

Physical exercise conditioning as management modality during the in-hospital phase: A systematic literature review

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Abstract

Regular physical exercise conditioning is already acknowledged for many years as an important component in healthy living, as well as an effective management modality in the later phases of rehabilitation for patients suffering from chronic / non-communicable diseases. Very little information regarding the involvement of “exercise therapists” during the in-hospital phase is available. The purpose of this study was to assess by means of a systematic literature review, the relevant application of physical conditioning during the in-hospital phase (acute phase) for some clinical conditions and which health professionals use as an interventions. A total of 38 studies were found from the internet search engines and other relevant sources. Of these studies 17 research studies complied with the criteria relevant to the purpose of the study. Only literature which reported on some structured physical training programme during the in-hospital phase were analyzed for the purpose of this study. Seven (7) out of seventeen (17) reviewed studies indicate that physiotherapists were primarily responsible for the physical conditioning management required for orthopedic patients during the in-hospital phase, while the remaining 10 were based on other chronic and non-communicable diseases. Regarding the application of physical conditioning during the in-hospital phase for lifestyle related as well as other chronic, non-communicable diseases, no clarity could be found about which health professionals were responsible for the treatment required. From the reviewed literature it became clear that a knowledge gap exists in health science research literature regarding the use of physical exercise conditioning during the in-hospital phase (acute phase) for some clinical conditions. In addition, no specific conclusion was made about which health professional were responsible for the treatment of patients especially for non-communicable diseases. It is therefore, recommended that more research studies in this area are needed to clarify or refute these findings.

Keywords: Physical training, rehabilitation, rehabilitation phases, illness care, health promotion, health care team.

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Introduction

The knowledge about the salutogenic impact of regular physical activity dated back to the 9th century BC (Orfanos, 2007), and presently, more than 2000 years after Hippocrates’ comments on the health related benefits of regular exercises (Paffenbarger, Blair & Lee, 2001), numerous researchers continuously alert the public on this important health modality (Sallis, Linton, Kraft, Cutter, Kerr, Weitzel, Wilson, Spoon, Harrison, Cervero, Patrick, Schmid & Pratt, 2009). Nevertheless the

physical inactive lifestyle of the major portion of the global population still remains a serious health risk (Bouchard, Blair & Haskel, 2007).

According to Corbin, Welk, Corbin and Welk, (2008) the primary cause of premature death has shifted from infections to chronic diseases of lifestyle, with physical inactivity forming a major risk factor, leading to premature death in the USA (Booth, Gordon, Carlson & Hamilton, 2000). Katzmarzyk, Gledhill and Shephard (2000) indicated that hypokinetic conditions may lead to inter alia, the following chronic ailments, e.g. coronary artery disease, stroke, hypertension, colon and breast cancer, type 2 diabetes mellitus, etc.

In this respect, research indicated that exercise therapy can be effectively applied as management modality for these ailments (Kujala, 2004). The initiative of “Exercise is medicine” which was developed in 2009, therefore seeks to motivate health practitioners to prescribe regular exercise for their physical inactive patients (<http://exerciseismedicine.org/index.htm>).

When a patient falls ill or become injured or hospitalized, the traditional medical treatment is rendered by the doctors, nurses, physio- and occupational therapists (Hamel, Drazen & Epstein 2009; Wachter & Goldman, 2009), which inter alia may include physical exercise/therapy (De Witt, Putman, Lincoln, Baert, Berman, Beyens, Bogaerts, Brinkmann, Connell, De Jaeger, De Weerd, Lesaffre, Jenni, Leys, Louckx, Schuback & Schupp, 2006). However, this is often a focus to support the primary medical procedure like surgical procedures, aimed to prevent detrimental complications and speed-up recovery. These therapeutic exercises fall within the scope of practice of physio- and occupational therapy, and as such contribute significantly to the rehabilitation and recovery of the patient. As the treatment of a patient develops further (in the later phases of rehabilitation) some other health professionals may also become part of the treatment and management for example, clinical psychologists, dieticians, exercise therapists etc. (Rippe, Crossley & Ringer, 1998).

During the last couple of years, indications existed where “exercise therapists” (clinical exercise physiologist, exercise scientists) were already involved during the in-hospital phase (acute phase) of the treatment regimen – especially in cases of the treatment of chronic lifestyle diseases (Thompson, Buchner, Pina, Balady, Williams, Marcus, Berra, Blair, Costa, Franklin, Fletcher, Gordon, Pate, Rodriguez, Yancey & Wenger, 2005; Ehrman, Gordon, Visich & Keteyian, 2009). In this respect, Ehrman *et al.* (2009) indicated that most of the “exercise therapists” (CEP/ES) engaging in this phase of treatment (acute phase) primarily focus on cardio-pulmonary rehabilitation. Some tendency, however exist that they (“exercise therapists) may also get involved in the rehabilitation regimes of other chronic ailments, following progression of research in these areas (Ehrman *et al.*, 2009).

Presently very little information is available regarding the involvement of “exercise therapists” (CEP/ES) during the in-hospital phase. This gap in research literature, serves as the motivation to analyzed the implementation of structured physical therapy regime during the in-hospital phase, as well as the health professionals responsible for the treatment or management. In order to establish this, a systematic literature review was undertaken. Therefore only research literatures using structured physical training/conditioning regime during the in-hospital phase were analyzed for the purpose of this study. The purpose of this study was to assess by means of a systematic literature review, the relevant application of physical exercise conditioning during the in-hospital phase (acute phase) for some clinical conditions and which health professionals present the exercise interventions.

Methodology

This study followed a systematic literature analyses using computer based literature survey. The following data basis were scrutinized; NEXUS, Science Direct, Scopus, Pubmed, Highwire, and Medline. The following keywords related to this study were used in the literature search e.g. physical activity, rehabilitation, rehabilitation phases, illness care, health promotion, health care team. All literature referring to the implementation of a structured exercise training programme as therapeutic modality during the in-hospital treatment, were analyzed. The conventional physical mobilization of the patients during this phase of treatment, focusing on the support of the clinical treatment/procedure was regarded as outside the scope of this study and therefore was excluded. In addition, studies on conventional exercise therapy rendered by the physio- and occupational therapists were excluded.

The clinical conditions included into this research were: lifestyle-related/ chronic disease as well as orthopedic conditions related to an injury, accident or any incident resulting into the hospitalization of the patient. All research which was found to comply with the preset criteria (available regarding the involvement of “exercise therapists” (CEP/ES) during the in-hospital phase; as well as which health professionals present the exercise interventions), were analyzed and presented in table format as indicated below. Although the effect of the physical training rehabilitation was not the core focus of this research, the protocol and outcomes of the various studies selected, are included for the sake of completeness.

Results

In Table 1, the reviewed studies which meet the inclusion criterion for the study are presented. Only one study could be found where patients suffering with type 2 diabetes mellitus were subjected to a structured physical training programme during the in-hospital phase (Özdirenç, Koçak & Güntekin, 2004). In this study 44 patients

hospitalized with type 2 diabetes mellitus, followed a 12-day low-intensity physical conditioning regimen presented by physiotherapists, resulting in positive outcomes.

Table 1: Results from a literature survey regarding the implementation of a physical conditioning (training) programme during the in-hospital phase, as well as the health professionals responsible for administering the programme.

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
1.	Type 2 diabetes mellitus	Özdirenç, Koçak & Gütekin. 2004	Dokuz Eylül University Hospital. Turkey	<p>Aim: To evaluate the acute effect of a short term in-hospital programme of physiotherapy on the functional capacity of hospitalized patients with type 2 diabetes mellitus.</p> <p>Method: 44 patients were involved in this study - divided into experimental (n=23) and a control group (n=21). The latter received no exercise treatment. A 6-minute walking test was used pre- and post-treatment to determine the progress. The rehabilitation programme was based on low intensity exercises, divided into 3 parts, (1) first 5 minutes for warming-up (stretching, & breathing exercises, (2) 10-30 minutes of cardio vascular, posture and strengthening exercises, (3) cool-down of 5 minutes – stretching and breathing exercises.</p> <p>Duration: 12 days</p> <p>Results: Post evaluation showed the following results</p> <ul style="list-style-type: none"> • 4.1% decrease in resting heart rate. • Significant decrease in resting systolic and diastolic blood pressure. • Significant increase in distance covered in 6-minutes, • Increase in VO₂-max. <p>Conclusion: A supervised in-hospital physical conditioning programme is a safe and effective way to manage type 2 diabetes patients.</p>	Physical therapists

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
2.	Chronic obstructive pulmonary disease (COPD)	Cockroft, Saunders & Berry. 1981	Llandough Hospital, South Glamorgan	<p>Aim: To determine the effect of physical training on respiratory limitations.</p> <p>Method: 39 COPD patients were involved- divided in to a control and exercise group. 4 Patients of the control and 1 of the exercise group did not complete the programme. During the 6 weeks of hospitalization the exercise group participate in a variety of activities like bicycling, rowing, swimming and walking (2 times daily). After the 6 weeks of in-hospital programme they were dismissed with a home-based programme for the exercising group. After 4 months the patients were re-hospitalized for the final evaluation.</p> <p>Results: The exercising group showed a significant increase in the walking distance covered in 12 minutes at the end of the rehabilitation period.</p>	No indication of affiliation of responsible professionals
3	COPD	Goldstein & Gort. 1994	Not mentioned	<p>Aim: To evaluate the effect of an exercise training programme on the exercise tolerance and quality of life of COPD-patients.</p> <p>Method: 89 stable COPD patients (male=44, female =45) were involved. They were divided into an exercising and control group. Training programme included the following: 30 minutes stretching and rotation of main muscle groups and wrists. Diaphragmatic exercises like expiration through pursed lips were encouraged. Interval sessions (40 minutes in total) was conducted for 3 days per week which included high and low intensity strength training. Recreation walks were also included. As the patients improved the duration of the programme was</p>	No indication of affiliation was provided

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
				<p>increased. After dismissal the exercising group received a home-based programme to follow.</p> <p>Duration: In-patient programme lasted for 8 weeks, followed by 16 weeks out-patient programme. Patients were re-evaluated on 12, 18, 24 weeks after the termination of the regimen.</p> <p>Results: Improvement of exercise tolerance and quality of life could be maintained for 6 months following the termination of an exercise training programme.</p>	
4.	Stroke	Rønning & Guldvog 1998	Central Hospital of Akershus, Norway.	<p>Aim: To determine the effect of total rehabilitation programme of stroke patients during the sub-acute phase during the in-hospital rehabilitation, on the mortality, independence and health related quality of life.</p> <p>Method: 251 stroke patients from various hospitals were included in this study. Patients received information about the pathophysiology of stroke, where-after they were involved into strengthening exercises (out-of-bed).</p> <p>Duration: Hospitalization period averaged 27.8 days</p> <p>Results: Hospital based rehabilitation of the sub-acute stroke patient is beneficial for the individual, leading to increased health related quality of life as well as decrease in dependence and mortality rate.</p>	<p>Multidisciplinary team: Nurses Neurologist Physiotherapists Occupational therapists Social workers</p>
5.	Stroke	Jette, Latham, Smout, Gassaway, Slavin & Horn 2005	Six rehab centres in the USA	<p>Aim: To determine the content and the approach of physiotherapy sessions.</p> <p>Method: Physiotherapy sessions covering a certain period were analyzed.</p> <p>Duration: Physiotherapy sessions from March 2011 to August 2003</p>	<p>86 Physiotherapists, - assistants and - students were involved.</p>

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
				<p>at 6 rehab centers were analyzed.</p> <p>Results:</p> <p>In 50% of the total rehabilitation time, focus was on gait and posture exercise. Rest of the time was spent on pre-functional activities using resistance exercises.</p>	
6.	Stroke	Harris, Eng, Miller & Dawson 2009	Multi- centre study. Canada	<p>Aim:</p> <p>To determine a practical and cheap protocol for strengthening the upper extremities.</p> <p>Method:</p> <p>103 patients divided into an exercising (n=53) and control group (n=50) participate in this study. The control group received some information on the pathophysiology of the condition, while the experimental group received strengthening exercise for arm and hand, range of motion, stretching as well as small and greater motor skills.</p> <p>Duration:</p> <p>4 weeks</p> <p>Results:</p> <p>The experimental group showed improved progression of the upper extremities, following the treatment regimen.</p>	
7.	Stroke	Bode, Heinemann, Semik & Mallinson 2004	Rehabilitation institute, Chicago.	<p>Aim:</p> <p>To evaluate the relative importance of therapy, intensity and duration of hospitalization.</p> <p>Method:</p> <p>198 patients from 8 in-hospital rehabilitation centres were recruited for this study. Both physiotherapy and occupational therapy focused on functional adaptations as well as specific limitations. Occupational therapists were responsible for the therapeutic adaptation rehabilitation programme, while the physiotherapists focused on exercise aimed at restoration /improvement of balance, strength and range of</p>	Physio-, Occupational & speech therapists.

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
				movement. Duration: Varied- longest duration was 8 weeks. Results: The content and duration of the rehabilitation programme of a stroke patient are important parameters. Longer duration resulted in significant better results regarding cognitive capacity as well as mobility.	
8.	Stroke, brain and spinal cord injury	*Personal consultation 2011	*Public Hospital, South Africa.	Aim: To rehabilitate patients suffering from stroke, brain or spinal cord injuries. Method: A rehabilitation programme for public and private patients is offered by a multidisciplinary team focused on total rehabilitation of each patient. Physical rehabilitation focused on improvement of endurance (bicycling, walking, wheel chair and water activities) strength (dumbbells, pulleys and springs) flexibility (passive and active stretching) and balance. Exercise sessions of about 45 minutes daily, developed to each patient individual need is prescribed and last for 3-8 weeks, followed by the out-patient programme up to the date of hospital discharge.	Multidisciplinary team consist of doctor, nurses, psychologists, physio- & occupational therapists, biokineticist, dietician, social workers and speech therapists.
9	Brain injuries- not specified	Bateman, Culpan, Pickering, Powell, Scott & Greenwood 2001	Four in-patients programmes, London	Aim: To determine the effect of a conditioning programme on brain injured in-patients regarding exercise tolerance, psychological and functional outcomes. Method: 157 patients with brain injuries (unspecified) were involved in this study. Patients were divided into an aerobic and recreation group following 3 sessions per week for 30 minutes per session The recreation group participated in some breathing exercises, progressive muscle relaxation techniques, outogenic and visualization	Physiotherapists – support from occupational and speech therapists and other specialized services were available when needed.

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				<p>activities. Duration: 12 weeks Results: The exercise capacity of the aerobic group increased but no significant results occurred with regard to functional independence, mobility or psychological function.</p>	
10.	Clinical depression	Knubben, Reischies, Adli, Schlattman, Bauer & Dimeo 2007	University Hospital, Germany	<p>Aim: To determine the short term effect of a physical conditioning programme in patients suffering clinical depression. Method: 38 patients were involved in this study with 20 subjected to a physical conditioning programme and 18 to low intensity stretching and recreational activities. The exercising group trained for 10 days on a treadmill, following an interval programme. The other group participates in stretching of the calves, quadriceps, back, shoulders and pectoralis, followed by some recreational activities. Duration: 10 days. Results: The "depression index" (Hamilton depression scale) was significantly lower in the training group than in the low intensity recreation group.</p>	No indication of the affiliation of the health professionals.
11.	Hip fracture	Barnes, 1984	Madonna professional Care- and Rehabilitation centre, USA	<p>Aim: To determine the recovery to pre-fracture functionality of geriatric patients after hip fracture surgery. Method: To geriatric patients following hip fracture surgery were recruited for this study. Active support together with resistance exercise formed the main part of the treatment. Duration: 12 months – but no indication was given of the time spend in hospital. Results: After completion of the study, 40% of the participants regain the pre-</p>	Physiotherapists

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
12.	Hip/ knee replacements	Barnes & Dunovan 1987	Madonna professional Care- and Rehabilitation centre, USA	<p>facture mobility level.</p> <p>Aim: To determine the amount of patients, regaining functional movement, 60 days post surgery.</p> <p>Method: 65 patients, with mean age=78 years receiving a hip/knee replacement were recruited for this study. Subjects followed a programme consisting of active support and resistance exercise for the injured as well uninjured part.</p> <p>Duration: No indication of the in-hospital stay were mentioned.</p> <p>Results: 83% of the participants regain independent movement.</p>	Physiotherapists
13.	Knee-replacement	Oldmeadow, McBurry & Robertson, 2002	3 Public, acute care Hospitals. Melbourne, Australia	<p>Aim: To determine cost prior to dismissal as well as functional capacity at time of dismissal.</p> <p>Method: 105 patients receiving a knee replacement were recruited for this study. All were given the normal physiotherapy treatment as well as attention to the gait pattern of the patients.</p> <p>Duration: Average in-hospital stay was 3.5 days.</p> <p>Results: Early discharge increased the total time for hospitalization as well as total cost for the patient.</p>	Physiotherapists
14.	Hip fracture	Sherrington, Lord & Herbert. 2003	Bankstown Lidcombe Hospital, Sydney, Australia	<p>Aim: To determine the difference (if any) between weight bearing and non- weight bearing exercises on strength, balance, gait pattern and functional movement.</p> <p>Method: 80 patients, mean age= 81 years with repaired hip fracture were involved in this study. They were divided into 2 groups e.g. weight- and non-weight bearing. Both groups participated in the normal</p>	Physiotherapists. Support from other disciplines e.g. occupational therapists, social workers, medical and nursing staff were available when needed.

Nr.	Clinical condition	Authors/ date of publication	Hospital/ clinic. Country	Description of the physical conditioning programme	Health professional responsible for the programme
				<p>physiotherapy treatment while the weight bearing group received additional exercises for hip abduction, flexion, ankle dorsi and plantar flexion as well as hip/knee flexion and extension.</p> <p>Duration: Two weeks. In cases where patients were discharge earlier, the programme should be continued at home.</p> <p>Results: Same results were obtained from both groups regarding strength, balance gait and functional movement.</p>	
15.	Knee/hip osteoarthritis	Weigl, Angst, Stucki, Lehmann & Aesclimann 2004	Zurzach, Rhumatology and Rehabilitation clinic. Switzerland	<p>Aim: To determine the pain profile, physical function, and some other health dimensions, following an in-hospital rehabilitation programme.</p> <p>Method: 128 patients with hip/knee osteoarthritis were recruited for this study. They received 4 x 30 minutes individual physiotherapy sessions per week including the following activities e.g. manual techniques, passive range of movement, active support in range of movement, movement against resistance supply by the physiotherapist, as well as a home-based programme. Patients also participated for 2 x 30 minutes group sessions per week including exercises like active range of movement, strengthening, weight-bearing endurance and coordination exercises. They also participated in 2 x 30 minute sessions per week in hydrotherapy- non – weight bearing, strengthening and active range of movement exercises.</p> <p>Duration: 3-4 weeks</p> <p>Results: Results indicated that at the end of the rehabilitation programme, physical function as well as pain</p>	

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				improved, associated with reduced pain on long term.	
16.	Knee-replacement	Lensen,Crijns, Waltje, Van Steyn, Geesink, Van den Brandt & De Bie 2006	Maastricht University Hospital, Netherland	<p>Aim: To determine the impact of 1 versus 2 physiotherapy sessions per day, on the functionality of the patients.</p> <p>Method: Patients with total knee replacement were involved in this study. No indication of the number of patients involved, were provided. Treatment focused on passive and active mobilization of the knee, strengthening exercises for quadriceps and functional activities e.g. from prone position to sitting in a chair, to the standing position, stair climbing and walking without support.</p> <p>Duration: 4 days.</p> <p>Results: No significant better results were associated with the two sessions per day compare to the one session.</p>	Physiotherapists
17.	Knee/hip replacement	Rahmann, Brauer & Nitz 2009	Acute care Hospital, Australia	<p>Aim: To compare an in-hospital water rehabilitation programme with a normal rehabilitation programme in the ward regarding strength, function and gait, following surgery.</p> <p>Method: 65 patients were included in this study.</p> <p>Duration: 2 weeks.</p> <p>Results: Hydrotherapy proved to be superior in the early regain of hip strength.</p>	Physiotherapists

Regarding patients with chronic obstructive pulmonary disease (COPD), only 2 studies could be found (Cockcroft et al., 1981; Goldstein & Gort, 1994). In both studies COPD-patients were divided into an experimental and control groups respectively, with the experimental group managed with a structured physical training programme. In both studies, it was expected from the experimental group to keep up with their programme for some time after being discharged from the hospital. In the study by Cockcroft et al. (1981) the initial conditioning period lasted for 6 weeks during the in-hospital phase, followed by a 4 months home programme after hospital discharge. This was followed up by another 6 weeks of hospitalization,

with a physical reconditioning programme before final assessments. In a study of Goldstein and Gort (1994) the patients followed an 8 week in-hospital physical conditioning, with another 16 weeks of home-based intervention; notwithstanding some differences in the contents, the conditioning programmes yielded significant positive results. With regard to professionals responsible for conducting the programme, contrasting findings were found wherein, a study by Goldstein and Gort (1994) indicated physiotherapists, while Cockcroft *et al.* (1981)' study did not mention any profession. As such in analyzing the programme it became obvious that any professionals well versed in exercise science would be able to manage the programme.

Regarding the in-hospital treatment of stroke patients using a physical conditioning programme, 4 international studies and one national study (one institution in South Africa) which included treatment regimen could be found. However, it was found that the aims of the rehabilitation intervention differed considerably. In the studies by Rønning and Guldvog (1998) as well as Harris, Eng, Miller and Dawson (2009) the effects of strengthening exercises were determined. Harris *et al.* (2009) also sought to develop a cheaper but effective rehabilitation protocol. Both of these studies revealed positive outcomes (Table 1). In the study by Jetteet al. (2005) the content of physiotherapy programmes in 6 rehabilitation centres in the USA indicated that about 50% of the time were spent on restoring gait patterns and positive awareness, while the rest were spent on the improvement of functional activities by using resistance exercises.

The study by Bode *et al.* (2004) which focused on the various types of rehabilitation interventions as well as the effect of the duration of hospitalization on the intervention outcomes revealed that longer duration resulted in significant results regarding cognitive capacity and mobility. In South Africa only one facility could be found where stroke patients were subjected to a structured physical rehabilitation programme during the in-hospital phase. In the above mentioned rehabilitation interventions, the physio- and occupational therapists were responsible for the treatment. They are further supported by other health professionals like speech therapists, neurologists, social workers, nurses etc. (Table 1). In the programme in South Africa, the Biokineticist (CEP) also forms an important part of the multidisciplinary team.

In the study by Bateman *et al.* (2001) patients suffering from brain injuries in 4 rehabilitation centres in London were studied. Again, in this study the health professionals, primarily responsible for the programme management were physiotherapists, supported by a multidisciplinary team of speech & occupational therapists, neuro-psychologists and other specialized professions.

Knubben *et al.* (2007) studied two types of physical conditioning programmes in hospitalized patients with clinical depression. Results indicated that patients who participated in more intensive cardio-respiratory rehabilitation were superior to those

who participated in the low intensity programme of stretching exercises. The professionals responsible for managing the programmes however were not mentioned.

In Table 1, studies 11-17 deal with orthopedic conditions including hip fractures, hip and knee replacements and knee and hip arthritis. In some of the studies, the rehabilitation programme which started during the in-hospital phase was also continued as a home programme (Barnes, 1984). It is also clear from Table 1 that the aims and outcomes of the various programmes differed. Because the outcomes of the various programmes do not fall within the focus of this study, it is not discussed further. What is however important for this study is to notice that the health professionals primarily responsible for the treatment of the patients, are the physiotherapists. Only in the study of Sherrington et al. (2003) other health professionals' services such as occupational therapists, social workers, medical and nursing staff are mentioned.

Discussion

Health still remains as a difficult concept to define, irrespective of the progress that has been made (Bouchard et al., 2007). Some reasons for this may be that the various health paradigms are not in isolation, but are closely related to each other, causing the health constructs e.g. illness care, illness prevention and health promotion to overlap (Strydom, Wilders, Moss & Bruwer, 2009). These interactions just confirm the importance of a multidisciplinary approach in the field of health sciences, for the benefit of the patient.

The importance of regular physical exercise/ activity as therapeutic modality is already well documented (Bouchard et al., 2007; Ehrman et al., 2009). Together with this, the recognition of "*exercise therapy*" in the clinical context have also developed in various parts of the world (Strydom, 2008; Ehrman et al., 2009), and have eventually become recognized by some statutory health professions council (Strydom, 2008). This "new" health discipline has various nomenclature in different countries for example *clinical exercise physiologists* (USA & Australia), *Biokinetics* (South Africa, Namibia & Botswana) (Strydom et al., 2009). According to Ehrman et al. (2009) this development, if not properly managed, may cause friction with other health disciplines working in similar circumstances like physio- and occupational therapy. As such, this may create a real threat, especially if the scope of practice of the various health disciplines is not properly determined. For example in South Africa, physiotherapy, occupational therapy and Biokinetics (all 3 professions) are registered with the Health Professions Council of South Africa. It seems there is overlap by first sight, as all the professions (a) are working with patients suffering from some or other ailment or clinical condition, (b) aim to improve the condition of the patient, (c) and use exercise/movement as therapeutic modality (Strydom, 2005). However when the disease/condition (phases) that

requires “*exercise therapy*” is analyzed, this ‘*threat*’ of trespassing on the scope of practice of another health professional body disappears in view of the importance of a multidisciplinary treatment to the benefit of the patient (Strydom, *et al.*, 2009).

Non-communicable diseases, also known as chronic or lifestyle associated illnesses, have increased over the last couple of years to the extent that presently the condition can be regarded as a “global epidemic” (United Nations, 2011). Effective management of these patients is *inter alia* structured exercise therapy within the mainstream of the contemporary medical treatment regimen (Franklin *et al.*, 2010). In the two studies reported on COPD patients, one study (nr. 3) in Table 1 indicated that the physiotherapists were responsible for managing the physical conditioning programme. In the case of study number 2 in Table 1 the affiliation of the programme managers were not mentioned, however when looking into the content of the programme it falls in the scope of practice of the clinical exercise physiologist. When analyzing the rehabilitation of patients suffering a stroke (nrs. 4-8, Table 1), it becomes clear that the in-hospital treatment is managed by a multidisciplinary team. The reason for this could be that this clinical condition can affect multiple systems leading to motor, sensory, speech, affective and cognitive dysfunction in patients (ACSM, 2010). In all the cases- except for number 8 (South Africa), the physio- and occupational therapists were responsible for the conditioning programme during the in-hospital phase. In the case of study number 8 a biokineticist (clinical exercise physiologist) together with the other professionals form part of the multidisciplinary team. In study number 9 (brain injury) the cause of injury was not mentioned therefore it is discussed separately. In the case of the studies reporting on stroke patients the in-hospital rehabilitation is managed by a multidisciplinary team with the physiotherapists being responsible for the physical rehabilitation of the patients.

A study on clinical depression (nr. 10) did not mention the health professionals responsible for the physical rehabilitation. In the case of some of the other studies, when analyzing the content of the programme it is clear that it also fall within the expertise of the clinical exercise physiologist. From Table 1 it is clear that in the case of orthopedic injuries (11-17), the physiotherapists are mainly responsible for the physical rehabilitation programme. In some cases however where the treatment requires physical exercise therapy, other health disciplines are also included (nr. 14).

Conclusion

From this study it is clear that physiotherapy is the profession mainly responsible for the physical exercise conditioning/rehabilitation regimen during the in-hospital phase. However, some of the studies reviewed referred to a multidisciplinary approach to the rehabilitation during this phase (in-hospital). In South Africa one reviewed article indicated that Biokineticist (clinical exercise physiologist) is part of

the multidisciplinary team treating or management of stroke patients. In some other studies the professionals managing the physical conditioning programmes were not mentioned, but after analyzing the programmes, indications alluded to clinical exercise physiologist as being responsible for the management of the programme.

The findings in this study to a large extent refers (indirect) to the scope of practice of physiotherapy and Biokinetics in South Africa (HPCSA, 2007), which indicates that Biokinetics should focus mainly on the rehabilitation in the “post-medical” (out of hospital) phase while physiotherapy focuses on “supplementary” service to the medical treatment during the in-hospital phase. More research is needed in order to come up with comprehensive guidelines for physical exercise in the management of patients - especially due to the reason that the clinical condition for the hospitalization of patients become very diverse and in some cases may also need the support of other “exercise therapists”. This statement is supported by Ehrman *et al.* (2009) who alluded that in future the clinical exercise physiologist may be progressively, become more involved in the physical rehabilitation team during the in-hospital phase. This however will calls for mutual cooperation among the health professionals for a comprehensive and effective multidisciplinary approach to the benefit of the patient.

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References

- American College of Sports Medicine (ACSM) (2010). *ACSM'S Guidelines for Exercise Testing and Prescription* (8th ed). Philadelphia: Lippincott, Williams & Wilkins.
- American College of Sports Medicine (ACSM) (2010). Exercise is Medicine™ initiative. Available: <http://exercisemedicine.org/index.htm>. American College of Sports Medicine, www.acsm.org. Date accessed: 16 September 2011.
- Barnes, B. (1984). Ambulation outcomes after hip fracture. *Physical Therapy*, 64(3), 317-320.
- Barnes, B. & Dunovan, K. (1987). Functional outcomes after hip fracture. *Physical Therapy*, 67(11), 1675-1679.
- Bateman, A., Culpan, F.J., Pickering, A.D., Powell, J.H., Scott, O.M. & Greenwood, R.J. (2001). The effect of aerobic training on rehabilitation outcomes after recent severe brain injury: A randomized controlled evaluation. *Archives of Physical Medicine Rehabilitation*, 82, 174-182.

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Bode, R.K., Heinemann, A.W., Semik, P. & Mallinson, T. (2004). Relative importance of rehabilitation therapy characteristics on functional outcomes for persons with stroke. *Stroke*, 35, 2537-2542.

Booth, F.W., Gordon, S.E., Carlson, C.J. & Hamilton, M.T. (2000). Waging war on modern chronic diseases: Primary prevention through exercise biology. *Journal of Applied Physiology*, 88, 774-787.

Bouchard, C., Blair, S.N. & Haskel, H.W. (2007). *Physical Activity and Health*. Champaign, Illinois: Human Kinetics.

Cardiac rehabilitation [online]. Available from world wide web: <http://wuphysicians.wustl.edu/page.aspx?pageID=303>, [Date of access: 30 September 2011].

Cockcroft, A.E., Saunders, M.J. & Berry, G. (1981). Randomised controlled trial of rehabilitation in chronic respiratory disability. *Thorax*, 36, 200-203.

Corbin, C.B., Welk, G.J., Corbin, W.R. & Welk, K.A. (2008). *Concepts of Fitness and Wellness: A Comprehensive Lifestyle Approach* (7th ed). New York: The McGraw-Hill Companies Inc.

De Wit, L., Putman, K., Lincoln, N., Baert, I., Berman, P., Beyens, H., Bogaerts, K., Brinkmann, N., Connell, L., Dejaeger, E., De Weerd, W., Lesaffre, E., Jenni, W., Leys, M., Louckx, F., Schuback, B., Schupp, W., Smith, B. & Feys, H. (2006). Stroke rehabilitation in Europe: What do physiotherapists and occupational therapists actually do? *Stroke*, 37, 1483-1489.

Ehrman, J.K., Gordon, P.M., Visich, P.S. & Keyteyian, S.J. (2009). *Clinical Exercise Physiology* (2nd ed.). Champaign, Illinois: Human Kinetics.

Franklin, B., Fern, A., Fowler, A., Spring, T. & de Jongh, A. (2010). Exercise physiologist's role in clinical practice. *British Journal of Sports Medicine*, 43, 93-98.

Goldstein, R.S. & Gort, E.H. (1994). Randomised controlled trial of respiratory rehabilitation. *Lancet*, 344(8934), 1394-1397.

Hamel, M.B., Drazen, J.M. & Epstein, A.M. (2009). The growth of hospital and the changing face of primary care. *New England Journal of Medicine*, 360(11), 1141-1143.

Harris, J.E., Eng, J.J., Miller, W.C. & Dawson, A.S. (2009). A self-administrated graded repetitive arm supplementary program (GRASP) improves arm function during inpatient stroke rehabilitation: A multi-site randomized controlled trial. *Stroke*, 40, 2123-2128.

Health Professions Council of South Africa (HPCSA) (2007). Regulations defining the scope of the profession of physiotherapy. [www://hpcsa.co.za/downloads/regulations/scope_of_professions](http://www/hpcsa.co.za/downloads/regulations/scope_of_professions). Date of access: 9 September 2011.

Jette, D.U., Latham, N.K., Smout, R.J., Gassaway, J., Slavin, M.D. & Horn, S.D. (2005). Physical therapy interventions for patients with stroke in inpatient rehabilitation facilities. *Physical Therapy*, 85(3), 238-248.

Katzmarzyk, P.T., Gledhill, N. & Shephard, R.J. (2000). The economic burden of physical inactivity in Canada. *Canadian Medical Association Journal*, 163, 1435-1440.

- Knubben, K., Reischies, F.M., Adli, M., Schlattmann, P., Bauer, M. & Dimeo, F. (2007). A randomised, controlled study on the effects of a short-term endurance training programme in patients with major depression. *British Journal of Sports Medicine*, 41, 29–33.
- Kringlen, E., Torgersen, S. & Cramer, V. (2001). A Norwegian psychiatric epidemiological study. *American Journal of Psychiatry*, 158(7), 1091–1098.
- Kujala, U.M. (2004). Benefits of exercise therapy for chronic diseases. *Scandinavian Journal of Medicine and Science in Sports*, 14, 339-345.
- Lenssen, A.F., Crijs, Y.H.F., Waltjé, E.M.H., Van Steyn, M.J.A., Geesink, R.J.T., Van Den Brandt, P.A. & De Bie, R.A. (2006). Efficiency of immediate postoperative inpatient physical therapy following total knee arthroplasty: an RCT. *BMC Musculoskeletal Disorders*, 7, 71.
- Oldmeadow, L.B., Mcburney, H. & Robertson, V.J. (2002). Hospital stay and discharge outcomes after knee arthroplasty: Implications for physiotherapy practice. *Australian Journal of Physiotherapy*, 48, 117-121.
- Orfanos, C.E. (2007). From Hippocrates to modern medicine. *European Academy of Dermatology and Venereology*, 21, 852-858.
- Özdirenc, M., Koçak, G. & Güntekin, R. (2004). The acute effects of in-patient physiotherapy program on functional capacity in type II diabetes mellitus. *Diabetes Research and Clinical Practice*, 64, 167-172.
- Paffenbarger, R.S., Blair, S.N. & Lee, I.M. (2001). A history of physical activity, cardiovascular health and longevity: The scientific contributions of Jeremy N Morris, DSc, DPH, FRCP. *International Journal of Epidemiology*, 30, 1184-1192.
- Rahmann, A.E., Brauer, S.G. & Nitz, J.C. (2009). A specific inpatient aquatic physiotherapy program improves strength after total hip or knee replacement surgery: A randomized controlled trial. *Archives of Physical Medicine Rehabilitation*, 90, 745-755.
- Rippe, J.M., Crossley, S. & Ringer, R. (1998). Obesity as a chronic disease: Modern medical and lifestyle management. *Journal of the American Dietetic Association*, 98, S9-S15.
- Rønning, O.M. & Guldvog, B. (1998). Outcome of subacute stroke rehabilitation: A randomized controlled trial. *Stroke*, 29, 779-784.
- Sallis, J.F., Linton, L.S., Kraft, M.K., Cutter, C.L., Kerr, J., Weitzel, J., Wilson, A., Spoon, C., Harrison, I.D., Cervero, R., Patrick, K., Schmid, T.L. & Pratt, M. (2009). The active living research program: Six years of grant making. *American Journal of Preventive Medicine*, 36(2S), S10-S21.
- Sherrington, C., Lord, S.R. & Herbert, R.D. (2003). A randomized trial of weight-bearing versus non-weight bearing exercises for improving physical ability to inpatients after hip fracture. *Australian Journal of Physiotherapy*, 49, 15-22.
- Strydom, G.L. (2005). Biokinetika – *Handleiding vir studente in Menslike Bewegingskunde*. Instituut vir Biokinetika, Potchefstroom.
- Strydom, G.L. (2008). The Biokinetic story: From condemnation to recognition. Potchefstroom: Institute for Biokinetics.

Strydom, G.L., Wilders, C.J., Moss, S.J. & Bruwer, E. (2009). A conceptual framework of Biokinetic procedures and referral system: An integrated protocol for the various health paradigms. *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD)*, 15(4), 641-649.

Thompson, P.D., Buchner, D., Pina, I.L., Balady, G.J., Williams, M.A., Marcus, B.H., Berra, K., Blair, S.N., Costa, F., Franklin, B., Fletcher, G.F., Gordon, W.F., Pate, R.R., Rodriguez, B.L., Yancey, A.K. & Wenger, W.K. (2003). Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease. *Circulation*, 107, 3109-3116.

United Nations (2011). Non-Communicable Diseases Deemed Development Challenge of 'Epidemic Proportions'. In Political Declaration Adopted During Landmark General Assembly.

Wachter, R.M. & Goldman, L. (2009). The Hospitalist Movement 5 years later. *Journal of the American Medical Association*, 287(4), 487-494.

Weigl, M., Angst, F., Stucki, G., Lehmann, S. & Aeschlimann, A. (2004). Inpatient rehabilitation for hip or knee osteoarthritis: 2-year follow-up study. *Annals of the Rheumatic Diseases*, 63 (4), 360-368.