Australian Aboriginal	Cerebral Palsy	SPS, Frame, W/chair	19
20	M	European NZ	Cerebral Palsy	Frame, W/chair	19

Key: F = female, M = male, NZ = New Zealand, SCI = spinal cord injury, MS = multiple sclerosis, GBS = Guillain Barrè Syndrome, w/chair = wheelchair, w/frame = walking frame, SPS = single point walking sticks

Table 2: Results of initial clinical walking tests and self-report questionnaires

Clinical Test	Median	Range
Rivermead Mobility Index	13.2	9-15
ABILOCO (raw score)	11.5	5-13
Activities-Specific Balance Confidence Scale	72.1%	16.0-98.8%
6 Minute Walk Test	309m	80-545m
Self-selected Gait Speed	1.0m/s	0.2-1.4m/s
Self-selected Step Length	0.48m	0.15-0.67m
Fast Gait Speed	1.3m/s	0.3-2.0m/s
Fast Gait Step Length	0.59m	0.17-1.1m

Abbreviations: m = metres, m/s = metres per second.

between the groups. Individuals with neurological conditions had a significantly different average number of daily activity bouts ($p < 0.001$), minutes of activity ($p < 0.001$) and variability of activity ($p < 0.001$) than the healthy younger and older adult, and older adult with functional limitations samples. However, adults with neurological conditions had similar average daily step counts to healthy adults and older adults, but showed a significant difference from older adults with functional limitations ($p < 0.001$).

Walking and rest bout durations

The average values of steps in a row, frequency of walking bouts, walking bout durations and rest bout durations of adults with neurological conditions were calculated. The data were then compared with Orendurff et al's (2008) data from healthy individuals.

Steps in a Row: Adults with neurological conditions participated in short duration walking bouts with a high occurrence (17.3%) of low numbers of steps in a row (4 SD 1) (Figure 1). Twelve (SD 1) or fewer steps per bout accounted for 44% of all walking bouts, and 40 (SD 1) steps or fewer accounted for 75% of all walking bouts. Healthy individuals show a similar pattern of sequential steps. The lowest step count of 4 (SD 1) steps was also the most frequent, totalling 17% of all walking bouts. Forty percent of all walking bouts were 12 (SD 1) steps or fewer. Similarly, 75% of all walking bouts had step counts of 40 (SD 1) steps or fewer.

Table 3: Comparison of activity patterns between differing populations

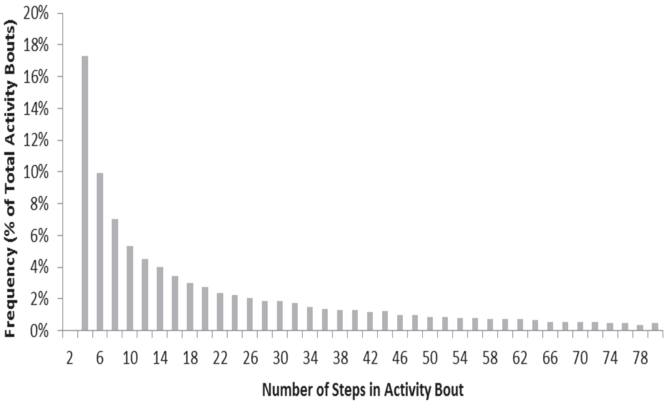
Variables of Activity Patterns	Adults with Neurological Conditions	Healthy Younger Adults[a]	Healthy Older Adults[a]	Older Adults with Functional Limitations[a]
Total Steps	9,997*	11,075	9,982	7,682
Total Minutes of Activity	197**	400	336	298
Total Number of Activity Bouts	227**	77	68	63
Variability of Activity (%)	38**	100	93	85

[a] Data reproduced with permission from Cavanaugh et al 2007.

* Significant difference between adults with neurological conditions and older adults with functional limitations (p<0.001)

** Significant difference between adults with neurological conditions, and healthy older and younger adults and older adults with functional limitations (p<0.001)

Figure 1: Frequency of sequential step counts in individuals with neurological conditions



Walking Bout Duration: Figure 2 shows that individuals with neurological conditions have a high frequency (41%) of short duration bouts (10 seconds). Healthy individuals, similarly engage most frequently in short duration bouts (10 seconds and 20 seconds, occurring 20% and 26% respectively).

Rest Bout Durations: Individuals with neurological conditions most commonly took rest periods of short duration (10 – 20 seconds) throughout the day, encompassing 52% of all rest bouts daily (Figure 3). Rest bouts up to 3 minutes in length total, 88% of all rest bouts, similar to the patterns of rest taken by healthy individuals. Rest durations of 10 or 20 seconds accounted for 50% of all rest bouts. As the rest duration increases, the frequency of rests decreases in both groups.

Relationship between the daily walking activity of individuals with neurological conditions and clinical walking tests

In general, the clinical walking tests (self-selected and fast gait speed tests and 6MWT) and the self-report questionnaires (RMI, ABILOCO and ABC) showed little to low correlation with walking activity in individuals with neurological conditions (Table 4). The only significant, but low correlation was between the total number of steps per day and the RMI (r=.45; p<0.01).

Figure 2: Frequency of walking bout durations in individuals with neurological conditions

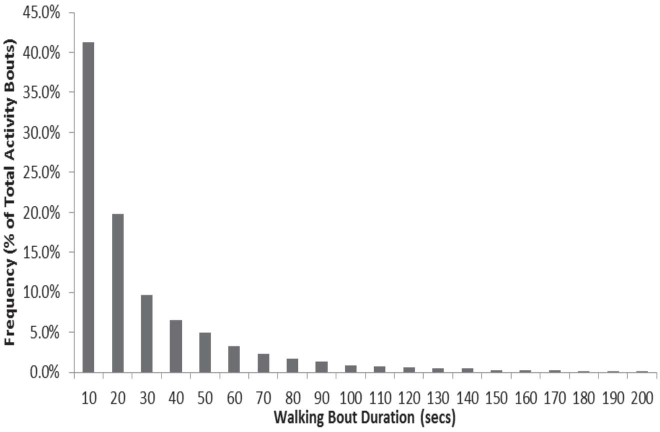
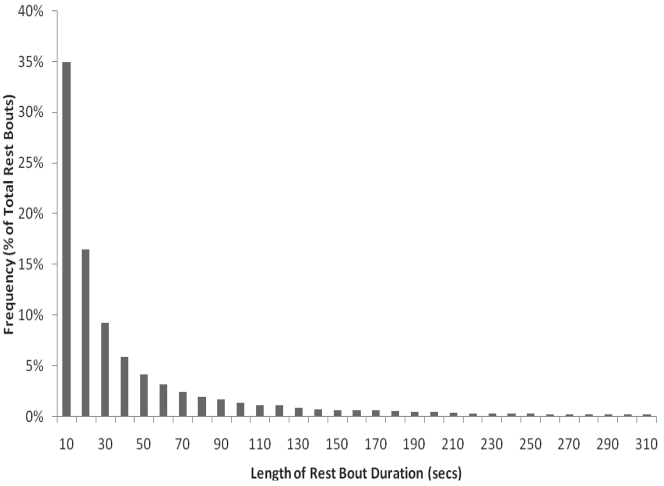


Figure 3: Daily frequency of rest bout durations for individuals with neurological conditions



DISCUSSION

Our findings show that while individuals with neurological conditions and healthy adults have a similar number of total

Table 4: Association between activity patterns and clinical walking tests for people with neurological conditions (Spearman correlation r-values)

	6MWT	SSGS	FGS	RMI	ABILOCO	ABCS
Total Steps	.178	.159	.093	.449*	.208	.428
Total Minutes	.022	.087	-.023	.212	.109	.227
Variability	.229	.344	.329	.155	.226	.174
# of Bouts	-.045	.073	-.055	.121	.172	.11

*Significant 0.05 level (2-tailed).

Total Minutes = total minutes of activity, Variability = variability of activity, # of Bouts = total number of activity bouts.

Abbreviations: SSGS, Self-selected gait speed; FGS, fast gait speed.

steps; the number of steps in a row and the length of rest periods taken over the course of a day differ. Individuals with neurological conditions take more short duration walking bouts per day. These activity bouts are shorter and occur more frequently than those of healthy adults.

Possible reasons for shorter walking bouts within the neurological sample include poor levels of fitness and/or inefficient and disrupted gait patterns. It is well known that people with neurological impairments have reduced cardiorespiratory fitness, which is likely to limit walking endurance (Kelly et al 2003). Increased energy expenditure caused by gait disturbances associated with neurological conditions, together with decreased walking endurance may contribute to shorter activity bouts (Macko et al 1997).

Individuals with neurological conditions generally have a shorter step length (Brandstater et al 1985, Reid et al 2011). The mean step length of participants in this study was 0.48 metres at self-selected speed, which is almost half that previously reported for healthy adults (Bilney et al 2003). An increased number of activity bouts may be one way in which individuals with neurological conditions compensate for covering a reduced distance during activity bouts. So shorter bout duration and decreased step length together may be associated with the higher number of daily activity bouts taken by adults with neurological conditions.

Achieving functional distances is important for successful integration within the community (Lord et al 2004). Research suggests that 300 metres was the minimum distance required for safe community ambulation (Lerner-Frankiel et al 1986), however, there is some question whether this distance is underestimated (Andrews et al 2010). Even with the increase in the number of daily activity bouts described in this study group, the time spent active is still almost half that of healthy adults. This suggests adults with neurological conditions may not be achieving functional distances and may not be able to access important community locations.

The variability of activity patterns of individuals with neurological conditions is much lower than that reported for healthy adults (Cavanaugh et al 2007, Orendurff et al 2008). Low variability of activity suggests that individuals with neurological conditions participate predominantly in orderly and repetitive activities. Other studies have shown that individuals with neurological conditions often function closer to their maximal functional capacity than healthy adults (Dean et al 2001). It also suggests a reduced ability to adapt to unexpected changes in the environment, which would again impact on functional independent living (Cavanaugh et al 2007). Given this, adults with neurological conditions may use a less flexible and more ordered daily structure as a strategy to ensure completion of activities.

Gait speed and endurance have previously been shown to correlate with total steps per day (Busse et al 2006, Mudge and Stott 2009), however, we found little to no correlation between the clinical gait tests and total steps or other measures of activity patterns. Although our participants walked at a similar speed to participants in previous studies (Busse et al 2006, Mudge and Stott 2009), they took a relatively high number of steps per day, in the magnitude of what would be expected from healthy older adults (Cavanaugh et al 2007). This may account for the low correlation.

Clinical Implications

The results of this study may assist practitioners to target very specific aspects of walking retraining. For example, daily activity patterns in individuals with neurological conditions were made up of a large number of short bouts of activity, similar to healthy adults. This shows that initiation and termination of gait are undertaken multiple times each day together with speed modulation, which requires acceleration and deceleration with each bout. This suggests that, as well as training walking speed in one direction, changing speed and direction may also need to be assessed and trained in order to prepare individuals with neurological conditions for community walking.

Based on the activity patterns described in this study, early rehabilitation may need to include the retraining of initiation, acceleration, deceleration and termination of gait. Retraining should also occur in multiple bouts of short duration, which are interspersed with short periods of rest to replicate the described patterns of activity. This initial training would be seen as a preparation for longer bouts or endurance training as is needed for achieving the distances required in the community.

Later gait rehabilitation can be targeted more specifically by increasing the length of walking bout duration, improving step length, and establishing longer distances walked in order to achieve the patterns and distances undertaken by healthy older and younger adults. This would assist individuals with neurological conditions to achieve functional community distances, and therefore independence within the community setting.

Limitations

The heterogeneity of neurological conditions and small sample size may have limited the appearance of relationships and patterns within the data. In saying this, the information from this pilot study could be used for further studies looking at more homogeneous populations or larger sample groups. This study also cannot be generalised to people with inconsistent step length from step to step due to the inclusion criteria, which limits the findings of the study.

Other factors may have influenced walking activity during the collection of data. Health concerns and unfavourable environmental conditions may have limited the amount of activity undertaken. On the other hand, factors such as individual behaviour and wanting to achieve “good results” may have caused increased walking activity. However, apart from individual behaviour, these factors represent normal features of daily activity and, as such, may not be considered a limitation. Recollection of data was not performed on the particular days of the week that were missed during the initial seven days. This may have had an impact on individual results, as certain days may have been significant for individual routines.

Further research should focus on whether rehabilitation changes activity patterns over the course of the rehabilitation period. If not, investigations into whether activity patterns or aspects of activity patterns are amenable to change may be required. For example, changes may be dependent on a number of factors such as disease progression, the severity of the neurological condition, the use of assistive devices and behavioural influences.

CONCLUSION

The StepWatch was used to describe the activity patterns of individuals with neurological conditions demonstrating that participants were active for shorter durations, with fewer steps in a row, which was interspersed with short periods of rest compared to healthy adults. Participants also covered less distance than previously reported by healthy adults. This information may assist in the development of more specific walking rehabilitation. Training should include retraining acceleration and deceleration, and focusing on increasing the duration of walking in single bouts, together with the ability to cover distances required for functional community ambulation.

KEY POINTS

- Adults with neurological conditions walk in bouts with low step counts interspersed with short, frequent rest periods, similar to healthy adults.
- Adults with neurological conditions take a higher number of short duration bouts than healthy individuals do.
- While adults with neurological conditions had a similar number of total steps per day to previously reported data from healthy adults, overall variability and activity levels were less.
- Rehabilitation may initially need to include a focus on more specific aspects of walking, such as acceleration and deceleration and short bursts of activity, as well as achieving functional walking distances.

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Use and validation of the Balance Outcome Measure for Elder Rehabilitation in acute care

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ABSTRACT

This paper reports on the concurrent validity of the Balance Outcome Measure for Elder Rehabilitation (BOOMER) while investigating balance, mobility, and perceived confidence to undertake daily activities experienced by patients at discharge from an Internal Medicine Unit; and seeks to determine if there are differences between patients discharged to rehabilitation to those discharged to their usual residence. Forty-four adults (30 female) average age 77 (SD 7) years, admitted with an acute illness to hospital consented to participate in this study. Balance was measured using the BOOMER and the Berg Balance Scale (BBS). Mobility was measured using the de Morton Mobility Index (DEMMI) and participants' perceived confidence in balance to undertake daily activities determined using the Activities-specific Balance Confidence (ABC) scale. BOOMER scores were highly associated with BBS scores ($r = .93$, $p < 0.001$) and raw DEMMI scores ($r = .89$, $p < 0.001$) while moderate associations with perceived confidence ($r > .52$, $p < 0.001$) were determined. Participants discharged to their usual residence had significantly higher balance and mobility scores compared to those requiring further rehabilitation; no difference was found for ABC scores. Concurrent validity of the BOOMER, BBS and DEMMI was established, supporting use of these tools to measure balance and mobility of patients at discharge from acute care.

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Key words:Hospital Related, Rehabilitation, Geriatric Assessment, Functional Performance, Balance, Falls

INTRODUCTION

Following hospitalisation for an acute illness many older adults experience functional decline (Covinsky et al 2003). This decline is likely multifactorial in nature; associated with the reason for the hospital admission, the subsequent reduced activity levels (Kuys et al 2012) and the patient's pre-existing functional level (Buttery and Martin 2009). Typically, acute care wards are not set up to offer extensive rehabilitation to ameliorate this functional decline. In fact, a recent study highlighted the difficulties associated with implementing an exercise programme in an acute care setting (Brown et al 2006). In addition, there appears to be a perception among staff and patients, that neither is interested in the patient getting up and out of bed (Brown et al 2007). Although an association between perceived confidence, balance, and mobility has been established for community dwelling older adults (Hatch et al 2003), the association between older adults perception of their confidence in their balance to perform everyday tasks when hospitalised with an acute illness has not been investigated. For those who experience the greatest functional decline or are at greatest risk of functional decline, early transfer to inpatient rehabilitation is the preferred option to maximise functional ability and minimise activity limitations.

One simple strategy associated with improved clinical outcomes, shorter length of stay (Harari et al 2007), and greater likelihood of remaining living at home in 12 months (Barer 2011) is the use of a comprehensive geriatric assessment for older adults hospitalised with an acute illness. It appears that such assessments result in early and appropriate geriatric intervention and management and have been associated with health outcomes such as mortality, functional decline, and quality of life (Abellan van Kan et al 2009; Graham et al 2008). Mobility and balance are key elements of a comprehensive geriatric assessment (Hubbard et al 2011). Using tools that measure balance and mobility and differentiate between those patients requiring further inpatient rehabilitation from those able to be discharged to their usual residence would help staff in acute medical settings prioritise use of resources.

The Berg Balance Scale (BBS) was originally developed as a clinical balance measure specific for older adults (Berg et al 1989). Despite its use in acute care settings (Graham and Norton 1999, Wee 2003), clinical utility of the BBS has been questioned with up to 20 minutes required to complete the measure (Blum and Korner-Bitensky 2008) and a lack of meaningfulness of the scores (Downs et al 2013) potentially limiting its use. Two recently developed tools of mobility and balance specifically target older hospitalised inpatients. The de Morton Mobility Index (DEMMI) comprises 15-items measuring mobility of all older adults regardless of mobility status (de Morton et al 2008). The Balance Outcome Measure for Elder Rehabilitation (BOOMER) (Haines et al 2007, Kuys et al 2011) appears to be a valid measure of the standing balance construct comprising common measures of static stance (feet together eyes closed) (Cohen et al 1993), functional reach (Duncan et al 1990), step test (Hill et al 1996) and timed up and go test (Podsiadlo and Richardson 1991). The BOOMER which can be administered in approximately 5 minutes, has been previously validated for use with geriatric rehabilitation inpatients (Kuys et al 2011) but further testing is required in the acute in-patient setting. It is not known if the BOOMER is valid to use in an acute care setting and if it is able to differentiate between the balance and mobility of patients able to be discharged to their usual residence compared to those requiring further inpatient rehabilitation.

The main purpose of this study was to determine concurrent validity of the BOOMER with measures of balance, mobility, and patients' perception of confidence in their balance to undertake daily activities at discharge from an Internal Medicine Unit. A second purpose was to determine if balance, mobility, and perceived confidence differed between older adults requiring inpatient rehabilitation and those discharged to their usual residence.

METHOD

A prospective cohort study was conducted over a six month period with a convenience sample of acute inpatients discharged from the Internal Medicine Unit of a tertiary referral teaching hospital in Brisbane, Australia. This Internal Medicine Unit comprised 76 beds across three wards. Typically patients admitted were at least 65 years old with a range of diagnoses including falls and related injuries, dementia and/or delirium, chronic diseases or acute infections such as urinary tract infections (Kuys et al 2012). Institutional Ethics Committees approved this study and all participants provided written informed consent.

Participants were eligible to be recruited to this study if aged at least 65 years old, scored at least 24 on the Mini Mental State Exam (Folstein et al 1975) and were discharged to their usual residence or inpatient rehabilitation. Patients were excluded if they were unable to provide informed consent. Participants were assessed within 48 hours prior to hospital discharge by a blinded assessor who was not involved in the care of the patient. Assessments were conducted over two days to minimise the effect of fatigue. Clinical information and demographics were recorded on the first day, along with the DEMMI assessed at the bed side. Perceived confidence (ABC) and balance measures (BBS and BOOMER) were assessed on the second day. Relevant clinical and demographic information recorded included age, sex, admission diagnosis, home support at admission, falls history in last 6 months, length of hospital stay, and discharge destination to inpatient rehabilitation or to usual residence.

Balance was measured using the BOOMER and the BBS. Mobility was measured using the DEMMI and perceived confidence determined using the Activities-specific Balance Confidence (ABC) scale. The BOOMER includes four balance measures - static stance with feet together and eyes closed, functional reach, step test and the timed up and go – with the performance of each task rated (0-4) resulting in a maximum possible score of 16 (Haines et al 2007). The BBS comprises 14 items of static and functional balance tasks, scored on a five-point scale with a maximum score of 56 (Berg et al 1992, Berg et al 1996). The DEMMI, developed and validated for use with older patients in acute medical inpatient settings (de Morton et al 2008, de Morton et al 2010, de Morton et al 2011), comprises 15-items including bed mobility, sitting balance, static and dynamic standing balance, and walking. The tool is scored out of 19 and this score is then converted to an interval scale ranging from 0 to 100. The ABC scale (Myers et al 1998, Myers et al 1996, Powell and Myers 1995) includes 16 everyday tasks with participants required to identify their perceived confidence to undertake these tasks (0-100%) with a maximum score of 100% able to be calculated.

Data analysis

Descriptive analyses were conducted for all measures at discharge from the Internal Medicine Unit. Concurrent validity of the BOOMER with the BBS and the DEMMI was determined using correlational analyses. A clinically meaningful result was determined a priori as achieving a correlation coefficient of at least 0.7, which has been suggested to demonstrate evidence of validity between measures of a similar construct (Fitzpatrick et al 1998). Differences in balance, mobility, and perceived confidence for those participants discharged to their usual residence compared with those requiring inpatient rehabilitation were determined using independent t-tests or nonparametric equivalent as necessary. Balance and mobility measures were also correlated with perceived confidence. Data were analysed using SPSS Statistic Package, V19.0. Significance was set at 0.05.

RESULTS

Participant characteristics

Forty-four patients consented to participate in this study across the study period; 14 males and 30 females (Table 1). The most common reason for admission was falls, with more than one-third of recruited patients admitted following a recent fall. Approximately 70% of participants (n = 31) were discharged to their usual residence, three of whom received domiciliary rehabilitation, and 30% were discharged to inpatient rehabilitation. Participants discharged to inpatient rehabilitation were significantly more likely to have had a fall as the reason for their hospital admission than those discharged to their usual residence (Chi Square 7.452, $p < 0.001$). The average (SD) length of stay for the entire cohort was 9 (5) days.

Table 1: Participant characteristics

Characteristic		All participants (n = 44)	Discharged to usual residence (n = 31)	Discharged to inpatient rehabilitation (n = 13)
Sex n (%)				
	Males	14 (32)	13 (30)	1 (2)
	Females	30 (68)	18 (41)	12 (27)
Age (years) Mean (SD)		77 (7)	78 (7)	77 (8)
Diagnosis, n (%)				
	Falls	16 (36)	7 (16)	9 (21)
	Geriatric condition including delirium, malaise, Reduced mobility	10 (23)	6 (14)	2 (5)
	Pneumonia	5 (11)	5 (11)	0
	Other	13 (30)	10 (23)	3 (7)
Residence on admission, n (%)				
	Home alone	23 (52)	18 (41)	5 (11)
	Home with carer / spouse	15 (34)	9 (20)	6 (14)
	Low-level Aged Care Facility	6 (14)	4 (9)	2 (5)
Falls history				
	None in last 6 months	17 (39)	16 (32)	1 (2)
	At least one fall in last 6 months	27 (61)	15 (34)	12 (27)
Length of stay / Days Mean (SD)		9 (5)	8.7 (5.4)	8.6 (4)
Mini Mental State Exam /30 Mean (SD)		27 (2)	27 (2)	26 (2)

Validity of using the BOOMER in acute care setting

BOOMER scores were significantly associated with BBS (rho = .93, $p < 0.001$), raw DEMMI (rho = .89, $p < 0.001$) and converted DEMMI scores (rho = .82, $p < 0.001$) when both tools were applied in the acute care setting. Balance performance measured using the BOOMER and the BBS achieved moderate, but significant associations with ABC scores relating to perceived confidence to carry out everyday tasks (rho > .55, $p < 0.001$).

Balance, mobility, and perceived confidence at discharge

Table 2 illustrates participant balance, mobility, and perceived confidence scores to carry out everyday tasks of participants discharged to their usual residence compared to those discharged to inpatient rehabilitation. Those participants discharged to their usual residence had significantly higher DEMMI and balance (BBS and BOOMER) measures but had similar scores on the ABC compared to those referred for inpatient rehabilitation services.

Patients hospitalised following a fall

Given the high proportion of fallers admitted to hospital compared to those with other medical reasons for their hospital admission, further analyses were undertaken for the two groups. Table 3 shows the differences between balance, mobility, and perceived confidence scores for these groups of participants. Significantly lower scores for all measures were found for those adults living in community who had recently had a fall which required them to be admitted to hospital.

DISCUSSION

This study determined that the BOOMER was valid to use in an acute care setting with hospitalised older adults. The BOOMER has not previously been used in an acute care setting although discharge scores were similar to those reported for patients discharged from an inpatient rehabilitation unit (Kuys et al 2011, Haines et al 2008). In line with the DEMMI and BBS, the BOOMER differentiated between patients discharged to their usual residence compared to those discharged to inpatient rehabilitation; supporting the view that the tool has concurrent validity in an acute care setting. This view is further supported by the very high correlations between BOOMER scores with BBS and DEMMI scores. Thus the BOOMER could be recommended for use in the acute care setting as a tool to guide referral for rehabilitation or to determine those who could safely be discharged to their usual residence with recommendations to access community based education and falls prevention programmes.

Unexpectedly we determined that significant balance and mobility deficits were experienced by this group of older adults on discharge from an acute care medical inpatient setting. Balance performance in our study cohort was quite limited considering the BBS score (median 37, IQR 24-47), even for those discharged to their usual residence (BBS 43, IQR 31-49). Previous studies have reported that a BBS score of 45 or lower is indicative of a falls risk for older adults hospitalised in acute care settings (Scott et al 2007) as well as community-dwelling older adults (Perell et al 2001). Indeed a recent study reported that many older adults with BBS scores above 45 still have falls

Table 2: Participant balance, mobility, and perceived confidence scores at discharge to carry out everyday tasks

Measures	All participants (n = 44)	Discharged to usual residence (n = 31)	Discharged to inpatient rehabilitation (n = 13)
de Morton Mobility Index raw / 19: Median (IQR)*	14 (9-16)	15 (12-16)	7 (3-10)
DEMMI scaled / 100%: Mean (SD)*	50 (19)	57 (14)	732 (19)
Berg Balance Scale /56: Median (IQR)*	37 (24-48)	43 (31-49)	16 (5-30)
Balance Outcome Measure for Elder Rehabilitation /16: Median (IQR)*	8 (5-12)	10 (6-12)	1 (0-6)
Activities Balance Confidence Scale /100: Mean (SD)	65 (21)	67 (20)	59 (25)

IQR: Interquartile range

* Statistical significant difference between those discharged to their usual residence compared to those discharged to inpatient rehabilitation, $p < 0.001$.

Table 3: Participant balance, mobility, and perceived confidence scores at discharge for patients grouped by reason for admission (admission following a fall or management of an acute medical condition)

Outcome Measures	Patients admitted to hospital following a fall (n = 16)	Patients admitted for management of an acute medical condition (n = 28)
de Morton Mobility Index raw / 19: Median (IQR)*	9 (6-12)	15 (13-16)
de Morton Mobility Index scaled / 100: Mean (SD)*	38 (12)	56 (19)
Berg Balance Scale /56: Median (IQR)*	24 (7-30)	43 (33-50)
Balance Outcome Measure for Elder Rehabilitation /16: Median (IQR)*	4 (0-6)	10 (7-13)
Activities Balance Confidence Scale /100: Mean (SD)*	50 (23)	74 (14)

IQR: Interquartile range

* Statistical significant difference between those admitted following a fall compared to those admitted for management of an acute medical condition, $p < 0.001$.

and suggested that the tool may be better used for predicting multiple falls risk (Muir et al 2008). With approximately one-third of the total study cohort admitted to hospital following a fall, it is not surprising to find that balance performance was impaired. Balance impairment and prevalence of fallers in the study cohort suggest that even those discharged to their usual residence would possibly benefit from education and community based interventions to prevent a fall or recurrent falls.

Unlike the BBS, the BOOMER has not been investigated for its use as a falls prediction tool (Perell et al 2001, Scott et al 2007). Analysis of the balance impairment at hospital discharge of those who presented to hospital following a fall in the current study revealed that BOOMER scores differentiated between those admitted following a fall compared to other medical conditions. It is possible, therefore, that the BOOMER could be a predictive tool for falls within hospitalised and community dwelling older adults. Further prospective work needs to be conducted to investigate this premise.

It is interesting to note that perceived confidence to carry out everyday activities for the total cohort was similar for participants discharged to their usual residence and those transferred for inpatient rehabilitation and well under the reported scores for healthy older adults (Myers et al 1998, Myers et al 1996). It is possible, that these findings are due to our small sample size. However, as the balance and mobility measures were significantly lower for the inpatient rehabilitation group, it is also possible that this group had more insight into their reduced balance control as the majority (70%) were admitted following a fall. It is likely that those admitted for a medical reason – rather than a fall – may be the group with less insight into their balance ability, as those admitted following a fall reported significantly less confidence to carry out everyday tasks and were more likely to be transferred for inpatient rehabilitation than those admitted for a medical reason. The reduced confidence of the faller has been reported (Myers et al 1996), but studies exploring the tendency of the non-faller to overestimate their ability to manage everyday tasks were not identified. Further research into perceived confidence of people with high medical needs but without a falls history is warranted.

The BOOMER has some potential advantages for use in acute care settings. It is quick and easy to administer (Kuys et al 2011), is able to be used at the bedside, and appears to be able to differentiate between patients requiring inpatient rehabilitation as well those hospitalised following a fall. This makes the BOOMER an attractive measure for use in the acute care setting. Our findings suggest that those hospitalised following a fall, those who achieve a low score on balance and mobility tests towards discharge, and those who perceive reduced confidence to carry out everyday tasks should be considered for rehabilitation. Based on the evidence of our study findings, other patients with medical conditions may manage at home with or without the support of transition care services but would likely benefit from accessing community based education and falls prevention programmes.

Several limitations to this study need to be acknowledged. This study included a small sample of convenience and only participants who were willing and able to consent to participate were included which may limit the generalisation of our findings. We did not track all patients admitted to the Internal Medicine Unit during our recruitment period due to time constraints in this busy setting. The sample recruited to the study however, appears to be representative of those older adults without cognitive decline or dementia admitted to acute care settings. Another limitation to consider is the grouping of those participants discharged to their usual residence but who required domiciliary rehabilitation. A closer look at the balance and mobility measures of these three participants, revealed similar scores to those discharged to usual residence. However, our findings cannot be generalised to those older adults who receive domiciliary rehabilitation following discharge from hospital.

In conclusion, balance and mobility deficits were exhibited by patients discharged from an acute care setting. Those patients discharged to inpatient rehabilitation had greater balance and mobility impairments, yet did not report lower levels of perceived confidence, compared to those discharged to their usual residence. Those participants hospitalised following a fall also experienced greater balance and mobility impairments and also reduced perceived confidence compared to those admitted for some other medical reason. The BOOMER is valid for use in acute care settings; making it an alternative measure to the DEMMI and BBS. Additionally, the BOOMER can also be used to guide the referral process when discharging these older adults.

KEY POINTS

- The BOOMER is a valid measure for use in an acute care setting and could be used to guide the referral process when discharging these older adults.
- Significant balance and mobility deficits are experienced by older adults discharged from an acute care setting.
- There was no difference in perceived confidence experienced by older adults requiring rehabilitation compared to those discharged to their usual residence suggesting less insight or willingness to acknowledge underlying balance issues

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The frequency of hamstring stretches required to maintain knee extension range of motion following an initial six-week stretching programme

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ABSTRACT

Stretching exercises are commonly prescribed in training and rehabilitation programmes. The purpose of this study was to determine the frequency of on-going hamstring stretching required to maintain knee extension range of motion (ROM) following an initial stretching programme. A test-retest randomised control trial was undertaken. Sixty-three healthy male participants were randomly assigned to two stretch groups and a control group. Active knee extension (AKE) stretches were performed five days a week for an initial six weeks. Stretch group 1 then reduced the frequency of stretching to three days per week, and stretch group 2, to one day per week, for a further six weeks. The control group did not stretch. Active knee extension ROM was measured at baseline, weeks six and 12. A significant improvement in AKE ROM was observed in stretch group 1 (17.5° SD 11.8°) and 2 (18.8° SD 7.1°) after the initial six weeks of stretching ($p < 0.05$). After six-weeks of on-going stretching group 1 maintained their improvement in ROM, whereas stretch group 2 lost ROM. The difference between stretching groups was significant ($p < 0.05$) and no change in ROM was observed in the control group. These results indicate that an on-going hamstring stretching programme with a frequency of three times a week is required to maintain the initial improvement in ROM.

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Key words: hamstrings, extensibility, on-going stretching

INTRODUCTION

Stretching exercises are commonly prescribed during warm-up and cool-down protocols, and training and rehabilitation programmes, with the aim of improving muscle extensibility and joint range of motion (ROM) (Chan et al 2001, Reid and McNair 2004, Small et al 2008, Smith 1994, Willy et al 2001). Research has demonstrated that a stretching programme to the hamstring muscle group consisting of 15-60 seconds, one to three repetitions per day, five days a week, for six weeks is sufficient to elicit significant changes in knee extension ROM (Bandy and Irion 1994, Bandy et al 1997, Davis et al 2005, Decoster et al 2005, Reid and McNair 2004, Russell et al 2010, Willy et al 2001). While research supports the effect of stretching, it has been suggested that improvements gained from stretching programmes are short-lived and start to diminish following the cessation of stretching (Rubley et al 2001, Willy et al 2001). However, it is unclear how often a stretch needs to be performed each week to maintain the initial improvements in ROM.

Two studies have investigated the effect of on-going stretching following an initial stretching programme (Rancour et al 2009, Wallin et al 1985). Wallin et al (1985) investigated the effect of 30 days of proprioceptive neuromuscular facilitation (PNF) and ballistic stretching, and 30 days of on-going PNF stretching with different stretching frequencies from one to five times a week. The authors suggested that on-going stretching, once per week was sufficient to maintain the initial improvement. In a similar study, Rancour et al (2009) examined the effect of an on-going stretching programme of two to three times a week, following a four-week static hamstring muscle stretching programme. The results indicated that this continuing dosage was sufficient to maintain the initial increases in ROM. However, neither of these studies used a control group who did not undertake a stretching programme. In addition, research has demonstrated that the compliance rates with home exercise programmes are low and too many repetitions of the prescribed exercises can reduce compliance (Haynes 1979 Schneiders et al 1998, Sluijs et al 1993).

The hamstring muscle group is commonly acutely injured (Verrall et al 2001) and stretching is often used in the management of such injuries (Malliaropoulos et al 2004). Ensuring compliance and adherence to prescribed exercises has been shown to be a critical factor in outcomes of the exercise programmes and the frequency and number of the exercises prescribed also influences this compliance (Bassett 2003). Therefore, the purpose of the current study was to undertake a randomised control trial to determine the frequency of hamstring stretches required to maintain knee extension ROM following a six-week initial hamstring stretching programme. This study would also help determine the minimum number of stretches required to maintain ROM as this may improve compliance with on-going stretching programmes.

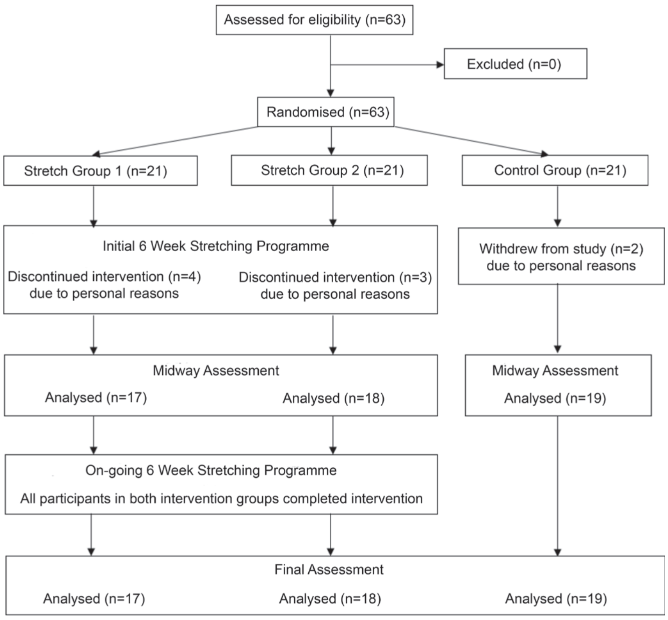
METHODS

Experimental Procedures

This was a 12-week study, using a test-retest randomised control trial design with repeated measures. Participants were randomly assigned using a computer-generated random number table to one of three groups: two intervention (stretch) groups and a control group. During an initial six-week programme, the frequency of stretches was the same for both stretch groups. For the six-week on-going stretching programme, stretch group 1 reduced the frequency of stretching to three times a week and stretch group 2 reduced to once a week. The control group did not perform any stretching exercises over the 12 week study period. Figure 1 outlines the flow of participants through the study.

This study was approved by the Auckland University of Technology (AUT) ethics committee.

Figure 1: Flow diagram of randomisation, intervention and assessment process



Participants

Participants were recruited from the student population of the Auckland University of Technology (AUT). Prior to data collection, written and verbal explanations of the experimental procedures were provided, and written consent was gained. Participants were included in the study if they were male, between the ages of 18-40 years of age and had tight hamstring muscles defined as having greater than 20° loss of passive knee extension ROM using the passive knee extension test (Nelson and Bandy 2004). Only male participants were recruited as there are sex differences that affect ROM measures (Cornbleet and Woolsey 1996, Shephard et al 1990). Participants were excluded if they had any current lower limb injuries or low-back pain or had been participating in a stretching regime over the past three months.

Based on previous research by Reid and McNair (2004), to detect an initial 10° change in knee extension ROM with 80% power and $p < 0.05$, a sample size of approximately 48 participants was determined appropriate, with 16 in each group (www.biomath.info/power).

Procedures

The AKE test, which has been shown to be highly reliable for measuring hamstring muscle tightness (r=0.99, Gajdosik and Lusin 1983), was used as the dependent variable. The participants were positioned in supine with the right hip and the knee flexed at 90°. This position was secured with a seat belt over the anterior pelvis and left thigh to reduce the potential movement of the pelvis during the test procedures, while the right thigh was in contact with a crossbar placed above the iliac crest. This was determined as the start position (Figure 2). Prior to assuming this position an electronic goniometer (Penny and Giles Blackwood Ltd., Gwent, UK); accurate to 0.5° (SD 0.41) (Piriyaprasarth et al 2008) was placed along a line between the greater trochanter of femur and the lateral femoral epicondyle, and a line between the lateral femoral epicondyle and lateral malleolus (Figure 3). Each participant was asked to actively extend the knee to the point at which he perceived significant stretching discomfort in the hamstring muscle group. This was determined as the end position (Figure 4). At this position, the knee extension ROM measurement was taken. Any lateral deviation or rotation at the hip or pelvic joints was closely monitored by the assessor. The measurement was repeated three times with a 10 second rest in between, taken only on the right lower limb as participants were instructed to stretch only their right hamstring muscles.

Figure 2: Start position of the active knee extension (AKE) test.

Prior to data collection, a pilot study assessing the intra-rater reliability of the AKE test was undertaken. Ten participants (mean age, 24.8 (SD 4.3) years; height, 172.9 (SD 6.1) cm; weight, 68.0 (SD 16.7) kg) from a sample of convenience took part in the reliability study. Using the data-collection procedures outlined earlier, two sets of measurements of active knee extension were completed on two separate occasions with 10 minutes intervals (Depino et al 2000, Spernoga et al 2001). The intra-class correlation coefficient (ICC, 2,1) for the paired data was 0.99, establishing excellent test-retest reliability (Bandy and Irion 1994, Bandy et al 1998, Ford et al 2005).

Knee extension ROM was measured at baseline, and then at weeks 6 and 12. The measurement was performed following a standardised warm-up on a stationary bike for five minutes on the same load (50 Watts).

The stretching intervention was undertaken in two stages. Participants in the stretch groups performed an active static stretch of the right hamstring muscle group, for 30 seconds,

Figure 3: Placement of electronic goniometer. The proximal arm was positioned over the lateral aspect of femur and the distal arm on the lateral aspect of the fibula.

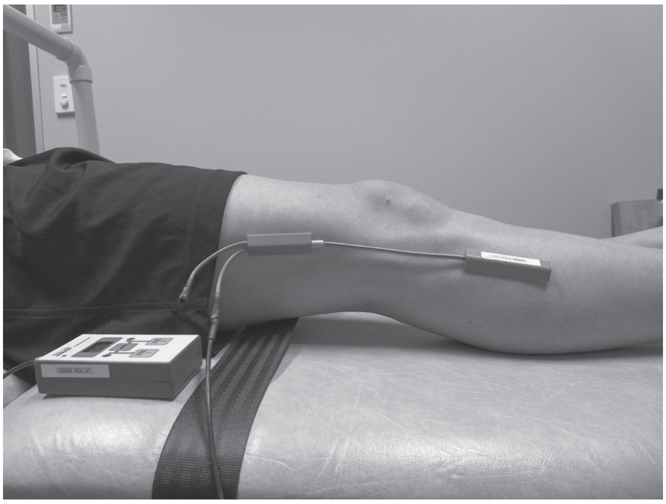


Figure 4: Finish position of the active knee extension (AKE) test.

three repetitions, once per day, five days a week, for six weeks. This programme was performed in the same manner as the AKE test described above.

Following this initial stretching period, participants in stretch group 1 reduced the frequency of stretching to three times per week and those in stretch group 2 stretched once a week for a further six weeks. All participants in the two intervention groups were educated in the stretching technique by a single researcher (JK) at baseline. To measure compliance with the stretching protocol, participants kept a diary of the stretching frequency and other physical activity, and the researcher contacted participants through email or text messages every three weeks to improve compliance. Participants were asked to record their compliance with the stretching intervention after each session and, for other physical activities on a weekly basis.

The control group did not stretch throughout the intervention period but their knee extension ROM was measured at the start and end of the trial. All participants were instructed not to alter their activity of daily living regimes throughout the duration of the study.

Statistical Analyses

Descriptive statistics were analysed to determine the appropriateness of utilising parametric analysis. A two-factor (time and group) repeated ANOVA was utilised to determine any significant changes in knee extension ROM over time and to compare ROM differences between the three groups over time. The participant diaries were assessed for compliance via descriptive statistics. Statistical analysis was performed using SPSS statistical analysis software version 18 (SPSS Inc. Chicago, IL). The alpha level was set at 0.05.

RESULTS

Participants

A total of 63 participants were recruited (see Table 1). Nine participants withdrew from the study; four in stretch group 1, three in stretch group 2 and two in the control group. The main reason stated for the withdrawals were a lack of time to commit to the programme. The data from these participants were dealt with via an intention-to-treat analysis.

Knee extension range of motion

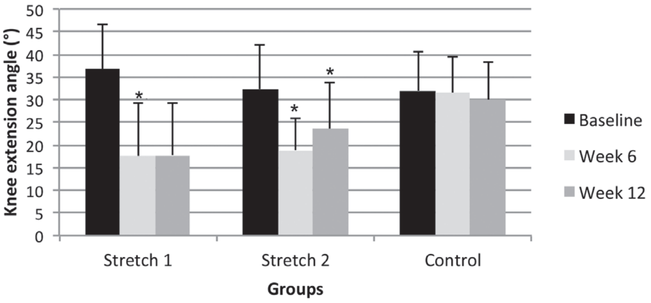
The two-factor repeated ANOVA found a significant effect for time ($p < 0.05$) and group, and a significant interaction between time and group ($p < 0.05$). Figure 5 displays the mean knee extension ROM for the stretch groups and the control group. The start angle for the test movement was 90° knee flexion and 0° was determined as full knee extension. Participants in stretch group 1 recorded a mean 36.6° (SD 9.8°) short of full knee extension at baseline, and participants in stretch group 2, a mean of 32.3° (SD 9.9°) short of full extension. These differences in ROM were not significant ($p>0.05$).

Table 1: Participant's age, height, mass and baseline knee extension range of motion. Independent t-tests indicated no significant differences at baseline (p>0.05). Data are means and standard deviations

Groups (n)	Age (years)	Height (cm)	Mass (kg)	Baseline ROM (degrees)
Control (21)	23.0 (5.4)	179.0 (6.7)	77.7 (13.3)	31.9 (8.5)
Stretch 1 (21)	23.2 (5.7)	177.1 (8.0)	76.4 (13.2)	36.6 (9.8)
Stretch 2 (21)	22.5 (4.3)	179.6 (7.7)	74.8 (10.1)	32.3 (9.9)
Group mean (63)	22.9 (5.1)	178.6 (7.5)	76.3 (12.1)	

Following the initial six-week stretching intervention participants in stretch group 1 improved significantly to a mean of 17.5° (SD 11.8°) ($p < 0.05$). This corresponded to 19.1° increase in ROM. At week 12 these participants had maintained their increased ROM at 17.7° (SD 11.7 °). This difference was not significant ($p > 0.05$). In stretch group 2, ROM improved significantly to a mean 18.9° (SD 7.2 °) after the initial six week stretching intervention ($p < 0.05$). This corresponded to a 13.3° improvement in ROM. At week 12, ROM for group 2 participants had reduced to 23.5 (SD 10.3 °), a 4.6 ° reduction in ROM. This difference was significant ($p < 0.05$). Participants in the control group had a mean 31.9° (SD 8.5°) short of full knee extension at the baseline, 31.5° (SD 7.8°) at week six and 29.9° (SD 8.5°) at week 12. These differences were not significant ($p > 0.05$). Overall compliance of the intervention groups to the hamstring stretching programme was 93%. There were no significant differences in compliance rates between groups ($p>0.05$). A qualitative examination of the participants' diaries indicated that none had undertaken additional activities that may have affected the results.

Figure 5: The knee extension range of movement for the intervention groups and the control group at baseline, week 6 and week 12. Data are means and standard deviations; *p<0.05.



Effect size

The effect sizes of the initial hamstring stretching intervention were calculated by taking the mean difference of the experimental and control group changes in knee extension ROM and dividing this figure by the pooled standard deviation of the experimental and control groups (Cohen, 1988). Stretch groups 1 and 2 both demonstrated a large effect size, 1.75 and 1.56 respectively, during the initial stretching intervention.

DISCUSSION

The main findings of this study were that a six-week static hamstring stretching programme significantly improves knee extension ROM, and that an on-going stretching programme of three times per week is required in order to maintain the improvement in ROM following an initial stretching programme.

The initial changes in ROM over the first six weeks are consistent with previous stretching studies (Bandy et al 1997, Reid and McNair 2004, Roberts and Wilson 1999, Russell et al 2010). Following a further six weeks of stretching, stretch group 1 successfully maintained this initial improvement with an on-going stretching frequency of three times a week, while stretch group 2 lost ROM with an on-going stretching frequency of once a week. In comparison, the control group did not demonstrate significant change in ROM over the course of the study.

A number of studies have suggested that improvements in ROM following a stretching programme are short lived (a maximum of four weeks) and start to diminish following the stretching intervention (Depino et al 2000, Ford and McChesney 2007, Rubley et al 2001, Willy et al 2001). Willy et al (2001) examined the effect of cessation and resumption of static hamstring muscle stretching on knee ROM. The study demonstrated that any initial improvements in ROM were lost four weeks after stopping the stretching intervention. Once the stretching programme was re-introduced the initial gains in ROM were restored. These findings indicate a need to continue a stretching programme once the initial gains in ROM have been achieved, and the results of the current study are consistent with this.

Only two other studies have investigated the frequency of on-going stretching (Rancour et al 2009, Wallin et al 1985). Wallin et al. (1985) investigated the effect of 30 days of PNF and ballistic stretching, followed by 30 days of on-going PNF stretching alone. Passive plantar-flexion and hip adduction and extension angles were measured at baseline, and after 14, 30 and 60 days. In the initial stretching programme, three groups performed PNF stretching and one group performed ballistic stretching, three times a week for 30 days. After the initial stretching period, the three groups performed the same PNF stretching protocol once, three or five times a week, respectively, for another 30 days. The results showed that following 30 days of on-going PNF stretching all groups demonstrated a significant increase in ROM. The authors concluded that on-going stretching of once a week was sufficient to maintain the initial improvement in ROM. Their results are in contrast to the current study that demonstrated on-going stretching of once a week was not sufficient to maintain ROM following the initial improvement. These differences may be due to the different types of stretching techniques used (PNF and ballistic versus static stretching), and the differences in durations of on-going stretching programmes (30 days versus 42 days).

Rancour et al (2009) examined the effect of on-going stretching following a four-week static hamstring stretching programme. Participants were randomly assigned to one of two groups and both groups performed passive static hamstring stretching two repetitions of 30 seconds, twice a day, seven days per week, for four weeks. After the initial stretching programme, one group reduced the frequency of hamstring stretching to two to three times a week for four weeks, while another group ceased stretching. The results demonstrated that both groups had a significant improvement in hip flexion ROM after the initial four weeks of stretching. In the current study, the magnitude of the initial changes in ROM of the stretch groups over the first six weeks was 19.1° and 13.5°, respectively. Rancour et al (2009) demonstrated improvements of 19.2° and 20.5°, respectively over the same period; however, the group performing the on-going stretching regime maintained the improvement while the group that ceased stretching over the next four weeks, lost an average 6.7° in ROM. The authors concluded that on-going stretching with a frequency of two or three times a week was sufficient to maintain the initial improvement in ROM.

The results of the study by Rancour et al (2009) are similar in magnitude to the current study but also greater than other studies using a similar frequency of stretching. Reid and McNair (2004) demonstrated an average 10.1° increase in knee extension ROM after six weeks of hamstring stretching in school-aged individuals. This may indicate that the optimal frequency of initial stretching has yet to be determined or that increases in ROM may vary in different population groups. However, Rancour et al (2009) did not provide a set frequency of on-going stretching but instead allowed participants to decide whether to stretch two or three times a week. For this reason, it is difficult to conclude whether the optimal frequency of on-going stretching is two or three times a week. With respect to the optimal frequency of on-going stretching, the results of this study are consistent with the current study that to maintain an initial improvement in ROM three times a week of on-going stretching is required. Finally, in comparison to the current study, Rancour et al (2009) and Wallin et al (1985) did not have a true control group.

From a clinical and practical perspective, an on-going stretching programme with reduced frequency allows maintenance of the benefits of stretching exercises with minimal effort and potentially improves participants' compliance with on-going stretching exercises. Although stretching is commonly prescribed in clinical practice, research has shown that once a client is discharged from therapy, compliance rate with the home exercise programmes are low and too many exercises can reduce compliance (Haynes 1979, Henry et al 1999, Schneiders et al 1998, Sluijs et al 1993). In the current study, both stretching groups maintained a high level of compliance, averaging 93%, throughout the study. Possible reasons for this high compliance may include the reduced frequency of stretching required, clear written and verbal instruction, and continuous reminders and regular follow-up by the research team (Eakin et al 2007, Jacobs et al 2004, Schneiders et al 1998).

A number of limitations were associated with this study. Recruitment of participants for this study was primarily carried out within a university setting and only healthy and university-aged individuals were included in the study. The findings, therefore, may not be directly applicable to injured or older populations. Despite regular reminders and follow-up, nine of the 63 participants withdrew from the study. An intention-to-treat analysis was used to compensate for this. Finally, other variables such as force or muscle stiffness (Gajdosik 1991, Magnusson 1998, Reid and McNair 2004) associated with stretching interventions were not measured this study.

Future research examining structural changes associated with static stretching and whether these changes are maintained through on-going stretching is required. Future studies may also need to look at that whether different types of stretching (e.g. PNF versus static stretching) or stretching of different muscle groups have different effects on maintenance. Finally, as the results of this study are limited to a healthy university-age population, the effect of on-going stretching protocol of this study needs to be confirmed in different clinical populations such as elderly and females, and those with diseases that affect joint ROM such as osteoarthritis, and muscle injury.

CONCLUSION

The results of the current study demonstrated that on-going hamstring stretching programmes of three times a week was required to maintain the increased ROM following an initial six week stretching intervention. Reducing the number and frequency of stretching exercises required from five to three times a week may enhance compliance, particularly, in populations where maintaining an appropriate range of motion is helpful to enhance performance and reduce the risk of injury and re-injury.

KEY POINTS

- Stretching exercises are commonly prescribed to improve muscle extensibility and joint ROM, but on-going stretching exercises may be required to maintain any initial improvements in ROM.
- An initial stretching regime of 3×30 seconds, once per day, five days a week for six weeks to the hamstring muscles, significantly increases knee extension ROM.
- A frequency of three times a week is required with an on-going stretching programme for a further six weeks to maintain the initial improvement in knee extension ROM.

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CONFLICT OF INTEREST

The authors hereby declare there is no conflict of interest with this submission.

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Can persons with paraplegia obtain training heart rates when boxing on the Nintendo Wii?

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ABSTRACT

The objective of this study was to determine whether playing the boxing game on the Nintendo Wii^{TM} could produce heart rates within 50 to 80% of the estimated heart rate reserve in people with paraplegia. Two participants engaged in three gaming sessions on the Nintendo Wii over a two week period. A ten minute warm up was done using the cycling programme on the Wii, followed by ten minutes of boxing. During the warm up participants were instructed to cycle at a comfortable pace. For the boxing, they competed against an able bodied player and were encouraged to give maximal effort. Heart rate was recorded at one minute intervals. Participant 1 was a 19 year old male who was classified as AIS A, neurological level T_{11}. Participant 2 was a 23 year old male who was classified as AIS A, neurological level T_7. During boxing participant 1 demonstrated values ranging from 33 to 55.7% of his estimated heart rate reserve. Participant 2 showed values ranging from 56 to 83.5% of his estimated heart rate reserve. The results indicate that persons with low level paraplegia can achieve training heart rates on the Nintendo Wii. Further studies are required however using a larger and more varied sample.

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Key words: cardiovascular training, video gaming, spinal cord injury, Nintendo Wii

INTRODUCTION

The incidence of traumatic spinal cord injuries for Western Europe, Australia and North America has been found to range from 15 to 39 per million (Cripps et al 2011). The incidence of spinal cord injury in Jamaica is somewhere within this range. The head of the physical therapy department at the major treatment facility on the island (population size approximately 2.71 million) indicated that they see on average 50 patients per year with a spinal cord injury (Henry, 2012 personal communication).

A significant risk for persons who have sustained a spinal cord injury is the development of cardiopulmonary problems (Bauman and Spungen 2008, Myers et al 2007, Phillips et al 1998). In the past respiratory and renal complications were leading contributors to mortality in this population; however, in recent years cardiovascular disease has been shown to be the leading cause of mortality in persons with chronic spinal cord injuries (Garshick et al 2005). A review of studies investigating physical capacity in wheelchair dependent persons shows that low values for maximal oxygen consumption (VO_{2max}) and peak power output were a common finding across studies (Hasima et al 2006). On an arm ergometer test, nearly one in four healthy persons with paraplegia fail to achieve VO_2 levels required to perform many of the essential activities of daily living (Noreau et al 1993).

Regular exercise has been shown to be beneficial in partially reversing some of the negative metabolic and musculoskeletal changes that occur following a spinal cord injury (Myers et al 2007). Common modes of accomplishing cardiopulmonary conditioning in this population include arm ergometry, wheelchair propulsion or swimming. For many, these activities can become quite monotonous resulting in decreased effort and low adherence. For others lack of resources may prohibit exercise participation. In the North American population, lack of motivation, lack of energy, not knowing where to exercise and lack of interest were the main barriers to exercise participation in persons with spinal cord injuries (Scelza et al 2005). In Jamaica, economic cost, lack of transportation and inadequate facilities were identified as the main barriers to exercise in persons with spinal cord injuries (Roopchand-Martin et al 2013). The use of virtual reality, in particular activity based video games, may be one approach that could potentially address several of these barriers.

Studies investigating the use of virtual reality training in adult and pediatric neurological conditions have shown significant improvement in physical outcomes including posture, balance, locomotion and upper and lower extremity function (Braynton et al 2006, Brüsch et al 2010, Chen et al 2007, Jack et al 2001, Merians et al 2002, Reid and Campbell 2006, Saposnik et al 2010, Sveistrup et al 2003, Viau et al 2004, You et al 2005). Researchers have also begun to explore the use of virtual exercise environments to augment traditional treadmill and ergometer exercises in order to improve cardiac and pulmonary function in persons with spinal cord injury (Widman et al 2006, Burns et al 2012).

Eight adolescents with spina bifida participated in a study which attempted to integrate a computer gaming programme into an arm ergometer activity. After sixteen weeks of training there was significant improvement in all cardiopulmonary variables investigated. All participants indicated that the use of the game made the task more enjoyable and provided greater motivation to exercise than cycling without the gaming system (Widman et al 2006). Heart rate values greater than 50% of the heart rate reserve were reported by Burns et al (2012) for nine persons with chronic spinal cord injury during a bout of exercise with the Nintendo Gamecube controlled by a custom arm ergometer and a session of game play with the XaviX Tennis System.

The Nintendo Wii® (Nintendo, Redmond, Washington) is a commercial off the shelf gaming system which is fairly easy to set up. A range of activities are available which can be used by both able bodied individuals as well as those with physical disabilities. Studies in sedentary young and older adults have shown that games on the Nintendo Wii can be used as an effective activity for promoting physical health (Bosch et al 2012, Douris et al 2012, Guderian et al 2010, Worely et al 2011). A comparison of Wii Fit aerobics with traditional aerobics in twenty-one healthy sedentary college students has shown that the Nintendo Wii Fit, Free Run programme could act as an alternative to traditional moderate intensity exercise in fulfilling the American College of Sports Medicine (ACSM) requirements for physical activity (Douris et al 2012). Thirty minutes of boxing using the Wii Sports programme was shown to provide a moderate to vigorous aerobic response in healthy young adults (Bosch et al 2012).

Very little research has been done to date regarding the energy expenditure associated with active videogaming in persons with disability. Hurkmans et al explored the energy expenditure associated with playing tennis and boxing on the Wii Sports disc in adults with cerebral palsy (Hurkmans et al 2010) and patients with chronic stroke (Hurkmans et al 2011). In both studies participants played each game for fifteen minutes and energy expenditure, which was reported in metabolic equivalents, was found to be consistent with the requirements for moderate intensity exercise stipulated by the American College of Sports Medicine.

While observing persons with paraplegia engaged in a balance training programme on the Nintendo Wii this team of researchers noted that they appeared to be working at levels that could potentially result in cardiopulmonary benefits; however, no data were identified at the time that explored the use of the Nintendo Wii for cardiopulmonary training in this population. The optimal exercise intensity for improving cardiovascular fitness in persons with spinal cord injuries still needs to established, however, based on research to date, a range of 50 to 80% of the heart rate reserve (HRR) has been recommended, with the higher training intensities (70 – 80% HRR) showing greater improvements in cardiovascular function (Wharburton et al 2012). This study sought to determine whether the boxing game on the Nintendo Wii could produce heart rates anywhere within 50 to 80% of the estimated HRR in persons with paraplegia when competing against another player.

METHODS

An observational study was conducted at the Sir John Golding Rehabilitation Centre in Jamaica after ethical approval was obtained from the ethics committee of the University of the West Indies, Mona Campus and the regional health authority for the centre.

PARTICIPANTS

Two persons were recruited into the study from the in-patient population at the Sir John Golding Rehabilitation Centre. They were included on the basis that they had a traumatic spinal cord injury resulting in paraplegia, were medically stable, had been attending physical therapy for at least eight weeks, and signed an informed consent form for participation in the study. Persons with orthopedic impairments that could hinder their participation in the game were excluded.

Participant 1 was an 18 year old male patient who had sustained a gunshot injury to the spine. At the time of the study he was seven months post injury and his neurological level was T_{11} on the American Spinal Injury Association (ASIA) International Standards for Neurological Classification for Spinal Cord Injury Scale (ISCOS). Participant 2 was a 23 year old male, who sustained a gunshot injury resulting in fractures of the T_6 and T_7 vertebrae and a haemopneumothorax. At the time of the study he was six months post injury and his neurological level of injury was T_8. Both participants were classified as AIS A on the ASIA Impairment Scale, which indicates complete injury with no preservation of sensory or motor function in the sacral segments. Prior to the injury both participants were healthy and had no previous history of chronic or systemic medical problems. At the time of the study both participants were engaged in some strength training activities but were not involved in any form of structured cardiovascular training activity.

PROCEDURE

Training was conducted in a gym setting with participants seated in their wheelchairs. The Nintendo Wii system was connected to a television which was placed 1.2m in front of the participant. The boxing game on the Wii Sports disc was used for training and the game was set for two players, allowing the research participant to compete against an able bodied physical therapy student. The student played from a seated position in a stable chair. A space of approximately 1m was left between the two players to ensure that there was no physical contact with one another while playing.

Heart rate values were obtained during the gaming activity using a Polar heart rate monitor which consisted of a chest strap and a wristband. The wristband was positioned on a stable surface close to the participant to allow for the heart rate values to be read off with no disruption to the game. Heart rate values were documented at one minute intervals, for a total of ten minutes, by another physical therapy student. A total of three gaming sessions were conducted with a two day gap between each session.

Immediately prior to the boxing session each participant did a ten minute warm using the cycling programme on the Nintendo Wii Sports Resort disc. This required the participant to hold the Wii remote in one hand and the Wii nunchuck in the other. By pumping the arms up and down both participants were able to navigate the virtual bicycle through a virtual path, while remaining seated in their wheelchairs. During this time they played alone and were instructed to play at a comfortable pace. For the boxing they competed against the able bodied physical therapy student and were instructed to give maximal effort. During the gaming activity participants were constantly encouraged to maintain good technique and not just flick the remote with their wrist.

The training heart rate range was estimated using the Karvonen formula (American College of Sports Medicine, 2006). The maximal heart rate was determined from the age predicted maximum values. The heart rate values obtained during training were compared with the estimated target values to see whether participants were working in the range required to obtain cardiovascular benefits.

RESULTS

Participant 1 had an average resting heart rate of 95 beats per minute and his age predicted maximal heart rate was 202 beats per minute. The training heart rate range representing 50 to 80% of his estimated heart rate reserve was 148 to 180 beats per minute. Participant 2 had an average resting heart rate of 109 beats per minute and his age predicted maximal heart rate was 197 beats per minute. The training heart rate range for him was 153 (50%) to 179 (80%) beats per minute.

During the boxing game the mean heart rate values achieved by participant 1 over the three trials fell within 33 to 55.7% of the heart rate reserve. For participant 2 the values ranged from 56 to 83.5% of the heart rate reserve (Table 1).

Table 1: Heart rate values obtained over three trials of boxing for participant 1

Time into the boxing programme (minutes)	HR Trial 1	HR Trial 2	HR Trial 3	Mean HR (beats/ minute)	Mean % HRR
0 (HR at the end of warm up)	105	106	106	106	10
1	130	130	129	130	33.0
2	140	136	144	140	42.5
3	166	136	152	151	52.8
4	166	146	138	150	51.9
5	162	138	145	148	50.0
6	163	125	135	141	43.4
7	157	146	152	152	53.8
8	149	149	148	149	50.9
9	167	153	141	154	55.7
10	156	150	140	149	50.9
Mean and SD values obtained over the 10 minute period	156 SD 12	141 SD 9	142 SD 7	146 SD 7	48 SD 7

Resting HR = 95, Age predicted maximal HR = 202

50% HRR = [(202-95) x 0.5] + 95 = 148 80% HRR = [(202-95) x 0.8] + 95 = 180

DISCUSSION

The results of the study indicate that males with low level paraplegia can obtain between 50 to 80% of the heart rate reserve during 10 minutes of boxing on the Nintendo Wii when preceded by a 10 minute cycling warm up. It was noted however, that the values obtained varied widely between the two participants, with participant 1 maintaining heart rate levels between 50 to 60% HRR for most of the ten minute period whilst participant 2 was 70% and above.

The higher heart rate values obtained in this study were similar to that of Bosch et al (2012) who showed a mean heart rate response of 77.5% of heart rate maximum in healthy adults age 23 – 27 years during 30 minutes of Nintendo Wii boxing. The lower values obtained were similar to that of Donovan and Hussey (2012) who showed a mean heart rate response of 58% of heart rate maximum in healthy males aged 19 – 27 years with 15 minutes of Nintendo Wii boxing. Findings were also comparable to that obtained by Burns et al (2012) who reported heart rate values averaging > 50% heart rate maximum in persons with paraplegia during exergaming cycling.

Both participants were given the same instructions, which included giving their maximal effort; however, the heart rate responses were different. Factors such as upper body muscle strength and endurance would have had an impact on maximal performance levels; however, these were not assessed prior to the trials. It is possible that participant 2 may have had better conditioned upper body muscles. This could have possibly allowed him to sustain a higher rate of punching during the boxing game as compared to participant 1 resulting in higher heart rate values. Further studies exploring the use of Wii games in this population should take into consideration upper body endurance and the possible impact on performance on the games.

Both participants in this study were instructed to give maximal effort; however, apart from looking at the heart rate values, no other method was used to evaluate effort. It would have been useful in this study to ask the participants to rate their levels of perceived exertion during the activity to ensure that they were in fact giving maximal effort. Persons with spinal cord injuries below the level of T_6 generally have elevated resting heart rates and therefore changes in heart rate

Table 2: Heart rate values obtained over three trials of boxing for participant 2

Time into the boxing programme (minutes)	HR Trial 1	HR Trial 2	HR Trial 3	Mean HR (beats/ minute)	Mean % HRR
0 (HR at the end of warm up)	134	131	137	134	28.4
1	141	172	162	158	56
2	177	179	173	176	77
3	176	176	160	171	70
4	176	179	170	175	75
5	169	183	180	177	78
6	175	181	169	175	75
7	169	169	169	169	68
8	185	186	179	183	84
9	171	174	174	173	73
10	179	179	174	177	78
Mean and SD values obtained over the 10 minute period	172 SD 12	178 SD 5	171 SD 6	174 SD 7	73 SD 8

Resting HR = 109, Age predicted maximal HR = 197

50% HRR = [(197-109) x 0.5] + 109 = 153 80% HRR = [(197-109) x 0.8] + 109 = 179

may not necessarily be the best measure of effort during an exercise activity. Future studies should consider measuring exertion levels in addition to heart rate when exploring the use of the Wii boxing game in persons with spinal cord injury.

In this study there were only two participants and both were AIS A and had low levels of paraplegia. In addition to the upper extremity muscles being intact they also had almost fully intact abdominal muscles which would have allowed their participation in the game to differ from persons with higher levels of paraplegia. The results of this study therefore are not applicable to full spectrum of persons with spinal cord injuries. Further studies need to be conducted with a larger sample of persons with spinal cord injury including wider age ranges, varying degrees of impairment and of both sexes. This study also indicates that it would be useful to conduct studies exploring cardiopulmonary conditioning with the Nintendo Wii in this population.

CONCLUSION

This study showed that males with low levels of paraplegia can obtain heart rate values that are within the zone required for cardiopulmonary benefits when competing in boxing against another player on the Nintendo Wii. Further studies are required however using a larger and more varied sample of persons with spinal cord injury.

KEYPOINT

- Boxing on the Nintendo Wii can elicit training heart rate values in persons with paraplegia.

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PERMISSIONS

Ethics – Ethical approval for this study was granted by the University of the West Indies Ethics Committee (ECP 28,11/12) and the South East Regional Health Authority.

DISCLOSURES

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A narrative review of hope after spinal cord injury: Implications for physiotherapy

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ABSTRACT

Spinal cord injury is a life-changing event that can affect both physical and psychological wellbeing. Frequently, physiotherapists working with patients with spinal cord injury are asked about prognosis and outcomes, leaving them unsure whether to be cautious in their responses or to promote hope for recovery. The purpose of this narrative review was to investigate the literature regarding the role of hope after spinal cord injury, whether hope is beneficial and if so, whether there are strategies that may be incorporated into physiotherapy practice to support or foster hope. Common themes regarding hope after spinal cord injury included the hope to walk again, that hope changed over time, images of past and present, and the power of hope. Cross-sectional studies report hope after spinal cord injury to be associated with reduced depression, improved coping, higher self-esteem and increased life satisfaction. Although no studies were located that specifically investigated either enhancing hope after spinal cord injury or how physiotherapists can support or enhance hope, strategies from other populations are discussed to illustrate how they could be utilised in a physiotherapy setting.

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INTRODUCTION

Spinal Cord Injury (SCI) can be a sudden and devastating event that changes a person's life forever. It often leads to permanent neurological injury and a range of associated consequences such as paralysis, loss of sensation, changes to bowel, bladder and sexual function, and loss of functional abilities such as walking (Harvey 2008). Furthermore, not only does SCI affect a person's physical function, but also their psychological wellbeing. Research has shown that after SCI, people have reduced subjective wellbeing (Dijkers 1997), life participation (Gerhart et al 1993) and quality of life (Craig et al 2009) and an increased likelihood of developing anxiety or depressive disorders (Craig et al 2009). This suggests that physical interventions alone may not be enough to lead to successful and comprehensive rehabilitation outcomes.

In New Zealand 30 out of every million people each year sustain a SCI (Derrett et al 2012). The majority of those people will be admitted to one of two specialised spinal rehabilitation units. There, they will have a dedicated interdisciplinary team comprising a number of health care professionals including physiotherapists.

One challenging aspect of SCI rehabilitation is the uncertainty surrounding recovery (Soundy et al 2010, Sullivan 2001). Depending on the level of SCI and impairment, some patients will have a much greater chance of improvement than others; with those with incomplete injuries tending to make the most gains (Vazquez et al 2008). Very few patients make a full recovery, although an increasing number will walk again in some form, thanks to improving emergency and acute care. Patients often ask health professionals, physiotherapists in particular, about prognosis: *"Will I ever walk again?", "Will I be able to use my hands again?"* One can rarely answer these questions with absolute certainty, due to the variable nature of SCI and recovery. Conversations such as these often leave therapists with the dilemma of either encouraging hope and promoting what may be perceived to be "unrealistic expectations" or confronting the patient with the reality that these things may never happen. Hope in itself, however is a personal and complex phenomenon that is not easy to define.

The aims of the following review and discussion were to investigate the role of hope after SCI, whether hope is potentially beneficial in a rehabilitation setting such as a Spinal Unit, and to identify strategies or interventions that have the potential to be incorporated into physiotherapy practice to support or enhance hope. A literature search was undertaken between August and September 2011 to locate pertinent studies relating to hope, SCI and physiotherapy. Databases searched included: Allied and Complementary Medicine Database (AMED); Cumulative Index to Nursing and Allied Health literature (CINAHL); MEDLINE; The Cochrane Controlled Trials Register in the Cochrane Library; Physiotherapy Evidence Database (PEDRO); PsycINFO and Embase. Key search terms included combinations of *spinal cord injury, hope, physiotherapy, physical therapy and rehabilitation.* Due to the absence of strategies found to support or enhance hope within the SCI population or physiotherapy more specifically, the search was broadened for this aspect of the review to capture those implemented in a healthcare context more generally. Studies investigating hope within mental health populations were excluded to allow focus on the relationship of hope to more physical rather than psychological impairment. Reference lists of key papers were also searched to identify other papers pertinent to the topic. The literature search was repeated in August 2013 to capture studies published after the initial search, with two further articles found to add further value in the context of this review (Bright et al 2011, Kortte et al 2012). The findings of this review have been summarised into four key sections: Defining the concept of hope, patients' experiences of hope after SCI, benefits of hope after SCI, and strategies that physiotherapists might use to support hope.

What is hope?

Many authors have attempted to define hope in the literature, the majority originating from psychology and nursing fields. There is no universally agreed upon definition. However, there are common characteristics such as its future orientation and positive nature (Dufault and Martocchio 1985, Farran et al 1995, Lohne 2001, Snyder et al 2006). The word hope is often associated with other words and concepts such as wants, expectations, goals, desires, dreams and optimism (Bright et al 2011). It can be a noun "I have the hope of walking again", a verb "I hope that I will walk again", or an adjective "I am hopeful that I will walk again".

Dufault and Martocchio (1985) describe hope as a multidimensional and dynamic life force embodied by an expectation of a positive, realistically possible, yet uncertain future that is personally significant to the individual. These authors suggest hope can be a way of being (generalised hope), or related to a specific object or event (particularised hope). Farran et al (1995) also defined hope more generally and multidimensionally as a way of feeling, thinking, behaving and relating to oneself and the world.

Contrastingly, both Snyder et al (2006) and Lohne (2001) link hope more uni-dimensionally to goals with less emotional conceptualisation. Lohne, one of the few authors to define hope specifically in relation to SCI, outlined hope as a positive prospective phenomenon involving both the substance of hope (appearing as specific wishes and goals) and the process of hoping (Lohne 2001). Snyder also described hope as a positive motivational state comprising two distinct ways of thinking about goals. *Agency thoughts* involve the motivation or sense of determination to meet goals. The person believes that a particular goal can be achieved and they *want* to achieve it, with thoughts such as 'I can do it' and 'I will not let … stop me from…' *Pathway thoughts* concern how a specific goal is going to be achieved. These thoughts reflect the person's perceived ability to be able to find routes towards the goal and can involve self-talk messages such as 'I will find a way to do it' and 'I am going to get there by …' (Snyder 2000, Snyder et al 2006). This conceptualisation of hope as an active process that is outcome oriented was also mirrored by Bright and colleagues (2011) in their systematic review of hope in people with stroke.

Given the multiple and varied notions of what hope is and how it might be conceptualised, no one definition has informed this review. However, drawing these definitions together, hope appears to be a way of thinking or being that is often both positive and oriented towards the future or goals.

The Experience of Hope after SCI

To determine whether hope should and could be supported after SCI, it is first necessary to better understand what hope means to people after SCI. A number of qualitative studies have investigated how people experience hope after SCI using a mixture of phenomenological and ethnographical methodologies (Dorsett 2010, Laskiwski and Morse 1993, Lohne 2009, Lohne and Severinsson 2004, Lohne and Severinsson 2005, Lohne and Severinsson 2006, Smith and Sparkes 2005). Methodologically, all the studies had clear objectives, appropriate and relevant research designs, and proposed themes that were well supported by raw data. Other than Dorsett (2010), all studies had two authors who coded data independently and then compared the findings and themes in an attempt to reduce bias. All participants had sustained SCI, although there was some variation in setting with some undergoing initial inpatient rehabilitation and others living in the community. Table 1 provides a summary of included papers. The literature revealed four themes regarding the experience of hope after SCI. Each of these is discussed in turn below.

"I hope that I will walk again"

The majority of participants from almost all studies expressed the desire to walk again one day (Dorsett 2010, Laskiwski and Morse 1993, Lohne and Severinsson 2004, Lohne and Severinsson 2006, Smith and Sparkes 2005). For many, this hope remained no matter what evidence was presented to them; even if they had accepted it was a remote possibility. This suggests that patients may still hold this particular hope, no matter what information their physiotherapist or other health care professional provides them with, and is an interesting finding in light of other literature that suggests walking is not always the highest priority after SCI, especially in those people with tetraplegia and chronic SCI (Anderson 2004, Simpson et al 2012). Hope of this type represents "concrete hope" as described by Smith and Sparkes (2005) who carried out interviews exploring hope with men who had sustained traumatic SCI's playing rugby. These authors found concrete hopes to be the most common type of hope, associated with specific material outcomes and often a "cure" or return to being "able-bodied".

"Hope for past and future"

Closely linked with the hope of walking again, was the frequent mention of hope for a return to life as it was before their SCI, to what was lost, to "normal" (Dorsett 2010, Laskiwski and Morse 1993, Lohne and Severinsson 2004, Smith and Sparkes 2005). This is also an example of concrete hope, usually related to physical goals such as regaining the ability to stand, dance, garden, and grasp objects with their hands. Often health professionals viewed these hopes as an unlikely possibility; while the media, family, and friends tended to reinforce them (Smith and Sparkes 2005). The popular belief held by others was that if you worked hard enough and stayed positive recovery was more likely (Dorsett 2010). In practice, this longing for the past may motivate the patient to engage in their rehabilitation to maximise any recovery they may make, or to better utilise any treatments or cures that become available. Alternatively it may also limit the person's acceptance of their disability. They may not see the point in participating in therapies that involve learning compensatory strategies when they are awaiting a return to their

Table 1: Overview of qualitative papers exploring the experience of hope after SCI

Authors	Methodology	Design	Key themes found
Smith and Sparkes 2004	Narrative Inquiry	Unstructured interviews in homes of 10 men living in community who sustained SCI due to rugby accidents in England.	Concrete hopes and the restitution narrative - hope for return to previous physical attributes and abilities. Transcendent hope and the quest narrative – acceptance of disability and generalised hope for the future not oriented to a specific or physical outcome. Despair and the chaos narrative – loss of hope altogether.
Dorsett 2010	Phenomenology	Longitudinal mixed method study of 46 women and men discharged from an Australian Spinal Unit. Semi-structured interviews at discharge, 6, 12 and 36 months and 10 years post-injury (qualitative findings only discussed in this article).	Participants hoped for a complete recovery, a cure and a satisfying quality of life. Hope identified as a key factor helping participants both adjust and cope after SCI. Improving self-esteem and self-efficacy and facilitating goal achievement may help to engender hope for the future.
Lohne 2009, Lohne and Severinsson 2004, 2005, 2006	Hermeneutic phenomenology	Longitudinal study of 6 men and 4 women admitted to a rehabilitation hospital in Norway. Interviews carried out during the first few months after SCI at the hospital, at one year post SCI and again at 3-4years post SCI in participants' homes.	Early after SCI: Images of the past and future and longing for former lives. Balancing between inner emotional dichotomies and the vicious circle of suffering. The power of hope. Chronic SCI: Hope focused more on "life" than on making specific improvements. Ongoing movement between suffering and being hopeful "the vicious circle".
Laskiwski and Morse 1993	Ethnography	Observations and unstructured interviews with the patients (3 women, 25 men), family and staff in an inpatient SCI rehabilitation unit in Canada. A written journal of the authors own reflections and suppositions was also utilised.	Hope to walk again. Hope modified throughout patients journey through rehabilitation, initially focussed on recovery and returning home and becoming more realistic and centred around coping in the community as they increasingly accepted the permanence of their injury. Feelings of despair expressed as swearing rather than crying.

former abilities and life roles. In this instance, physiotherapists have the potential to educate patients regarding therapy goals to encourage engagement in rehabilitation.

Alongside this hope for the past, some participants also held a vision of and hope for the future; that a fulfilling yet possibly different life from what had been expected was still possible after SCI (Dorsett 2010, Lohne 2009, Lohne and Severinsson 2004, Smith and Sparkes 2005). Smith and Sparkes (2005) linked this type of hope to the "quest narrative" in which people believe that something can be learned from their experience and termed it "transcendent hope". Hope in this form is different from concrete hope in that the participant had more acceptance of their injury, which offered them the chance to reconstruct a new identity/self, the hope of becoming a better person as a result. It possibly allowed participants to deal more effectively with a future that is still uncertain. Hammell's (2007) meta-synthesis exploring the experience of rehabilitation after SCI also highlighted the importance participants felt in being able to envision future life possibilities. These authors found that peers with SCI played a key role in providing exemplars of what could be achieved after SCI. Physiotherapists could also potentially facilitate this vision by providing education, discussing their own experiences with similar cases, and giving reassurance that disability is not necessarily a tragedy, that a satisfying and happy future can still be achieved after SCI.

"The transformation of hope over time"

Although the majority of participants had some form of hope most of the time, it also emerged that hope was not always consistent (Dorsett 2010, Laskiwski and Morse 1993, Lohne 2009, Lohne and Severinsson 2005). Participants hoped for different things over time as circumstances, understanding, and acceptance of their condition changed (Laskiwski and Morse

1993). Lohne and Severinsson (2004, 2005, 2006, 2009) conducted a longitudinal qualitative study in Norway following 10 individuals with SCI from initial rehabilitation through to four years post injury. Participants felt hope was most important in the early stages of rehabilitation and essential for recovering from the initial trauma (Lohne 2009). During this time hope tended to involve more particularised, specific hopes for physical recovery as mentioned above. Both the Lohne study (2009), and another longitudinal study carried out by Dorsett (2010) over 10 years found that as time since injury elapsed, hope became more generalised, focused more on having a good life and "living in hope" (Dorsett 2010, Lohne 2009). There was a shift from "having" hope to "being" hopeful with hope becoming less centred around specific goals. This resonates with both Dufault and Martocchio's (1989) and Lohne's (2001) definitions of hope. A similar modification of hope over an even shorter time was also found in an ethnographical study by Laskiwski and Morse (1993). These authors explored adaptation to injury in participants undergoing SCI inpatient rehabilitation, and found that even in the transition from acute settings such as intensive care early after injury to inpatient rehabilitation and then during preparation for discharge back to the community hope evolved and changed, almost on a daily basis.

Hope over time was also punctuated by periods of suffering and despair or loss of hope altogether. This occurred particularly when the consequences of the injury were initially comprehended, and also as functional and physical gains plateaued after the first year or two post injury and long-term outcomes became more certain. (Lohne 2009, Lohne and Severinsson 2005, Smith and Sparkes 2005). Participants described having good and bad days, ups and downs. Contrasting emotional dichotomies were linked with narratives of hope: feelings of strength versus vulnerability, helplessness versus independence, pride versus shame (Lohne and Severinsson 2004, Lohne and Severinsson 2005). Yet most reported that throughout all stages, even the smallest physical improvements would make them hopeful again that there was a possibility for future improvement (Dorsett 2010, Lohne 2009, Lohne and Severinsson 2006). Assisting patients to set meaningful and achievable goals may help to highlight those small gains. See Snyder (2000) for a more detailed discussion regarding the relationship between hope and goals.

"The power of hope"

To participants, the power of hope often represented not giving up (Lohne and Severinsson 2006, Smith and Sparkes 2005). It motivated them to persevere with their rehabilitation and therapy which in turn led to functional improvements. As mentioned previously, these improvements then inspired hope even further, perpetuating the cycle. This "power of hope" has also been likened to "weathering a storm" (Hammer et al 2009) where hope provides the determination and drive to keep fighting, believing a positive and worthwhile future is still possible in the face of adversity. This idea implies that attitude or state of mind may give further strength to hopes, mirroring the agency component of Snyder's Hope Theory (Snyder et al 2006).

Is hope beneficial after SCI?

It appears from the findings above that hope is a non-physical factor that plays a significant role in both the rehabilitation and lives of people who have sustained a SCI. In addition, correlational studies investigating the relationships between hope and other variables have also found significant associations with a number of positive factors such as improved life satisfaction, coping, and self-esteem, and reduced depression and psychosocial impairment. Generally most studies investigated participants with SCI who had only recently sustained their injury and were undergoing rehabilitation in Spinal Units similar to those found here in New Zealand, although no studies were actually completed in either New Zealand or Australia (see Table 2 for an overview of the papers discussed).

Kortte et al (2010) found that in 87 participants undergoing acute inpatient SCI rehabilitation, participants with more hope as measured by the Snyder Hope Scale (Snyder 2000) on admission, had improved life satisfaction both at admission and three months post discharge. Unfortunately the authors only assessed hope at baseline not at the three month reassessment; they did not take into account the fact that hope may change over time. Therefore, one can only conclude that hope *on admission* was correlated to life satisfaction, not hope throughout the rehabilitation process.

Kennedy et al (2009), using a cross-sectional survey study design, investigated the relationship between hope, coping, and cognitive appraisals (how an individual interprets or views a situation) in 54 people (80% men) who were less than one year post SCI. Hope was assessed using Snyder's State Hope Scale which assesses the agency and pathways components of hope (Snyder 2000). Agency score was associated with higher acceptance levels, while higher pathways scores were related to improved coping in the form of fighting spirit. Participants with lower levels of hope viewed their injury as more threatening. Further, those participants with higher levels of hope were more persistent when faced with challenges. A longitudinal qualitative study by Dorsett (2010) also supported the relationship between hope and coping, with 70% of participants clearly identifying hope as an essential factor in helping them cope after their injury, even though no specific questions were directly asked about hope itself in the interviews.

Hope's relationship with coping after SCI, particularly those hopes perceived as unrealistic, has been likened by some to denial (Dorsett 2010). It has been suggested that unrealistic hope may hinder participation in rehabilitation, leading to false expectations (Elliott et al 1991, Soundy et al 2010), and poorer long-term outcomes after SCI (Wegener and Kortte 2004). However no studies have yet clearly demonstrated these associations with hope. Unrealistic hope may play an important psychological protective role in the earliest stages after sustaining injury (Elliott and Richards 1999, Elliott et al 1991, Wegener and Kortte 2004). It may serve as a mechanism to reduce distress, trauma, and anxiety until the person is ready to accept the potential seriousness and permanency of their condition (Dorsett 2010). Therefore, destroying hope for recovery because it is seen to be "unrealistic" may possibly be more psychologically damaging than loss of hope altogether.

An important point to note is that defining what is "unrealistic" is in itself not easy. To be unrealistic or false, it is assumed that the likelihood of obtainment is far-fetched or impossible (Coulehan 2011). Yet there is often uncertainty around prognosis after SCI, particularly for patients with incomplete injuries. At present, a significant amount of effort and

Table 2: Overview of correlational research papers investigating the relationship between hope and outcome after SCI

Authors	Participants	Outcome Measures	Key Findings	Strengths and Limitations
Elliot et al 1991	57 men and women with traumatic SCI receiving treatment at a rehabilitation centre	Hospital Anxiety and Depression Scale (HADS) Snyder's Hope Scale	- ↑ hope negatively correlated with ↓ depression and psychosocial impairment.	HADS validated in SCI but not Snyder's Hope Scale. No clear inclusion criteria other than sustained traumatic SCI. Minimal description of patient characteristics, especially type of injury or in/outpatient status. Large variation in time since injury (1-452 months) and stage of rehabilitation, however hope is thought to change over time which may affect results.
Kortte et al 2010	87 rehabilitation inpatients	Snyder's Hope Scale Satisfaction of Life Scale	- ↑ hope on admission associated with ↑ life. satisfaction at admission and 3 months post discharge.	11 participants not followed up at 3 months. Inclusion of this data may have influenced results. Neither scale validated with SCI. Detailed description of patient characteristics.
Kennedy et al 2009	54 (80% men) who were <1 year post SCI	HADS Pakenham Scale (cognitive appraisals) State Hope Scale Spinal cord lesion related coping scale	↑ agency score associated with ↑ acceptance. ↑ pathways scores associated with ↑ coping. ↓ hope associated with view of injury as threatening. ↑ hope predicts ↑ persistence against challenge, and ↓ depression.	Coping scale has not been previously psychometrically tested. Use of self-report measures in an interview format may contribute to social desirability bias.
Kortte et al 2012	174 patients undergoing acute rehabilitation including SCI, stroke, amputation and orthopaedic injury	Snyder's Hope Scale Functional Independence Measure (FIM) Craig Hospital Assessment and Reporting Technique (CHART)	Hope was a predictor of functional role participation (CHART). Positive affect was not a predictor of functional role participation. Neither hope of positive affect predicted functional skill level (FIM).	Large sample size. Patients other than SCI also included in analyses. Although no significant differences were found in hope or positive effect scores between the subgroups, significant differences in FIM or CHART scores may have influenced the correlation results which analysed the entire sample as a whole. Measures validated in general rehabilitation populations, but not all with SCI specifically.
Piazza et al 1991	77 patients undergoing SCI rehabilitation	Miller Hope Scale Rosenberg Self-Esteem Scale Personal Resource Questionnaire	Hope associated with social support, education level self-esteem, race, inpatient versus outpatient. Hope not associated with sex and employment status.	Detailed description of patient characteristics. Unclear if any of measures validated with SCI. No description of data analysis methods.

resources is being directed at research aiming to identify better treatments, rehabilitation strategies, and even a "cure" for SCI (Tate et al 2011). It is becoming increasingly difficult to accurately and categorically say there is no chance someone may realise certain recovery hopes, calling into question this notion of "unrealistic" hopes.

Both the aforementioned Kennedy et al study (2009) and another by Elliot et al (1991) found higher levels of hope were also associated with lower levels of depression. Elliot and colleagues found a significant negative correlation between total hope score (measured by Snyder's Hope Scale) and both depression and psychosocial impairment measures in patients with traumatic SCI. The pathways component of the Hope Scale in particular was a significant predictor of depression.

A common limitation in many studies looking at the phenomenon of hope after SCI is the lack of description of patient characteristics, particularly injury level or completeness. Piazza et al (1991) is one of the only studies that explored the influence of patient demographics on hope. These authors original intention was to analyse the relationship between hope and self-esteem in inpatients undergoing rehabilitation after SCI. They found social support, education level, and self-esteem all to be strong predictors of hope measured using the Miller Hope Scale (Miller 1988). When looking at other variables, sex and employment status did not cause significant difference in hope levels. These authors did however find significant differences in hope according to ethnicity and whether participants were 'outpatients' or 'inpatients'. Unfortunately they did not look at the relationship between hope and injury level and type. As such, there is no literature available that states empirically whether these factors influence hope. It is possible for example that people with incomplete injuries, and therefore an improved prognosis of recovery, may have higher levels (and different types) of hope. Interestingly a positive association has been found between hope and functional role participation in acute rehabilitation populations (Kortte et al 2012). This study did not exclusively investigate people with SCI however and also comprised conditions such as stroke, amputation, and orthopaedic injury. As SCI participants were not analysed as a subgroup it cannot be concluded that these results are directly applicable to that population but warrants further investigation.

When discussing the quality and general applicability of the reviewed studies in relation to SCI rehabilitation, it is important to first note that none of the measures used to determine hope levels were designed specifically for the SCI population. For example Snyder's Hope Scale and State Hope Scale are derived from Snyder's Hope Theory, originating in psychotherapy (Snyder 2000). The Miller Hope Scale was designed for people who were critically ill (Miller and Powers 1988). The Herth Hope Scale, another popular hope measure, originates from research in oncological and palliative care (Herth 1992). To date, no literature actually determines if these measures have true validity for measuring hope in someone who has sustained a SCI. As such, one needs to be cautious when interpreting findings. The variability in definitions, conceptualisations, and measures of hope used within these studies makes comparisons difficult.

In summary, although there have only been a limited number of studies investigating the relationships between hope and other variables, significant positive correlations have been found between hope and life satisfaction, coping and self-esteem, and significant negative correlations found between hope, depression, and psychosocial impairment. No evidence has yet demonstrated potential negative effects of hope, even though some authors have voiced concern regarding the effects of unrealistic hope . It must also be noted that because the majority of studies linking hope with positive outcomes are correlational rather than longitudinal in design, the causal direction of the relationship cannot be determined. Possibly greater hope contributes to better outcomes or alternatively better outcomes may foster greater hope. While further research is needed to confirm hope as a predictor of outcome in SCI, there is enough evidence linking hope to better outcomes in this population to warrant further consideration of how practitioners could support or enhance hope in the inpatient setting.

Facilitating hope after SCI

Despite descriptive and discussion articles that offer suggestions for enhancing hope, there have been no specific studies that explicitly investigate either how physiotherapists can support or enhance hope within their practice or how hope is enhanced in the SCI population. Studies have more commonly been carried out in the nursing and medical professions and in populations such as mental health, oncology, palliative care, and critical illness. While there are similarities between these different practice areas and patient populations, there remain significant differences which we must take into account when assessing the relevance and contribution of the literature findings.

However, with the lack of current evidence available in the physiotherapy and SCI field, it is still worth taking account of what evidence there is in these other populations. The following discussion focuses on medical populations rather than mental health, because they are more likely to have physical issues and this was considered to be more generalisable to the SCI population.

Implementation of strategies that foster hope into physiotherapy practice

Herth (2000) and Rustoen et al (1998) each carried out a randomised controlled trial investigating the effectiveness of two similar hope-enhancing programmes in cancer patients. Sessions focused on topics such as strengthening relationships with significant others, exploring spirituality and learning cognitive strategies to enhance hope such as goal refinement, and recognising negative thinking. Both interventions led to a significant improvement in hope on programme completion, but only Herth's participants maintained these improvements at follow up. These two studies did however use different hope assessment tools (the Herth Hope Index and the Nowotny Hope Scale) which may have contributed to the contrasting results.

Duggleby et al (2007) also carried out a randomised controlled trial with older terminally ill cancer patients in which the participants watched a video of other patients describing how they maintained hope and carried out one of three hope-enhancing activities over one week, such as making a hope collection. Hope was found to significantly improved. No follow up assessment was carried out to determine the long-term effects but this is not surprising as the participants were at the end stages of their disease.

Each of these interventions incorporated multiple approaches for enhancing hope. In their entirety they would be challenging for physiotherapists to carry out due to time constraints and difficult to incorporate into standard physiotherapy sessions. There are however a number of individual strategies within these interventions that have been explored in the qualitative literature (Buckley and Herth 2004, Chi 2007, Herth 1990, Koopmeiners et al 1997, Miller 1989, Raleigh 1992, Wong-Wylie and Jevne 1997) and which could be incorporated into physiotherapy practice in a rehabilitation setting. These studies were mixed in terms of research design and methodology, predominantly using semi-structured interviews as their primary form of data collection. Common sources of hope included *relationships* between family, friends, and health professionals, *spirituality,* the *therapeutic relationship* and *goal setting*. Each of these and their applicability to physiotherapy practice will be discussed in turn below.

Relationships and support from family and friends have been reported qualitatively to be an important source in fostering hope after cancer diagnosis (Chi 2007), critical illness (Miller 1989), chronic illness (Raleigh 1992), and in the terminally ill (Buckley and Herth 2004, Herth 1990). These findings were mirrored quantitatively by Piazza and colleagues (1991) who found hope to be positively associated with level of social support after SCI. Miller (1989) found that stronger family bonds were perceived to inspire hope in people who had been critically ill. Family provided a sense that the patient was still cared about and needed, that there was someone to live for and who could share their difficulties. Family could help identify when a patient's hope was waning and assist strengthening it again.

In a Spinal Unit environment, working with families is a part of the rehabilitation process. Families may be involved with goal setting, planning for leave and discharge, and assisting with functional activities. Family and friends are often visiting while patients are participating in physiotherapy sessions. Inviting them to observe therapy sessions and even participate may enhance their involvement with the patient's rehabilitation, enabling the patient to feel more supported. Family integrity may be enhanced by ensuring support people are aware and take advantage of visiting hours, are invited to attend relevant meetings, are listened to with respect, and by facilitating quality time together (Kautz and Van Horn 2009).

Spirituality is another common source of hope identified in the literature (Buckley and Herth 2004, Chi 2007, Herth 1990, Miller 1989, Raleigh 1992). Although often directly connected to religious beliefs, it also included other non-religious beliefs and philosophies about life and death. This finding regarding the role of spirituality may have particular relevance in the New Zealand context and in particular for Māori who have had a SCI given spirituality, or taha wairua, is identified as one of four core dimensions of Māori well-being in the now well-known Māori health model, Te Whare Tapa Whā (Durie, 1998). In practice, drawing out deeper discussions around an individual's spiritual side is not necessarily something all physiotherapists would feel comfortable about. Yet in a Spinal Unit environment, especially one with conānections to a larger tertiary care service, there is often the capacity to link the patient with other services who could offer support if this is identified as something that might be of value to the patient. Spirituality can be supported by informing the patient about the chaplaincy service and cultural support services, and/or making the Spinal Unit's counsellor available to patients. However, it should not be assumed all patients regard spirituality as important. Providing opportunities for the patient to go on leave to attend a church service may also have advantages in terms of encouraging community participation and reintegration, and strengthening the bonds with their church if they live locally.

Aspects of the *therapeutic relationship* may be important. For example, how health care professionals communicate with and relate to their patients has been perceived by patients to influence hope both positively and negatively (Buckley and Herth 2004, Koopmeiners 1997, Miller 1989, Wong-Wylie and Jevne 1997). Koopmeiners (1997) conducted semi-structured interviews with 32 men and women with various stages of cancer. These authors found that hope was inhibited by providing information in an insensitive, disrespectful, or contradictory way. Yet hope was also facilitated by health care professionals by:

Being present – taking time to talk and be helpful.

Giving information and answering questions in a positive, honest, and compassionate manner.

Demonstrating caring behaviours such as thoughtful gestures, showing warmth, being friendly, polite, and sympathetic.

Similar findings were found by Wong-Wylie and Jevne (1997) who looked at the interactions between physicians and HIV sufferers. How the patient perceived the patient/doctor relationship influenced whether interactions were hope-enhancing or hope-diminishing. Doctors who treated their patients as human beings rather than cases and who listened and talked *with* the patient rather than *to* the patient were seen to influence hope more positively. This highlights the importance of how health professionals interact with their patients. Unfortunately neither of these studies specifically looked at how physiotherapists interacted with patients, though the characteristics described are likely also applicable in a physiotherapy setting. These findings suggest that features of care naturally assumed to be good practice such as compassion, honesty, and the ability to listen may nurture hope. Showing a genuine interest in patients' needs and responding to their concerns demonstrates listening. Although physiotherapists are often constrained by session time, discussion and discourse is still a natural part of physiotherapy practice. The findings of this review would suggest physiotherapists would be well advised to take at least a few minutes where possible to just talk to the patient about things other than the actual intervention; maybe while they are having a rest between exercises or at the start of a session. Even a small act such as smiling can communicate caring.

Physiotherapists often provide education and information; they should think about how information is communicated, aspiring to be realistic and honest yet remaining compassionate and positive. If patients ask specific questions, including ones about prognosis, they should be informed truthfully about possible outcomes and likelihood of recovery, yet allow acknowledgement of uncertainty and possibility.

Physiotherapists can have an additional role in facilitating *goal setting* and attainment, which has also been observed to foster hope (Buckley and Herth 2004, Chi 2007, Miller 1989). Similar to hope, some participants reported goals that may be perceived to be more realistic than others. Yet being able to achieve personal goals further enhances hope; therefore, it could be suggested that having no achievable goals may diminish hope. Particularly in people with less realistic hopes and goals, physiotherapists may try to facilitate setting smaller, possibly shorter term goals that are more achievable. Engaging the patient in small achievable tasks might help them to see that a future can be developed. This links again with Snyder's Hope Theory, where setting smaller goals could be seen as enhancing pathways towards larger goals. Goal setting is not a new concept for physiotherapists and is something most physiotherapists already incorporate into their practice. These findings would suggest that goal setting is not simply a means to an end, but may also be an intervention in its own right. One should be cautious of ensuring goals are kept patient-centred and meaningful versus therapist-centred (Hammell 2007, Randall and McEwen 2000). Strategies such as identity-oriented goal training, which aids identification of what matters most to the patient, may be worthy of consideration for use in a Spinal Unit setting (McPherson et al 2009, Ylvisaker et al 2008).

CONCLUSION

It is becoming increasingly clear that hope plays a significant role in patients' experiences of rehabilitation after SCI, particularly in the early stages. These experiences of hope appear to be multidimensional and reflect elements common to published definitions of hope. Although there is still some debate as to the potentially damaging impact of what may be perceived to be "unrealistic" hopes, the evidence presented in this review would suggest the benefits of hope outweigh the perceived dangers. People with SCI have subjectively reported the importance of hope, and research has demonstrated hope to be associated with positive factors such as coping, enhanced life satisfaction, and lower rates of depression. While evidence of hope-enhancing strategies is limited in the context of SCI and/or physiotherapy practice, evidence in other populations suggests that hope can indeed be influenced or improved. Strategies adopted in other populations and by other health professionals could be incorporated into physiotherapy practice. The effectiveness of such strategies in the SCI population would warrant further investigation in the future. Other areas for future research could include: how specific comments that health care professionals make contribute to hope, what is the relationship between hope generally and different types of hope to specific functional and rehabilitation outcomes, and does injury level and type have an influence on hope levels. Psychometric testing of hope assessment tools in the SCI population is also necessary.

Notwithstanding the need for further research, the findings of this review highlight that physiotherapists need to give more explicit consideration to the role of hope in recovery following SCI. Physiotherapists may inadvertently impact hope through the course of rehabilitation, for better or for worse. As such, a greater awareness of the role of hope and factors that may help or hinder hope, along with the adoption of related strategies, is likely to optimise the potentially beneficial effects of hope for people following SCI.

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Presenting the case for all physiotherapists in New Zealand to be in professional supervision

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ABSTRACT

Professional supervision is a formalised process of support and learning which allows practitioners to develop and expand their professional knowledge and competence. Its aim is to assist practitioners to assume responsibility for their own practice and to ultimately ensure enhanced care and safety for patients. It is central to the process of ongoing learning and expansion of practice and provides a means of encouraging self-assessment, analytical and reflective skills of their work. This article aims to explain the difference between clinical and professional supervision, to expand the reader's understanding of the process of professional supervision and then to give compelling reasons as to why all New Zealand physiotherapists should be both trained and regularly engage in professional supervision.

Key words: Support, reflection, learning, partnership.

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INTRODUCTION

Professional supervision provides the practitioner with scheduled, protected time in which to reflect upon their practice, facilitated by a respected colleague. Its aim is to equip the practitioner with a forum for professional growth while ensuring consistency, quality and safety of the service they provide to their patients (Physiotherapy New Zealand 2012). Although professional supervision as a way of providing ongoing learning and support has been common in many of the caring professions since the 1990s (Bishop 1998), its use by physiotherapists worldwide has been less familiar (Sellars 2004). As a 'hands on' profession, strong emphasis has traditionally been given to improving clinical practice standards while managing the physical demands such practice places upon us as therapists (e.g. back care). However, with the development of professional supervision there has been increasing recognition of the benefits of using this technique to manage the other stresses involved in being part of a caring occupation. In recognition of this, Physiotherapy New Zealand (PNZ) issued a position statement in March 2012 stating that; "PNZ expects all members to engage in supervision, regardless of the stage of their career, and work settings/context" (Physiotherapy New Zealand 2012). This encouragement to engage with professional supervision brings our profession into line with physiotherapists and other allied health groups around the world. In this article, we explain the difference between clinical and professional supervision and present the case for all physiotherapists in New Zealand to be both trained and engage regularly in professional supervision, irrespective of their type of work or stage of career.

The differences between clinical and professional supervision

All physiotherapists in New Zealand are familiar with the term clinical supervision which is associated with junior and undergraduate learning in the clinical situation under the leadership of a more senior colleague. This process aims to develop the clinical skills of the less experienced clinician (Sellars 2004) by developing their clinical reasoning through discussion, appraisal and review (Hall and Cox 2009) and by presenting the junior with situations in which they are able to 'mirror' the actions of their supervisor (Mattsson and Mattsson 1994). Professional supervision, however, is defined as part of ongoing professional reflection and education, and is less well understood (Hall and Cox 2009) (see Table 1). Confusion between what constitutes professional and clinical supervision is complicated by the literature which commonly refers to the process of 'professional supervision' as 'clinical supervision'. Table 1 distinguishes between clinical and professional supervision (Mattsson and Mattsson 1994, Sellars 2004, van Ooijen 2003).

As with clinical supervision, professional supervision takes place in the work place but involves an exchange between colleagues to facilitate professional development (Winstanley and White 2003). Its aim is to provide the physiotherapist with a "structured opportunity to talk meaningfully to a trusted colleague about their circumstances at work" (Winstanley and White 2003, p 8) and provide a space for them to reflect on practice, to identify solutions to problems and thereby improve practice and increase understanding of professional issues (Hall and Cox 2009).

This lack of understanding of the role and function of the two differing types of supervision may limit the enthusiasm of physiotherapists to pursue professional supervision. To date, the adoption of regular supervision by physiotherapists in New Zealand is variable. In some places, it is considered the norm, with physiotherapists receiving excellent professional supervision but in many other areas, professional supervision is unavailable or provided by line managers resulting in the process being viewed with suspicion by those unfamiliar and distrustful of both the idea and the practice.

Table 1: Differences between Clinical and Professional Supervision

	Clinical supervision	Professional supervision
Location	Work place; office or clinical environment.	Generally in the work place; somewhere free of distractions.
Aim of the process	To improve clinical skills and clinical reasoning through a system of appraisal and review.	To provide support and reflective listening to facilitate professional competency, knowledge and professional growth.
Frequency	As required and as work load allows. Regularly occurs for junior staff but less common as the practitioner becomes more experienced.	Regular protected time. Most commonly for one hour every month irrespective of practitioner skill and experience.
Structure	No formal structure but may follow local guidelines.	Formalised contract agreed to by both parties at outset of supervisory relationship.
People involved	Senior physiotherapist as clinical supervisor and supervisee +/- patient or other supervisees.	Trusted colleague trained in supervision (who is not the line manager and may be from a different profession to the supervisee). Other models such as group supervision may involve other people.
What is discussed	Patient/whānau and clinical issues.	Professional issues including clinical, organisational and personal issues as they pertain to the work environment.
How is this discussed	Senior clinician oversight and/or monitoring - reviews and gives advice.	Supervisor listens and facilitates the supervisee to reflect upon their own practice and identify solutions, opportunities and outcomes.

The components of professional supervision

In recent times, there has been an increase in demand for physiotherapists to show high levels of professional and personal accountability and demonstrate provision of a high quality, innovative, effective and efficient service to the clients they serve, while working collaboratively within their wider team structure (Sellars 2004). This has occurred within a demanding healthcare environment of reduced Accident Corporation Compensation (ACC) subsidies for private practice physiotherapists and a reprioritising and reduction of spending within the rest of the healthcare sector. Both the professional and organisational pressures on physiotherapists have therefore risen considerably and it has become clear that as a profession we need to come up with ways of helping ourselves manage these pressures, while maximising the level of service and care we provide to patients.

Self-reflection on one's practice has historically been seen as one method available to physiotherapists to manage these issues, but may not always be helpful, as it is easy to become "stuck" within the process, resulting in an inability to move forward (van Ooijen 2003) or to put it a different way; for the physiotherapist to be 'unable to see the wood for the trees'. Previously, 'tea and a chat' conversations between colleagues were also used to help therapists manage their stress levels and in some cases to reflect upon their work (Santos et al 2010). However, the increasing time pressure demanded of those working in today's health service has put pay to much of this informal process, leaving many physiotherapists isolated, unsupported and lacking professional accountability (Clouder and Sellars 2004, Santos et al 2010). This potentially puts physiotherapists and their patients at risk. Professional supervision provides a way of managing these issues, through the use of 'learning from practice' and encouragement of a formalised process of critical self-reflection to identify solutions to problems, improve practice and increase understanding of professional issues (Sellars 2004).

The term professional supervision encompasses a number of models of supervision which act as frameworks or guidelines providing structure and intention to the process of professional supervision. These models can be loosely divided into four main groups, each one being more suited to particular groups or situations than the others;

1. Models of reflection; these provide different tools and ways of reflecting on an issue both before and during supervision e.g. brain storming and mind mapping (Bond and Holland 1998).
2. Psychological approach models; these are most frequently associated with counselling and are based on theories of 'what it is that makes people tick', such as those of Freud and cognitive behavioural therapy (van Oojen 2003).
3. Developmental models; these are influenced by developmental psychology and focus largely on the educative role of supervision. These models suggest that there are a number of stages a practitioner passes through, from beginner to experienced clinician and supervision is structured accordingly (Hawkins and Shohet 2000).
4. Supervision specific models; as professional supervision has become an increasingly important part of the caring professions, theoretical models have been developed pertaining specifically to this activity rather than being borrowed from other functions and fields. There are a number of these focusing on different aspect of supervision such as the tasks, functions, structure and process of supervision (van Ooijen 2003).

An example of a supervision specific model is the Supervisory Alliance Model developed by Proctor (Inskipp and Proctor 1993, 1995) which suggests there are three functions of supervision; normative, formative and restorative (Bowles and Young 1999). Generally, all three will be covered during a supervision session but the weight given to each is likely to vary from session to session depending on the supervisee's needs and requirements. Table 2 provides a summary of the normative, formative and restorative functions of supervision (Cutliffe 2001).

The normative function is concerned with professional and management issues. It encourages review of the administrative and ethical aspects of the physiotherapist's role and encourages the clinician to evaluate their work in relation to these (van Ooijen 2003). This important part of the supervisory process is likely to be compromised if the role of supervisor is taken by the practitioner's line manager. The lack of direct line management involvement in the professional supervisory process allows it to fulfil its supportive rather than confrontational function (Bishop 1998).

The formative function of professional supervision is concerned with developing the physiotherapist's ability and understanding of their skill base. The more inexperienced the supervisee, the more likely this function will share similarities with clinical supervision, in that the supervisor may be required to take on a more educative role, sharing their experience as a way of facilitating learning for the supervisee (Bishop 1998). With more experienced staff, the formative function is likely to be geared towards identifying opportunities for further learning outside the supervisory relationship and may play a less important part in the overall process of regular supervision.

In the restorative part of professional supervision, the supervisor seeks to provide support and understanding for the supervisee, helping them to manage their own needs and feelings in relation to their work (Bishop 1998). This is a big change from the more traditional model of managing physiotherapist's work related stress which assumed that burn out could be managed by 'getting on with things' and teaching the physiotherapist not to care, rather than assisting them to care with supports in place to help them manage the stresses associated with their work (Bishop 1998). The restorative function is central to professional supervision and is vital in a profession such as physiotherapy which has not had a strong history of caring and concern for the wellbeing of its members (Linsay et al 2008).

Although the three functions of professional supervision have been presented separately here, in practice they often overlap within the supervision session. For example, helping a supervisee to reflect upon a treatment session with a patient may involve a discussion of ethical issues, the appropriateness of treatment and if the supervisee had sufficient skill to carry it out effectively. The supervisee may require support around managing such a patient/whānau/condition and wish to discuss what went well or not so well. Likewise, supervision sessions rarely follow one specific model, instead taking elements from a number of models depending on the needs of the supervisee during a specific session. It is here that the benefits of formalised supervision training become clear in helping the supervisor to alter their approach as appropriate.

The value of professional supervision

So what is it that makes today's physiotherapist in need of regular professional supervision, rather than managing with individual reflection and the occasional 'corridor conversation' with a colleague as we have always done? Our profession has a strong tradition of being wedded to the biomedical view of 'the body as a machine' which has demanded the physiotherapist maintain an objective, depersonalised view of both the patient and their practice. As a result, physiotherapist's feelings for, and perceptions of, their clients have been considered of little relevance to clinical practice (Nicholls and Gibson 2010). Physiotherapists have commenced clinical practice with little understanding of the impact this can have on their own wellbeing and on the care they deliver to their clients. Butterworth et al (1998) suggest that the technological, output driven world of today's health service provides little room for emphasis to be given to nurturing, caring and compassion in the relationship we have with our patients. Much of the work undertaken by physiotherapists involves intense one on one relationships with clients, supporting and encouraging them through difficult and often uncomfortable regimes of treatment, frequently over a prolonged period of time. This leads to a responsibility of care which can result in the physiotherapist taking on the patient's distress for which they have had little or no preparation (Balogun et al 2002). The impact of carrying this burden for our patients can be huge, and may lead to an increase in work related stress and eventual burn out (Martinussen et al 2011). Professional supervision provides a place that acknowleges this and allows space for the supervisee to work out ways of managing the situation with the help of their supervisor. Professional supervision has been shown to be an effective preventative measure to avoid burn out in female nurses but is less effective when it comes to manging those who have already reached the stage of being overwhelmed by their professional roles (Koivu et al 2012). Certainly, in a small study of physiotherapists working in acute district hopitals in the UK, three quarters of participants reported having someone from whom they could seek support other than their line manager was considered very helpful (Hall and Cox 2009).

Table 2: Summary of the Supervisory Alliance Model

Function	Normative	Formative	Restorative
Description	Managerial	Educative	Supportive
Tasks in summary	To ensure both supervisee and supervisor monitor administrative aspects of job.	To set up a learning relationship & in some instances to teach	To council and consult.
Task examples	Review of quality assurance schemes, evidence based practice and standard setting. Monitor professional ethical issues. Evaluate practitioners' role within the organisation.	Learning may involve exploring educational opportunities outside the supervisory relationship, e.g. courses or external people who can help, or it may involve sharing clinical experiences for review by both parties.	This restorative element is central to professional supervision and allows the supervisee to 'unload' their stresses concerning their work and clinical practice.

Many of the physiotherapists working in New Zealand are employed by large government agencies such as the District Health Boards (DHBs). It has been suggested that distress in the caring professions comes not only from direct contact with patients, but also from the reactions of the organisation within which they work (Scaife 2001). Working within agencies such as the DHBs can place the physiotherapist in a situation where their basic mandate to care for their patients may conflict directly or indirectly with the organisational priorities (Butterworth et al 1998). This occurs in a myriad of ways but is often linked to increasing fiscal pressure, resulting in a discrepancy between the individual's professional values and the organisation's administrative objectives, a reduction in training opportunities and a lack of organisation in the hierarchal chain of command (Santos et al 2010).

Other physiotherapists in New Zealand work in small, often sole practitioner practices and for those, the lack of accountability, isolated working conditions and the financial pressures of keeping a small business afloat, may also frustrate their ability to maximise both patient care and job satisfaction. The increasing autonomy with which physiotherapists work has also added to the pressure, particularly for those working in smaller practices where the physiotherapist has minimal avenues from which to seek the help, reassurance and support often required.

The physiotherapy profession is able to control the work its members do, the requirements for entry and autonomy over its practice. The power that comes from being part of such an organisation can lead to an unequal relationship between the physiotherapist and the client, distancing the therapist from the patient by limiting the sense of 'being with' or being alongside the patient, helping to contain their anxieties (Bright et al 2012, Mudge et al 2013). These professional relationships often emphasise the practical and technical aspects of a job rather than the more basic but crucial act of caring. In recent times, this caring has been become an necessary component of 'patient centered care' and although understood to be important within clinical practice, there is limited literature suggesting what skills are required for physiotherapists to provide their patients with this type of caring (Bright et al 2012). Despite this lack of clarity on what is required to provide our patients with care as well as clinical expertise, many physiotherapists see their role as providing much more than the delivery of the practical and technical functions of health care. Professional supervision encourages the development of these relationships, both between the physiotherapist and the patient and between the physiotherapist and other members of the healthcare team (Butterworth et al 1998). This results in improved patient care and increased job satisfaction for the physiotherapist (Sellars 2004).

The challenges of professional supervision

Although there has been much written about the role of professional supervision and its use in positively enhancing the ongoing learning and practice of allied health practitioners (Hall and Cox 2009, Sellars 2004), there are a number of authors such as Gilbert (2001), Hall and Cox (2009) and Yegdich and Cushing (1997) who are less enthusiastic about the process. These authors suggest that the practice of regular professional supervision by various allied health groups around the world has become so normalised that its use as an important part of beneficial professional development is assumed, taking the practice beyond question by the rank and file membership. Gilbert (2001) also argues that supervision, far from being helpful, can act as a subversive mode of surveillance, resulting in the disciplining of professional activity and the squeezing of professional identities into a self-regulated autonomy of moral regulation. This view has been directly countered by Clouder and Sellars (2004), who agree that while we are all exposed to surveillance in both our home and professional lives, through a myriad of social agencies, the explicit nature of professional supervision makes the practice more ethical than the more illicit type of professional surveillance that occurs if a formalised regime of professional supervision is not in place. Bishop (1998) agrees with this view, going on to suggest there are ways of reducing the surveillance aspect of professional supervision such as ensuring the role of the supervisor and the manager are kept separate.

The early proponents of professional supervision did not appear to see it as a means of surveillance but instead as a way of ensuring competent practice while enhancing the service provided to patients (Bishop 1998). More recently, the benefits of professional supervision as a way of enhancing professional development have become more strongly emphasised (Hall and Cox 2009). Clouder and Sellars (2004) have suggested that that irrespective of whether or not individual rank and file practitioners agree with supervision, it is likely that the process of professional supervision is now so deeply embedded in policy documents (such as the position statement put out by PNZ in 2012), that it is unlikely to be displaced in the near future.

Where to from here?

So where does that leave us as a profession encouraged to engage and possibly provide regular professional supervision? Physiotherapists in New Zealand have a wide variety of clinical and supervisory experience and work in vastly differing areas of practice. In our view, all would benefit from being in regular supervision. Many physiotherapists may find it easier to see the immediate value of supervision for more junior clinicians who are still developing their professionalism and baseline clinical skills than for more senior staff who have been in their role for many years. However, it is clear from the literature that once engaged in supervision, all physiotherapists irrespective of the stage of their career are likely to feel the benefits of the process (Hall and Cox 2009, Sellars 2004).

Certainly, the days of physiotherapists spending hours caring for a seriously ill patient with nowhere to take their anxiety and grief should be long gone. Similarly, we should not be leaving physiotherapists to disappear unsupported under an avalanche of patients as they attempt to balance the books of their sole practitioner practices. Nor should we expect the profession to retain clinicians left to cope with impossible caseloads and overwhelming organisational demands, while being offered little in return. Scenarios such as these do us no credit as a profession and expose physiotherapists to huge stresses and place them at risk from eventual burn out (Yegdich and Cushing 1997). They also put the provision of good patient care at risk. If we continue to expect members of our profession to practise in a professional, holistic and caring way, we must offer them ways to do so and we believe that regular professional supervision provides such an avenue.

However, despite significant anecdotal evidence of the benefits of professional supervision, there are only a small number of published empirical studies that support its use for allied health professionals. This poses a problem when trying to persuade a profession of the benefits of the professional supervisory process. Further research is required, ideally carried out within the New Zealand context, to provide a firmer base of support for all physiotherapists to be in regular professional supervision.

Ensuring that all New Zealand physiotherapists embrace the idea of regular supervision will not only be hampered by the lack of research based evidence, but also by the actual time and cost of receiving regular professional supervision. The majority of physiotherapists in New Zealand are self-employed; working in small practices throughout the community. Such businesses have been hard hit in recent times by the changes to New Zealand's ACC levies and by the economic recession generally. Persuading these physiotherapists to take an hour out of their working day on a regular basis to engage in professional supervision will not be an easy task. This may be one reason why, to date, the vast majority of physiotherapists in New Zealand in regular professional supervision, work for DHBs or primary health organisations who are able to provide both time away from clinical work load and the financial resource to pay for professional supervision training.

For professional supervision to become the norm within New Zealand we must ensure professional supervision training is well organised and convincing enough to persuade our colleagues to enrol in both the training and the supervisory process itself. In the longer term, one way to achieve this would be to move the professional supervision training and education from the workplace into the schools of physiotherapy. This would ensure that newly qualified physiotherapists arrive at their first jobs with a reasonable knowledge of professional supervision and a desire to engage in the process throughout their career.

CONCLUSION

Our challenge as a profession is to ensure that regular professional supervision becomes the norm for all physiotherapists, firmly established as part of autonomous practice rather than allowing it to become a casualty of time in a profession that tends to favour patient contact time above all else. For this to happen, there needs to a commitment from both our schools of physiotherapy and our professional bodies to support ongoing training opportunities for professional supervision provided for both under graduate and post graduate physiotherapists as well as research to investigate the benefits of professional supervision in New Zealand.

KEY POINTS

- Professional supervision is different from clinical supervision.
- Professional supervision provides the physiotherapist with scheduled, protected time to reflect upon their practice, providing a forum for managing stress and encouraging professional growth while ensuring consistency, quality and safety of service.
- Physiotherapy New Zealand, through their position statement, expects all members to engage in supervision, regardless of the stage of their career, and work settings or context.

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Clinical and morphological changes following 2 rehabilitation programs for acute hamstring strain injuries: a randomized clinical trial.

Silder A, Sherry M, Sanfilippo J, Tuite M, Hetzel S, Heiderscheit B (2013) Clinical and morphological changes following 2 rehabilitation programs for acute hamstring strain injuries: a randomized clinical trial. Journal of Orthopaedic and Sports Physical Therapy 43: 284-299. (Abstract prepared by Ashokan Arumugam)

Aim

To investigate differences between two rehabilitation programmes (progressive running and eccentric training [PRES] and progressive agility and trunk stabilization training [PATS]) on clinical and morphological recovery following acute hamstring injury.

Methods

A double-blind, randomised clinical trial was used. Twenty-nine participants (23 males, 6 females) aged 16-46 (mean 24.0, SD 9.2) years, with a history of hamstring injury within the past 10 days were randomly allocated to either the PRES (n=13) or PATS (n=16) group. Primary outcome measures were time to return-to-sport (days) and the craniocaudal length of injury (measured with magnetic resonance imaging [MRI]). Various secondary outcomes based on physical examination (e.g. measures of pain, range of motion and strength) and MRI were measured at the beginning and the end of rehabilitation. Periodic follow-up was carried out through emails or phone calls at 2 weeks and 3, 6, 9 and 12 months following return-to-sport. Data were analysed on an intention to treat basis.

Results

Twenty-five participants completed the trial. There were no significant differences between groups in the mean time required to return-to-sport, the initial and final physical examination tests, the initial MRI measurements, and the magnitude of improvement based on physical examination at the end of rehabilitation. However, the mean improvement in the craniocaudal length of injury for the PRES group was less than the PATS group ($p = .035$). Despite the absence of clinical symptoms at the time of return-to-sport, all the participants in both groups showed signs of incomplete resolution of injury on MRI.

Conclusion

The extent of clinical and morphological changes in acutely injured hamstrings was similar in both groups at the end of rehabilitation. However, signs of muscle healing persisted on MRI for all participants at the time of return-to-sport.

Commentary

Hamstring injuries are common amongst people participating in various sports that involve running and/or kicking. The chance of hamstring injury recurrence can be as high as 26% in sports like the Australian Football League (Orchard et al 2013), and could be due to premature return to play without complete healing of the injury (Connell et al 2004). Therefore, effective treatment of acute hamstring injury with an appropriate rehabilitation programme prior to returning to sports is recommended. Eccentric hamstring training has been shown to be a promising approach to minimising hamstring injury incidence or recurrence (Petersen et al 2011). A recent systematic review documented that lumbopelvic exercises decrease the incidence of lower limb muscle strain by two and a half times when compared to other interventions (Perrott et al 2013). Specific to the hamstrings, progressive agility and trunk stabilisation (PATS) training (Sherry and Best 2004) has been documented to reduce re-injury rate.

The current study is interesting because it compares the outcomes of a progressive running and eccentric strength (PRES) training and a modified PATS programme on acute hamstring injury via a randomised clinical trial. This study is of high quality according to the PEDro scale rating, meaning the risk of bias associated with its findings is negligible.

Both groups were similar in the initial and final physical examination tests and the initial MRI measurements (craniocaudal length of injury, cross-sectional area of injury (%) and parameters indicative of oedema). There was a disagreement between MRI and clinical examination diagnosis of the muscle injured (medial or lateral hamstrings) for nine participants. Among them, MRI did not show any signs of injury for three participants. Moreover, clinicians should be aware that a diagnosis based on physical examination may not accurately detect the muscle injured (medial or lateral hamstrings) and minor hamstring injuries (grade1) may not always be discernible using MRI.

The magnitude of improvement based on symptoms at the end of rehabilitation and the mean time required to return-to-sport was not significantly different between groups. However, the mean improvement in the craniocaudal length of injury was significantly different between groups indicating that the PATS group improved to a greater extent compared to the PRES group. The craniocaudal length of injury appears to be an important prognostic indicator to estimate the time of return-to-sport, as a longer defect viewed on MRI correlated to a proportionately longer lay-off time.

All the participants showed signs of hamstring healing with many having early scar tissue formation at the time of return-to-sport. Three athletes in the PRES group and one in the PATS group sustained hamstring re-injury (at the same site as the previous injury) during the study. This might be due to premature return-to-sport without complete resolution of hamstring injury as evident in MRI. As MRI is not routinely available, clinicians need to rely on physical examination to assess pain, range of motion and strength bilaterally for diagnosis and follow-up.

Though most of the exercises in the PRES programme involved only the injured limb as opposed to the PATS programme that involved both limbs, both groups demonstrated improvement in muscle recovery to a similar extent at the time of return-to-sport. The authors acknowledge that the small sample size of this study precludes definitive conclusions on the effectiveness of either the PRES or PATS programme at reducing the risk of injury recurrence, which warrants further investigation with a larger sample size. However, one important implication for clinicians is that hamstring healing continues, as noticed on MRI, even after resolution of clinical signs and symptoms and return to sports participation. Therefore, periodic follow-up assessments and individually tailored ongoing training of individuals after they return-to-sport may be important.

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Trigger Point Dry Needling: An Evidenced and Clinical Based Approach.

Jan Dommerholt, Cesar Fernandez-de-las-Penas (eds), Churchill Livingstone, Elsevier, Edinburgh, 2013. ISBN 978-0-7020-4601-8. Hardcover 258 pages. RRP $102 (www.fishpond.co.nz).

This book has been published at a time where there are a number of arguments for and against the use of dry needling as a therapeutic modality. The editors aimed to address these arguments and bring together all current evidence, as well as giving the reader a point of reference for technique and application. The quantity of information is broken down into easily manageable sections. The text gives an excellent background and step-by step approach allowing an easy read for even the inexperienced therapist.

The text is split into three parts. Part 1 outlines the neurological and physiological effects of myofascial trigger point dry needling on both the connective tissue and fascia; effortlessly incorporating current research. A comprehensive section on safety and practical application then follows. Part one ends with the editor outlining a balanced argument for the use of dry needling; which is again adequately referenced.

In part two the use of trigger point dry needling on certain body parts for specific clinical presentations is presented. Each section begins with the author discussing the prevalence and aetiology of certain trigger points and then the evidence base for the use of dry needling. Some of the sections go into more detail than others on the current evidence base. Each muscle in that region is then detailed separately stating: anatomy, function, innervation, referred pain, needling technique and precautions. This is combined with clear photographs of each technique.

Part three focuses on other types of dry needling, stating their physiological benefits, clinical application and practical considerations. These approaches include: superficial dry needling, medical acupuncture, Gunn's intramuscular stimulation, for use in patients who present with neuropathy and Fu's subcutaneous needling, for the treatment of myofascial pain. Fu's subcutaneous needling uses a trigger point approach but with added dimensions, such as using a 'reperfusion approach' which has origins in Chinese acupuncture.

With the exception of the medical acupuncture approach, which provides current evidence based guidelines, the authors for the other three approaches discussed have not included current references.

Overall this book combines scientific explanations with practical applications and an in-depth look at the current evidence base, making this work clinically very applicable. The sections are easy to read and well set out whilst incorporating a wealth of information.

Part three is the only section that does not follow suit, possibly due to the topics not being the main focus of the book; thus the authors did not make reference to the current evidence base. Whilst it remains informative and visually pleasing the precedent set by the previous sections makes this section feel a little lacking in content.

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Musculoskeletal Assessment

Joint Motion and Muscle Testing, Third edition; Hazel M. Clarkson; 2013; Wolters Kluwer/Lippincott Williams & Wilkins; ISBN-13: 978-1-60913-816-5; Soft Cover with Online Resources; 532 pages.

This book is a practical resource in the assessment of joint range of motion (ROM) and muscle strength testing in both a clinical and classroom setting. This third edition provides an online resource for practical testing alongside updated photos and illustrations. Fresh techniques are described in testing ROM of the temporomandibular joint as well as the spine, using calipers, standard inclinometers, tape measures and the Cervical Range-of-Motion Instrument

The book is divided into two sections; the first is regarding principles and methodology of evaluation. A strong introduction is established in the basic application of practical testing, discussing communication; therapist posture; palpation and visual observation. The text continues to describe methods and measurement tools for both ROM and muscle strength testing as a pre-requisite for the following chapters. Interestingly an overview of the similarities between the techniques used for assessment and those used to apply treatment are provided earlier than with the previous edition in chapter two.

Section two focuses on the objective testing of the extremities, head, neck and trunk including the temporomandibular joint. Each chapter covers a specific joint complex and is presented in a systematic order including articulations, movements, and surface anatomy. Active and passive ROM is described as well as muscle length testing of key muscles of each joint complex. Manual strength testing is defined and each chapter provides tabular forms revising muscle actions, attachments and nerve supplies followed by the individual movement testing. Finally, functional application of the techniques is covered emphasizing the ROM required for performance of daily activities. Common compensatory movements that patients often perform are discussed in both sections along with specific tests for these, a valuable resource for clinicians.

Comprehensive photos and illustrations usefully accompany most of the assessment techniques described. The book is structured in a user friendly way with practical tables throughout and learning is promoted through practical examples. The online resources include videos, with clear narrative of the different tests as well as further assessment information, tools and practical recording forms.

The text and supplementary online additions provide an educational and clinical resource that combines joint ROM and manual muscle strength evaluation in one volume. It achieves its aim through visual guidance, clear description of techniques and promoting standardisation and competency in clinical assessment. Overall this would be beneficial for undergraduate physiotherapy students learning and practising techniques and applying these to a clinical setting. Normal ROM values are provided but some pre-requisite knowledge of anatomy is presumed.

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Rehabilitation for the Postsurgical Orthopedic Patient. Third edition.

Lisa Maxey and Jim Magnusson, Elsevier (Missouri). Hardcover. RRP: $99 AUD; Publication Date: 22-01-2013; ISBN: 9780323077477

In the wake of new research, surgical techniques and rehabilitation guidelines, this text has evolved through to its third edition. This edition continues to maintain the provision of current evidence based information to direct the physiotherapist in designing appropriate rehabilitation following a large range of orthopaedic surgeries. The text aims to offer the reader an evidence based understanding of the journey their patient takes right from injury, through surgery and finally onto successful rehabilitation.

The introduction invites the reader on how best to utilise the book and the attractive feature of the website link to the home exercise programme. A notable instigating feature is how the authors appropriately educate the therapist on the tissue healing process in the first two chapters. These founding chapters are deemed essential to take note of, in order to make effective use out of the book. These establishing chapters provide the reader with important information so to fashion appropriate graduated goal orientated rehab which is suitable for safe tissue development following the surgeries discussed in the ensuing 34 chapters.

The authors state that they aim to offer the reader with "the most comprehensive evidence based view of post-operative rehabilitation". The text includes addressing the most common orthopaedic procedures encountered by the physio. This includes covering the management from the upper extremities, through the spine to the lower extremities. The authors, who are physiotherapists themselves, respect the importance of the clinical application of the latest evidence. In light of this, each chapter's information has been supplied by surgeons and therapists who actively practice the relevant surgeries and rehabilitation discussed. The majority of the recommendations are backed up by research; however, there are some points made which are not referenced and thus indicate that they are based on the contributing authors` own experience.

Despite the variety of contributors, each chapter follows a similar and logical format in that they begin with the indications and considerations for surgery followed by a detailed description of the surgical technique itself. This is enhanced with diagrams and pictures throughout and with the addition of the surgeon's concerns with regard to rehabilitation. Following this description, the reader is then systematically lead through a graduated rehabilitation guideline which reflects the tissue healing process learnt about in chapters one and two.

The appreciation for teaching the reader clearly is emphasised by the plentiful illustrations, diagrams, pictures and tables. The novel feature of a website link via phone or computer to an exercise programme allows the therapist to edit and print recommended rehabilitation and home maintenance programmes and adds to the user friendliness of this book. The trouble shooting vignettes at the end of each chapter challenge the clinical reasoning of the reader and prompt the therapist to develop strategies to address varying clinical presentations. These latter two features are unique in the field of books related to the physical rehabilitation of the post op patient, highlighting how beneficial it is to all physiotherapists both at undergraduate and postgraduate level.

Overall, this book is highly recommended as a very helpful resource to the physiotherapist in both the primary and secondary care setting. Furthermore, it is deemed applicable and highly worthwhile for physio students to read to enhance their knowledge and clinical reasoning skills.

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Measuring Walking: a Handbook of Clinical Gait Analysis.

Richard Baker. Mac Keith Press London 2013. ISBN 978-1-908316-66-0. Soft cover. 229 pages. RRP: $95.90 (www.fishpond.co.nz)

Clinical or three-dimensional Gait Analysis is a specialized area of clinical practice that assesses, plans, and treats individuals with conditions that affect their walking ability. This book is the culmination of the author's scientific background and 25 years of practical experience in clinical gait analysis. This book is a practical guide that builds on the wisdom of authors such as David Sutherland and Jim Gage and also suggests new ways of thinking for future practice. This book is a good read for any clinician, student, or researcher working in or intending to work in a clinical gait service.

This book offers a clear and practical step by step guide that covers everything from the basic principles of clinical gait analysis through to more specific topics for the specialists in the field such as data processing, quality and how to set up and maintain a clinical gait analysis service.

Chapters One and Two cover the basic elements of gait and gait analysis such as the gait cycle and gait graphs. Good descriptions of these are provided with clear illustrations as backup. Chapters Three and Four cover the conventional gait model and alternatives to this model. These are good chapters to read in order to gain an understanding of marker placement and their relationship to the biomechanical model. Aspects of marker placement are well covered with good practical advice given on marker placement. Chapter Five focuses on advanced processing techniques for the specialist reader

Chapters Six to Eight cover electromyography, the clinical video and the physical examination. The author, in consultation with others, covers all aspects of setting up, collecting data and physical measurements in detail. It should be noted that not all labs collect data in all the areas covered in the text, such as electromyography, as part of their standard data collection.

Chapters Ten and Twelve are related to the relationships between data of different types (two-dimensional analysis, joint angles and force plate data); interpretation and reporting. The suggestions made when interpreting data of different types are well thought through and can greatly assist in establishing a clinical picture of the patient. The standardized methods of interpretation of the data will also assist in developing a consistent methodology within a gait analysis service. The impairment based reporting that the author suggests requires input from the whole team and helps to prioritize and focus the issues that affect the patients walking ability.

Chapters Eleven and Thirteen cover quality and accuracy and measurement variability. These chapters succeed in describing a very complex process and highlight areas where errors are typical. It gives clear direction on how to perform a quality audit and how to maintain the levels of service expected of such a service. Finally Chapters Fourteen and Fifteen offer good insight into setting up and maintaining a clinical gait laboratory and service. These chapters may be of interest when performing equipment upgrades or when setting up a brand new service.

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