SOUTH AFRICAN SOCIETY OF PHYSIOTHERAPY

Website: www.physiosa.org.za
Published three times a year by Physiotherapy Publications,
PO Box 752378, Gardenview 2047
Unit 4, Parade on Kloof
Office Park, Bedfordview
Tel: (011) 022 2132, Fax: 086 559 8237
Toll Free: 0800 001 870
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Circulation Manager: Fax 086 559 8237,
PO Box 752378, Gardenview 2047.
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Subscriptions: R117.50 overseas and R67.50 local (single copies), R470.00 overseas and R270.00 local (annual).
Advertising: E-mail: pr@saphysio.co.za
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The SASP affirms that:
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2. It strives to ensure the quality of physiotherapy services to all peoples throughout South Africa.
3. It does not discriminate on grounds of race, colour, creed, national origins, social status or gender in the practice of physiotherapy or in the administration of its organisation.
4. It safeguards the welfare of its members and makes representation against any form of discrimination against its members.
5. It acts as a planning, development and information resource to its members, to other health professions, to health planners at all levels and to the general public.
6. It supports unequivocally the provision of unitary health service and encourages all progress made in the integration of health care services.

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November 2009 • Volume 65 • Number 3
I had the opportunity of attending the Nordic Physiotherapy Congress in Oslo, Norway between 23 and 25 September 2009. The conference theme was: Movement towards better health. One of the main aims of the conference was to improve the relationships between researchers and clinicians and this was achieved in having almost 45% of the participants from the clinical sector. In addition one of the keynote addresses focussed on the transferring of knowledge from research into practice. The diagram below indicates the relationships between the various sectors contributing to physiotherapy. Each aspect is important in physiotherapy practice.

A practical example of how we can transfer knowledge through the various sectors is demonstrated in the table below using “stroke prevention” as an example.

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Clinician</th>
<th>Clients and their community</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Theses</td>
<td>• Manuals and protocols for patients</td>
<td>• Exercise prescription booklets</td>
</tr>
<tr>
<td>• Publications</td>
<td>• DVD’s for patients</td>
<td>• Health promotion activities</td>
</tr>
<tr>
<td>• Book chapters</td>
<td>• Education and training</td>
<td>• NGO’s involvement e.g</td>
</tr>
<tr>
<td>• Clinical guidelines</td>
<td></td>
<td>Heart and stroke foundation</td>
</tr>
</tbody>
</table>

It is evident from the diagram above that we all contribute to making the physiotherapy profession a success and we can all contribute into making knowledge available through various resources. Let physiotherapists as innovative, creative health professionals make a difference in the areas of research, clinical practice and the communities from which our clients and students come.

Editor: Prof JM Frantz
The rehabilitation of stroke patients at community health centres in the Western Cape

**ABSTRACT:** The structure and process of rehabilitation of stroke patients affects the outcomes of the patients. The aim of this study was to determine the structure and process of rehabilitation of stroke patients at Community Health Centres (CHCs) in the Western Cape, South Africa. A quantitative descriptive study was conducted. Questionnaires and archived records were used to collect the data. The study sample used to collect information related to the structure consisted of therapists (16) employed at the centres; while the study sample used to collect information related to the process consisted of 100 first time stroke patients. Descriptive statistics were conducted using Excel and SPSS. The results of the study revealed that there is a lack of occupational and speech therapy services at the centres forming part of the study sample. At centres where these services are provided the frequency and intensity with which the services are received by the patients is extremely low. Further research is needed to determine if the decreased intensity is only as a result of decreased availability of services or if inability of stroke clients to access the services also plays a role.

**KEYWORDS:** STROKE, REHABILITATION, COMMUNITY HEALTH CENTRES, STRUCTURE, PROCESS.
stroke patients referred to the centre were still in the acute stage post-stroke (Rhoda and Hendry, 2006). Earlier studies conducted elsewhere in South Africa have also highlighted that stroke patients are discharged from in-patient facilities even though community rehabilitation services have been found to be inadequate for the management of acute and sub-acute patients (Fritz, 1995; Hale and Wallner, 1996). The reality of stroke rehabilitation in the South African context is therefore not consistent with international trends or with local policy guidelines on [stroke] rehabilitation. Community Health Centres which have been designated as low intensity rehabilitation facilities (Provincial Government of The Western Cape, 2007) often have to manage stroke patients who are in the acute stage (Rhoda, 2002). It becomes important to examine rehabilitation services at CHCs in the Western Cape more closely in order to obtain a South African perspective regarding stroke rehabilitation.

In order to do this, the present study therefore aimed to determine the Structure and Process of the rehabilitation of stroke patients at CHCs in the Western Cape, South Africa. When examining the structure of care, the present study attempted to describe the facilities available for rehabilitation and the rehabilitation professionals required to provide treatment. The type, content and intensity of rehabilitative therapy comprised the process of care. The therapists employed at the centres during the time of data collection are presented in table 1.

From table 1 it becomes evident that three districts did not have occupational therapists deployed and therefore did not offer occupational therapy services. It also illustrates that the occupational therapists and physiotherapists are providing services to more than one centre in the same district.

METHODS

Research Setting
The study was conducted at all 39 CHCs which forms part of the Cape Town Metro District. The research setting was limited to these CHCs as the Comprehensive Service Plan for the provision of services in the Western Cape has package similar services for all the CHCs in this district (Provincial Government of The Western Cape, 2007). Patients accessing these centres should therefore receive equitable services. The CHCs in this district are located in urban and peri-urban geographical areas. The majority of people residing in these areas are classified as being part of the low to middle income groups (Stats SA, 2006).

Study Design
A cross sectional survey of all the therapists employed at the CHCs was conducted to collect data relating to the structure of rehabilitation. Process data relating to the services received was collected using a longitudinal design, while a cross sectional design was used to collect data relating to the number of therapy sessions received and the intensity of physiotherapy.

Participants
The population from which the information relating to the structure of rehabilitation was collected consisted of all therapists deployed at CHCs providing stroke rehabilitation in the Cape Metro District of the Western Cape. At the time of data collection a total of 6 occupational therapists and 16 physiotherapists provided services at 20 of the 39 CHCs comprising the research setting. The sample used to collect the process data consisted of 100 first ever stroke patients consecutively admitted to the 20 CHCs between 1st June 2005 and 31st November 2007.

Instrumentation
The researcher developed a questionnaire based on a taxonomy conceptualized by (Hoening, Sloane, Horner, Zolkewitz, Duncan & Hamilton, 2000), to assess structure and process of rehabilitation. The questionnaire requested information relating to the services and equipment available at the centres, as well as the occurrence of team meetings to discuss the management of patients. Three reviewers with extensive experience in the field of neurological rehabilitation provided feedback about the content validity of the questionnaire. The basis for their collective expertise included, but was not limited to, clinical practice, research and publication, teaching, as well as community-based intervention in neurological rehabilitation. After the necessary editorial changes the reviewers concurred that the questionnaire was valid in terms of its content. In addition, the questionnaire was sent to five therapists who did not form part of the sampling frame for completion. They verified the administration, logical flow, clarity of items and face validity of the instrument. Their feedback was that the questionnaire dealt with the proposed aims and objectives of the survey and was easy to complete as a self-report measure.

Table 1 Distribution of therapy services per district.

<table>
<thead>
<tr>
<th></th>
<th>Northern</th>
<th>Southern</th>
<th>Western</th>
<th>Tygerberg</th>
<th>Khayelitsha</th>
<th>Mitchell’s Plain</th>
<th>Klipfontein</th>
<th>Eastern</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of CHCs</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>39</td>
</tr>
<tr>
<td>No of occupational therapists</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>No of physiotherapists</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>No of centres with physiotherapist services</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>No of centres with occupational therapist services</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>


To collect information relating to the process of rehabilitation in this sample a structured interview questionnaire and archived records were used. This questionnaire was developed by Putman (2006) for use in a study which investigated stroke rehabilitation across Europe known as the CERISE study (Putman, 2006). This questionnaire was named the “use of care” questionnaire in both the recent study and the CERISE Study and was completed at 2 and 6 months post stroke was used to collect information relating to the services received by the participants. Patient registers and therapists’ records were used to extract data relating to the intensity and duration of therapy. This included; the date of admission to the centre, date of discharge or last date seen and the number of physiotherapy, occupational therapy and speech therapy sessions as well as the duration of physiotherapy treatment sessions.

**Procedure**

The questionnaires (n = 22) were hand delivered or posted to the therapists at the different centres together with a consent form and information sheet, as well as a self-addressed stamped envelop for the return of the questionnaire. The researcher followed-up non-respondents telephonically after three weeks to encourage participation and to increase the overall response rate to the survey. A researcher assistant called the centres thrice a week in order to ensure that stroke patients meeting the inclusion were recruited consecutively into the study. To complete the use of care questionnaire the researcher visited the patients at their homes when they were 2 and 6 months post stroke. To collect data relating to the frequency of physiotherapy, occupational and speech therapy and the number of hours of physiotherapy, the researcher made an appointment with the therapists and viewed the participants’ records and the therapists’ documents at a time that was convenient for the therapists. In cases where the admission and discharge dates for physiotherapy and occupational therapy differed, the earliest date of admission and latest date of discharge was recorded. This information was collected after the 6 month post stroke assessment period.

### Table 2: Services and equipment available at the 20 CHCs in the Cape Metro District of the Western Cape offering rehabilitation services.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Centres with services and equipment Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service providers</strong></td>
<td></td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>20</td>
</tr>
<tr>
<td>Medical officer</td>
<td>20</td>
</tr>
<tr>
<td>Nurse</td>
<td>20</td>
</tr>
<tr>
<td><em>Orthopaedic nurse</em></td>
<td>20</td>
</tr>
<tr>
<td>Physiotherapy assistant</td>
<td>1</td>
</tr>
<tr>
<td>Occupational therapist</td>
<td>10</td>
</tr>
<tr>
<td>Occupational therapy assistant</td>
<td>5</td>
</tr>
<tr>
<td>Rehabilitation worker</td>
<td>1</td>
</tr>
<tr>
<td>Home-based carer</td>
<td>14</td>
</tr>
<tr>
<td>Students (physiotherapy, occupational therapy, speech therapy)</td>
<td>10</td>
</tr>
<tr>
<td>Speech therapist</td>
<td>2</td>
</tr>
<tr>
<td>Psychologist</td>
<td>8</td>
</tr>
<tr>
<td>Dietician</td>
<td>16</td>
</tr>
<tr>
<td>Social worker</td>
<td>15</td>
</tr>
<tr>
<td>Other: (Health promoter and nutritional advisor)</td>
<td>10</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>Hot packs</td>
<td>20</td>
</tr>
<tr>
<td>Bobath couch</td>
<td>19</td>
</tr>
<tr>
<td>Assistive devices</td>
<td>19</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>19</td>
</tr>
<tr>
<td>Wheelchairs</td>
<td>19</td>
</tr>
<tr>
<td>Ice</td>
<td>17</td>
</tr>
<tr>
<td>Weights</td>
<td>17</td>
</tr>
<tr>
<td>Gymballs</td>
<td>16</td>
</tr>
<tr>
<td>Therapy mats</td>
<td>16</td>
</tr>
<tr>
<td>Parallel bars</td>
<td>15</td>
</tr>
<tr>
<td>Mirrors</td>
<td>15</td>
</tr>
<tr>
<td>Interferential therapy</td>
<td>13</td>
</tr>
<tr>
<td>Stairs</td>
<td>9</td>
</tr>
<tr>
<td>Tens</td>
<td>9</td>
</tr>
<tr>
<td>Suspension therapy</td>
<td>8</td>
</tr>
<tr>
<td>Wall bars</td>
<td>6</td>
</tr>
<tr>
<td>Nebuliser</td>
<td>6</td>
</tr>
<tr>
<td>Suction machine</td>
<td>5</td>
</tr>
<tr>
<td>Short Wave diathermy</td>
<td>5</td>
</tr>
<tr>
<td>Wax</td>
<td>4</td>
</tr>
<tr>
<td>Orthoses</td>
<td>3</td>
</tr>
<tr>
<td>Functional electrical stimulation</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
</tr>
</tbody>
</table>

* = Orthopaedic nurse = nurses who have been trained to follow-up persons with disabilities needs, e.g. wheelchair repairs
Data analysis
The data was captured and analysed using Microsoft Excel and SPSS version 15. Data relating to the structure and process of rehabilitation was summarised using descriptive statistics and presented as frequencies and percentages.

Ethical Considerations
Ethical approval to conduct the study was granted by the University of the Western Cape. Permission to conduct the study was also requested from the medical superintendent of the Community Health Services Organisation. Written informed consent was obtained from all participants or their families where the participants could not provide consent due to communication problems or cognitive limitation. The patients were assured of confidentiality and anonymity as no participant names were recorded during the capturing and analysis of the data. The participants were also ensured of their right to withdraw from the study at any stage.

RESULTS
The results that will be presented include the availability of staff and equipment at the CHCs, the services received by the participants, the number of therapy sessions and the intensity of physiotherapy provided. Twenty therapists provided data relating to the number of therapy sessions and the intensity of physiotherapy provided. Twenty therapists provided data relating to the structure of rehabilitation. Data relating to the process of care was collected from 100 stroke patients. Twelve patients dropped out of the study between baseline and 2 months therefore only 88 patients completed questionnaires at this assessment period. A further 12 dropped out between 2 and 6 month assessment periods. Therefore data collected at the 6 months assessment period was only collected from 76 patients.

Availability of Staff and Equipment at the CHCs
The number and percentage of staff and equipment available at the centres providing rehabilitation services as reported by the therapist when completing the questionnaires are presented in Table 2.

All the centres had physiotherapy services either on a part-time or full-time basis (n=20), medical services (n=20) and orthopaedic nursing services (n=20) available. With regards to auxiliary rehabilitation services more occupational therapy (n=10) than physiotherapy assistants (n=1) were employed at this level with only one of the centres having the services of staff formally employed as rehabilitation workers. Fourteen centres offered home-based care.

The majority of the centres (19) had a Bobath plinth and assistive devices which included walking aids such as walking sticks, crutches and quadrapods. Gymballs, therapy mats, parallel bars and mirrors were not available in respectively 4 and 5 percent of the centres. Only two (9.1%) of the therapists indicated having team meetings to discuss the rehabilitation of stroke patients.

Services received by the participants
Table 3 presents the information the participants provided regarding the services they received.

Number of therapy treatment sessions
Table 4 summarises the number and percentage of physiotherapy, occupational therapy and speech therapy sessions speech, the participants received.

Table 3: Services received by the participants as reported at 2 and 6 months post stroke.

<table>
<thead>
<tr>
<th>Services Received</th>
<th>2 month n=88 (%)</th>
<th>6 month n=76 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapy</td>
<td>87(98.8)</td>
<td>44(57.9)</td>
</tr>
<tr>
<td>Medical care</td>
<td>55(62.5)</td>
<td>63(82.9)</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>22(25.0)</td>
<td>16(21.1)</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>8(9.1)</td>
<td>6(7.9)</td>
</tr>
<tr>
<td>Home-based care</td>
<td>4(4.5)</td>
<td>1(1.3)</td>
</tr>
<tr>
<td>Nursing care</td>
<td>4(4.5)</td>
<td>3(3.9)</td>
</tr>
<tr>
<td>Other</td>
<td>3(3.4)</td>
<td>6(7.9)</td>
</tr>
<tr>
<td>Social worker</td>
<td>2(2.3)</td>
<td>7(9.2)</td>
</tr>
<tr>
<td>Intervention by dietician</td>
<td>2(2.3)</td>
<td>2(2.6)</td>
</tr>
<tr>
<td>Rehabilitation worker</td>
<td>1(1.1)</td>
<td>1(1.3)</td>
</tr>
<tr>
<td>Specialist services</td>
<td>1(1.1)</td>
<td>2(2.6)</td>
</tr>
</tbody>
</table>

Table 4: Number of physiotherapy, occupational therapy and speech therapy sessions the participants received between baseline and six months post stroke (N=100).

<table>
<thead>
<tr>
<th>Number of therapy sessions</th>
<th>PT 3(3.0)</th>
<th>OT 65(65.0)</th>
<th>Speech 92(92.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>68(68.0)</td>
<td>22(22.0)</td>
<td>8(8.0)</td>
</tr>
<tr>
<td>6-10</td>
<td>15(15.0)</td>
<td>5(5.0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>11-15</td>
<td>6(6.0)</td>
<td>4(4.0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>16-36</td>
<td>8(8.0)</td>
<td>4(4.0)</td>
<td>0(0)</td>
</tr>
</tbody>
</table>

Key: PT=Physiotherapy, OT=Occupational Therapy, Speech=Speech Therapy.
received between 1 and 5 physiotherapy sessions, while 22% percent of the participants received between one and five occupational therapy sessions. Only 8% of the patients received speech therapy.

**Intensity of Physiotherapy Treatment**

Only data relating to the intensity of physiotherapy was available in the records. The intensity of physiotherapy is expressed as the total treatment time received by the participants. Physiotherapists record the treatment session in units of 5 minutes. The total treatment time received by each participant was calculated by adding the number of units and multiplying by 5. This total was then converted to hours. The total treatment time received by each participant was calculated by adding the number of units and multiplying by 5. This total was then converted to hours. The total treatment time received by the participants is presented in Table 5.

The median (Q1-Q3) number of hours was 1.83 (0.83-3.9) hours. Almost half of the participants (49%) received between 1 and 4 hours of physiotherapy.

**DISCUSSION**

**Staff and Services Available for Rehabilitation**

The aim of the present study was to determine the structure and process of rehabilitation at Community Health Centres in the Western Cape. When considering all the CHCs in the district the results revealed that there is a lack of therapy staff employed at CHCs in the Metropole Region of the Western Cape Province. Of the 39 CHCs situated in various districts only 20 offered rehabilitation services. Although all centres offering rehabilitation provide physiotherapy only half offered occupational therapy services and only 2 offered speech therapy services which were provided by students. The limited availability of therapy services is in contrast to what is recommended by various policy documents. The National Rehabilitation policy of South Africa advocates that rehabilitation services provided should be “…equitable, affordable and accessible to all…” (Department of Health, 2000, p:8). South Africa has also adopted the Primary Health Care approach to provide healthcare services to its population. In this approach healthcare services that should be provided include preventative, promotive, curative as well as rehabilitative services. The lack of rehabilitation services meant that a large percentage of the population residing in this geographical area did not have access to rehabilitation services at a primary level of care which should be inclusive of a primary health care approach. It also meant that clients have to travel long distances to receive rehabilitation. The lack of services is also a challenge to therapists who need to refer patients from other levels of care e.g. tertiary and secondary level. Patients can receive intensive in-patient rehabilitation and not be followed-up in the community which might facilitate their re-integration into their homes and communities. Therapists working at CHCs often conduct home visits to determine the re-integration of patients into their homes. The consistent report from staff surveyed was that even though rehabilitation services were available, the services at CHCs are not optimally coordinated. Only 2 of the therapists in the present study reported that they had regular meetings to discuss the progress of stroke patients. It is important to note that there is empirical evidence suggesting that it is the coordination of services, such as physiotherapy, occupational therapy, speech therapy, nursing and medical services, that results in improved outcome, and not only the availability of services (Langhorne & Pollock, 2002). Similarly, Young and Forster (2007) reported that coordinated stroke care is beneficial for stroke patients irrespective of the level of severity, age or gender of the patients. One of the challenges to optimally coordinate services is that stroke is but one of the many conditions treated by the health professionals at the CHCs. Thus it becomes evident that the therapeutic value of rehabilitation is curtailed by the lack of optimal coordination at CHCs in the Western Cape.

Information related to the structure of rehabilitation gathered during the survey of therapists employed at the CHCs revealed that even though the majority of the centres (75%) had equipment needed for the rehabilitation of stroke patients the equipment was not equally available at all the centres. This however would not impact negatively on the rehabilitation of stroke patients, as no evidence is available indicating that the use of specific equipment would result in better outcomes of stroke patients.

**Availability and Intensity of Services Received**

The results of the study revealed that a wide range of services which include medical services, social work, dietician, physiotherapy, and occupational therapy are available to stroke patients at certain CHCs. This is disconcerting as not many of the patients reported receiving the above mentioned services. The majority of the participants consulted a medical officer. Similar to what is found in the literature, physiotherapy was the therapeutic service most frequently received by the participants (Jiménez et al., 2000; Whitelaw et al., 1993). At the 6 month follow-up assessment period, physiotherapy, followed by occupational therapy, and then speech therapy were the rehabilitation services most frequently received by the participants. These results are similar to those found in a follow-up study conducted in Cape Town by De Villiers et al. (2006) where more of the participants (27%) received physiotherapy than occupational therapy (5%) after being discharged from hospital.

<table>
<thead>
<tr>
<th>Table 5: Physiotherapy treatment time (N=100).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time (hours)</strong></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>&lt;1</td>
</tr>
<tr>
<td>1-2</td>
</tr>
<tr>
<td>&gt;2-4</td>
</tr>
<tr>
<td>&gt;4-7</td>
</tr>
<tr>
<td>&gt;7-10</td>
</tr>
<tr>
<td>&gt;10</td>
</tr>
</tbody>
</table>
In addition to the many participants not receiving optimal rehabilitation services the intensity and frequency of therapy is much less when compared to what is found in other out-patient community-based settings in developed countries (Young and Forster, 1992). In the present study the participants received physiotherapy sessions which averaged less than half an hour. This is much less than what is documented in other studies of patients receiving day hospital rehabilitation where patients receive up to one hour of rehabilitation per session (Hershkovitz et al., 2004). The number of treatment sessions in total was also less than what was provided in a study conducted in the United Kingdom (UK) by Young & Forster, (1992). Stroke patients treated in a day hospital in the Bradford Community Trial in the UK attended for a median of 31 times in a 6 month period (Young & Forster, 1992).

The decreased number of therapy sessions could be linked to availability of therapy staff or therapists workload. It should however be noted that an increase in the number of therapists do not also always result in an increase in the intensity of therapy. De Wit et al., (2005) suggest that an increase in therapy intensity is dependent on the structure of the rehabilitation sessions and not necessarily of the number of staff available. It should also be noted that the decreased frequency of therapy received by participants in the study could also be as a result of patients not attending follow-up sessions. An earlier study conducted at one of the tertiary hospitals in the Western Cape revealed that stroke patients could not attend follow-up treatment sessions due to a lack of transport to access the centres (Whitlaw et al., 1993). The present study however did not explore accessibility of the centres.

CONCLUSION AND RECOMMENDATIONS

According to the Comprehensive Service Plan of the Western Cape CHCs, which are identified as low intensity rehabilitation facilities should offer rehabilitation services which include physiotherapy and occupational therapy. Rehabilitation is also part of the package of services that should be provided as part of the comprehensive services that should be included in a primary health care approach. One can therefore conclude rehabilitation services should be available to patients accessing CHCs. The results of the present study however revealed that there is a lack of therapy services to provide rehabilitation to stroke patients at the CHCs in the Western Cape. Services that are currently available are not coordinated which could negatively impact effective rehabilitation. Findings about the process of rehabilitation indicated that the frequency of physiotherapy, occupational therapy and speech therapy as well as the number of hours of physiotherapy was low. It should however be noted that the decreased intensity of therapy received by stroke patients could either be as a result of lack of services as well as the inability to access the centres. In addition to advocating for an increase in physiotherapy, occupational therapy and speech therapy services at CHCs in the Western, the researcher would also like to recommend that further research is done to determine if the lack of intensity is also not linked to a lack of accessibility of the centres.

REFERENCES

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INTRODUCTION

The recent guidelines for the management of patients with CLBP recommend supervised exercise therapy as a first-line treatment for the reduction of pain and disability (Airaksinen et al., 2006). A potential exercise modality is water. Presently there is also sufficient evidence to suggest that therapeutic active aquatic exercise is potentially beneficial to patients suffering from chronic low back pain, compared to active dry land programs (Waddle et al., 2009). Deep water running is a feasible aerobic exercise for persons with physical impairments (Burns and Lauder, 2000).

The main indication for deep water running (DWR) in the treatment of chronic non-specific low back pain (CLBP) is based on the improvement of chronic pain by activation of the hypothalamus - pituitary - adrenal (HPA) axis, gradually increasing the plasma cortisol concentration levels above 60% of maximum oxygen consumption (Branderberger, 1985), although this depends on the duration of the exercise and the individual aerobic thresholds (AT) (Branderberger, 1985). A very recent study of high intensity aerobic exercise on CLBP reported a significant decrease compared with other forms of passive physiotherapy due to the activation of the HPA axis (Chatzitheodrou et al., 2007).

The mechanical indication for DWR is based on the decompression of the lumbar spine, assessed with precise measurements of body height, when compared with the motor-driven treadmill and shallow water running, with significant differences in height in favor of DWR (Dowzer et al., 1998). It also affords a guarantee of predominantly aerobic exercise with changes in all functional parameters of mobility, strength and endurance, and cardio-metabolic improvement, which all have a significant negative correlation with the degree of pain and physical disability (Reilly et al., 2003).

Deep water running has proved able to prolong the beneficial effect on functional ability after earlier stages of physical exercise on land (Quinn et al., 1994). In large military population samples, DWR was associated with a lower relapse rate in non-specific CLBP and other exercise-induced injuries compared with other programs based on land training (Burns AS, Lauder TD, 2000). The effectiveness of DWR as an alternative to other aerobic workouts has also been demonstrated at different ages: among young persons and middle-aged (Nakanishi et al., 1999) and older persons (Broman et al., 2006). Additionally, it is clinically effective in various musculoskeletal disorders with a mechanical impact, such as hip and knee osteoarthritis.

ABSTRACT: Objectives: To evaluate clinical effect of deep water running (DWR) on non-specific low back pain. Outcome measures were pain, disability, general health and physical fitness. Materials and methods: Experimental, randomized, controlled trial involving 46 persons with CLBP over 15 weeks with two experimental processes, each three times a week. Evidence-based Program (EBP, personalized physical exercise program, manual therapy and health education) was the common process to which was added 20 minutes of personalized intensity DWR at the aerobic threshold. Measurements were made at the beginning and end of the study of pain, disability, general health and physical fitness. Results: The pain of CLBP were homogeneous at baseline. Significant changes between group were don’t found in favour of the EBP+DWR group (p<0.3). The within-group differences were highly significant for all clinical and functional variables. The effect was clinically relevant for pain in the EBP+DWR group (0.70) and in the EBP group (0.38), and for disability degree it was also relevant in the EBP+DWR group (0.48) and relevant for the EBP group (0.36). Conclusion: Significant improvement was seen in CLBP when EBP was complemented with the high-intensity exercise of DWR.

KEYWORDS: DEEP WATER RUNNING, CLINICAL EFFECT, RANDOMISED TRIAL, EVIDENCE-BASED PHYSIOTHERAPY, AQUATICS, HYDROTHERAPY.
Manual therapy, specific training and education have all proved effective at increasing the functional capacity and symptomatic improvement in CLBP, either alone or in various combinations (Bentsen et al 1997, Cairns et al 2006, Frost et al 1998, Moseley L 2002, Niemisto et al 2003). The supplement to the EBP program of deep water running (DWR), an exercise modality with sufficient physiological inferences to improve the clinical success.

The aim of this study was to determine whether there were differences in pain, physical and mental health state, disability and functional ability following a combined EBP and DWR intervention, compared to EBP alone.

**MATERIAL AND METHODS**

**Design:** We undertook a randomized, controlled, prospective study with one group receiving evidence-based physiotherapy (EBP) and a second group with EBP plus DWR (EBP + DWR). The choice of an experimental design providing an intervention to the first experimental control group, but without DWR, was for the ethical requirement to provide the patients with the best physiotherapy service available, combining practical knowledge with the highest quality scientific evidence. The experimental group was given a supplement of aerobic exercise through DWR, based on physiological studies indicating its use. The study was authorized by the Ethics and Research Committee of the Faculty of Medicine at Malaga University. All the participants gave written informed consent and confidentiality and anonymity were preserved at all times. Two researchers were blinded to the participants groups. The physiotherapists also were blinded because the intervention is a procedure implemented in a community-based physiotherapy program of National Health Service and the staff don’t know which participant and which not were recruitment to this trial.

**Figure 1. Recruitment algorithm.**

```
Primary Health Care
  | Self-referred
  | Secondary Health Care
  | Health Area Physiotherapy Service
    | Volunteer n=64
      | Included n=49
        | Initial Assessment
          | Randomization (sealed envelopes)
            | EBP n=25
              | Lost n=2
                | Final Assessment n=46
            | EBP + DWR n=24
              | Lost n=1
```

**Figure 2. Symbolized drawing of deep water running.**

**Figure 3. Deep water running technique.**

- Spine neutral
- Simulate running
- Line of shoulders
- Shoulders flexed with elbows at 90%
- Wrist at least 5 cm under the water
- Fists closed
- Cyclic movement of legs
- Hip flexed 70º
- Ankle relaxed
  (adverse effect of running)
- Trunk inclination <10º
  (correlation with hip)

Deep water running technique
(Huey and Forster, 1993)
Subjects: The participants had all had non-specific CLBP, without radiating to the legs, for at least three months. Patients were excluded, during the health care recruitment interview, if they refused to participate in the study, or if they had low back pain as a result of specific spinal disease, infection, tumor, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome or caudal equine syndrome. Patients with cognitive worsening of whatever etiologic or exercise intolerance were also excluded. The recruitment system was between the subjects with eligibility criterion from primary or secondary health care. The final number of participants was 49 (figure 1). After providing written informed consent, these patients were randomly assigned to one of two groups, by the use of sealed envelopes, previously assigned to one group or another.

The clinical and physical procedures were selected for their reliability, relevance to the type of intervention and prior experience. Measurements were made before and after the intervention.

At the start of the study each participant completed various scales and questionnaires in order to measure the clinical outcomes. Disability was measured with the Roland Morris Disability Questionnaire (RMDQ), validated by Roland and Morris, using the Spanish version validated by Kovacks et al. (Kovacs et al 2002) which has a high reliability (0.87); pain was evaluated by the visual analogue scale (VAS) (Huskisson, 1974); and general health state by means of the Short Form 12 (SF-12) validated for back pain by Luo et al. (Luo et al 2003) with a good reliability of 0.70, and adapted from the larger SF-36 version.

To measure the physical results each patient underwent three tests measured impairments. The first was given in order to measure the maximum isometric strength of the lumbar and hip extensors (FIML test), using an extensiometer mechanical dynamometer (it evaluates traction strength). The dynamometer was a specially calibrated spring (KERN and Sohn GMBH mod. 80100), fixed to the floor by solid rings with a chain to a handgrip. The procedure consisted of extending the trunk and thighs whilst standing from a trunk flexion of 45 degrees (inclinometer) from vertical, which requires calibration of the length of the chain to the height of the subject. The peak power was recorded in kilogrames. The test was performed twice, with a rest of at least 2 minutes between tests (figure 2). The best measurement was recorded. The reliability and validity of this procedure has been correlated with surface electromyography in multifidus at L5, lumbar ilio-costal mass at L3 and dorsal width at L1 (r=0.64-0.69) (Lariviére et al 2008).

The second test measured lumbar-sacral mobility in flexion in the sagittal plane (LSMflex), by means of a dual inclinometer (DUALER Jtech) according to the protocol of Waddel et al (1992). With the subject upright, the primary inclinometer was placed on the T12-L1 interspinous space and the secondary inclinometer on S1. The patient was then requested to perform maximum flexion of the trunk with the hands together, arms extended and keeping the knees extended while the DUALER recorded the whole range of motion. The repeatability of the inclinometer is ±1 degree. The test was performed twice and the best value recorded. The inter-test reliability for the dual inclinometer in lumbar flexion has a Pearson correlation of 0.96 to 0.99 (Saur et al 1996).

The third test measured the muscular endurance of the lumbar and hip extensors by means of the Sorensen test (Burns et al 2000). The latest systematic review on the use of the Sorensen test found that the study by Biering-Sorensen in 928 persons demonstrated that good isometric resistance of the lumbar and hip extensors is a first-line preventive measure for mechanical conflicts of the spine. In persons with non-specific mechanical lower back pain it has high indices of reliability, with an interclass correlation (ICC) of 0.88, 0.83 in healthy persons and 0.77 in patients who have recovered from non-specific mechanical low back pain (Latimer et al 1999).

EBP: The EBP intervention consisted of the following:
An individual evaluation with a general clinical interview, which forms part of our procedure with the ASETER 2.0 computer program (12). Concentrating on functional ability, this initial evaluation was centered on defining the functional deficit to determine the prescription of more effective exercise enhanced in physical impairments found. During the clinical interview the patient was given a ten-point leaflet on lower back pain and encouraged to adopt an active role in the program, as well as making a “contract” concerning therapeutic adherence and program compliance.

An individual program of therapeutic physical exercise three times per week for fifteen weeks (INDIVIDUAL PHYSIOTHERAPEUTIC EXERCISE PROGRAM), based on a common structure of objectives to improve physical ability according to the initial individual evaluation, to be undertaken as a group. Each 60-minute session comprised 15 minutes dedicated to improving mobility, 15 minutes to the motor control of lumbar-pelvic stabilization and 30 minutes to resistance and muscle strengthening. The physiotherapists carried out the supervision the program of EBP in the group and adjust the individual workload of physical exercises and practice the manual therapy and education in the same time of patients development the exercise program.

INDIVIDUAL PHYSIOTHERAPEUTIC EXERCISE PROGRAM

Improvement of Mobility. Here, manual therapy is involved, normalising angular joint movements and translation of hypomobile findings as well as proprioceptive neuromuscular facilitation of the myotendinous barriers till the patients finds a position of myofascial elongation. First the physiotherapy achieve manually and after the patient self-stretching is repeated systematically. The method consists of holding muscular elongation continuously on one side of the body for 3 series of 30 seconds each, with a rest between series of 30 seconds. The patient always starts on the right side with stretching of the extensor muscles of the hip and the flexor muscles of the knee, stretching the pelvic and trochanteric muscles and stretching the iliolumbar muscles.
The method for the improvement of motor control of the local system of lumbar stabilisation is based on activation of the local system for 10 seconds by trial and error. The aim is to hold a neutral spinal lumbar position, with the help of air pressure feedback or the manual control of the physiotherapist and/or the patient. The patient should try to hold the position at least 10 seconds over 2 series each exercise in four stages of difficulty, Figure 5. In the exercise protocol the patient is taught to recruit the deep muscles of the local segmental system of the spine and to gradually reduce the undesired excessive activity of the overall system.

The method to improve isometric muscle resistance is based on proprioceptive exercises with an individually sized Swiss ball (diameter according to the shoulder-wrist distance). The method consists three exercises of 30 seconds each repeated three times with a rest of 30 seconds between exercises.

The method to improve strength is based on specific weight-training with the apparatus pre-set to the most relevant functional movements. During the strengthening exercise the patient was instructed to concentrate on local motor control of the neutral lumbar-pelvic position. Leg and back extensions were chosen because they are components of the specific muscle chains involved in sitting, standing up, bending, and going up and down stairs, and arm-pulls were used as they are involved in the muscle chain used for pushing and pulling. The workload was estimated taking 50% of one maximum repetition. This load was used for the first 15 weeks. For the first and second weeks, the participants attempted to perform 10-15 repetitions, and with effect from the third week 15 - 20 repetitions. If at any time the participant reached the maximum number of repetitions 2.5 kg were added. This system of strengthening was repeated for two series each exercise, with a two-minute rest between each exercise.

**EBP+DWR Group:** This group undertook both 1 and 2 above, as well as the following:

Aerobic exercise with DWR aided by a special flotation belt for 20 minutes in AT. Starting from individualized workloads based on the initial test, the intensity was increased by 2 to 4 millimoles (mmol) of lactatemia (LACT) over 15 weeks, using the heart rate to control the exercise intensity.

The initial test before the DWR was carried out on a different day to the rest of the functional evaluation. The subject undertook DWR whilst wearing a flotation belt tethered by an elastic band to the edge of the pool (figure 3). The temperature of pool was 28°C and every participant in experimental group was familiarizing with DWR in one individual session before the test and training. The DWR technique was supervised the whole time (Cuesta-Vargas and Guillen Romero 2005) as per figure 4. The only variable to increase was cadence, marked by an increasing rhythm of 10 beats per minute each two minutes provided by a programmed audio tape. The data were recorded by two observers at the end of each 2-minute stint without interrupting the increasing process of the test. This was done by puncturing the ear lobe to measure the LACT and by a precordial heart rate transmitter attached by an elastic band to the chest and a wrist receiver to measure the heart rate (HR). This procedure was used to calculate the individual prescription for the aerobic workload in DWR. This initial test was used to establish the individual correlation between the HR and LACT for the AT. For weeks 1 to 5 this workload corresponded to the HR at 2 mmol of LACT, for weeks 6 to 10 at 3 mmol of LACT, and for weeks 10 to 15 at 4 mmol of LACT. These figures were...
based on previous studies concluding that 2 to 4 mmol of LACT is the AT in water exercise (31).

The total time per DWR session was 20 minutes consecutively. A physiotherapist supervised both the technique (figure 3) and the intensity according to the HR, not the running speed or the distance covered.

**Sample size.** A minimum of 23 patients per group was necessary for the trial to have sufficient statistical power (80%), using the t test for independent data (alpha=0.05) and to detect differences between groups after the intervention of 2.0 on the visual analog scale (VAS) for pain (Moseley L 2002). The sample size was calculated using software EPIDAT 3.1

**Statistical analysis.** A database was used to collect the information provided by the participating therapists and the self-administered questionnaires. The analysis was designed to seek significant differences between the variables of disability, pain and general state of health. A descriptive analysis was also carried out, with measurements of central trend and dispersion of the study variables. An inferential analysis was made between the main study variables and the result. The changes were established for the primary outcome measures by examining and comparing improvement scores, as the difference between groups and standard deviation. The effect size was measured for the main result variables by relative risk reduction (RRR; % of 1-quotient two groups), absolute risk (ARR= means difference) and number needed to treat (NNT= quotient of AR) (Laupacis et al, 1998). In Health Science in general and in CLBP in particular, a very relevant effect size for pain is >0.5, a relevant effect >0.2, and irrelevant <0.2 (Keller et al 2007). These analyses were done with software SPSS 15.0.

**RESULTS**

Initially, 64 patients were recruited for the study, of whom 49 fulfilled all the inclusion criteria. Three of these 49 were lost, two unable to complete the program and one with increased pain (Figure 1).

Table 1 shows the sample characteristics. No significant differences were found between the descriptive variables at the start of the study. The results of the inferential analysis are shown in Table 2.

**Table 1. Comparison between groups at the start of the test.**

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<th>EBP + DWR</th>
<th>EBP</th>
<th>P</th>
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<tr>
<td>Age, years</td>
<td>39.88±11.21</td>
<td>37.65±13.21</td>
<td>0.563</td>
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<td>Body mass index</td>
<td>26.22±3.95</td>
<td>25.21±4.53</td>
<td>0.798</td>
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<td>Duration of symptoms, weeks</td>
<td>14.3±9.4</td>
<td>16.9±9.5</td>
<td>0.235</td>
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<td>Pain, (100 mm, VAS)</td>
<td>52.53±20.02</td>
<td>57.62±14.19</td>
<td>0.249</td>
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**Table 2. Score according to group and time and changes within-group and between group.**

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<td>Mean ± SD</td>
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<td><strong>INTERVENTION</strong></td>
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<tr>
<td>Pain (100 mm, VAS)</td>
<td>52.53±20.02</td>
<td>57.62±14.19</td>
<td>16.46±24.44</td>
<td>23.43±20.59</td>
<td>36.06±25.11b***</td>
<td>34.18±26.05b***</td>
<td>1.88b*</td>
<td>-28.65 to 11.59</td>
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<td>Disability, (24-RMDQ)</td>
<td>6.12±3.28</td>
<td>5.25±2.93</td>
<td>3.33±3.28</td>
<td>3.56±2.47</td>
<td>3.00±4.85b**</td>
<td>1.68±1.57b***</td>
<td>1.32a</td>
<td>-2.42 to 2.28</td>
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<td>PHS (0-100, SF-12)</td>
<td>41.29±11.74</td>
<td>37.80±9.10</td>
<td>51.88±6.14</td>
<td>46.73±9.17</td>
<td>-10.59±12.89b***</td>
<td>-8.93±13.04b**</td>
<td>-1.66a</td>
<td>-0.83 to -11.13</td>
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<tr>
<td>MHS (0-100, SF-12)</td>
<td>44.16±12.20</td>
<td>45.64±10.01</td>
<td>50.61±7.97</td>
<td>47.42±9.79</td>
<td>-6.44±14.52a</td>
<td>-1.77±12.97a</td>
<td>-4.67a</td>
<td>-3.59 to -10.96</td>
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<td>LP-ROMflex, degrees</td>
<td>46.31±20.56</td>
<td>47.60±18.84</td>
<td>59.00±21.61</td>
<td>60.76±15.26</td>
<td>-12.69±24.46b*</td>
<td>-13.16±17.29b**</td>
<td>1.38a</td>
<td>-9.22 to 23.04</td>
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<tr>
<td>FIML test, kg</td>
<td>54.25±16.97</td>
<td>58.40±16.10</td>
<td>66.93±23.05</td>
<td>75.26±21.78</td>
<td>-12.86±19.10b***</td>
<td>-16.86±21.91b**</td>
<td>4.18a</td>
<td>-4.29 to 24.79</td>
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<td>Sorensen test, seconds</td>
<td>25.80±13.60</td>
<td>24.28±12.48</td>
<td>63.07±25.29</td>
<td>45.28±13.09</td>
<td>-37.27±15.04b***</td>
<td>-21.00±17.43b***</td>
<td>-14.9a</td>
<td>-6.95 to 36.40</td>
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PHS: Physical health state

MHS: Mental health state

a Non-significant differences with the t test for independent samples.

b Significant differences with the t test for paired samples.

b *0.05

b ** 0.01

b ***0.001
The effect for pain of the intervention on CLBP was 0.70 in the EBP+DWR experimental group, 0.59 in the EBP control group, and 0.32 between the two groups. The size effect of our intervention for the degree of disability in CLBP was 0.48 in the EBP+DWR experimental group, 0.32 in the EBP control group, and 0.12 between the two groups.

The effect of the intervention on the physical health state was 0.20 in the EBP+DWR experimental group, 0.19 in the EBP control group, and 0.1 between the two groups; this latter at the limit of clinical relevance. The effect of the intervention on the mental health state was 0.12 in the EBP+DWR experimental group, and irrelevant for the EBP control group (0.03) and the difference between the two groups (0.06).

The results of this study were determined according to the NNT, following the current recommendations to express the clinical relevance of the findings of a randomized control trial (Reilly et al 2003). For EBP + DWR, the NNT was 3 for pain, 8 for the degree of disability, and 9 for the physical health state. For EBP without DWR, the NNT was 3 for pain, 14 for the degree of disability, and 11 for the physical health state. It is estimated that for chronic pain, a NNT of 2 or 3 is indicative of an effective intervention (Keller et al 2007).

**DISCUSSION**

The EBP intervention supplemented with 20 minutes of DWR at the individual AT was not more effective for pain than without the DWR. The changes between two active treatments not present significance difference in any outcomes. We have found no studies of DWR at the AT in CLBP. However, interventions involving part of the exercise program in water have shown significant changes in pain and disability scores when compared with controls or inefficient interventions (McIlveen and Robertson 1998). Significant improvement has also been found when the changes were evaluated from baseline (McIlveen and Robertson, 1998; Yozbatiran et al 2004). Comparison of water-based exercises with land-based exercises showed no significant differences for pain (Yozbatiran et al 2004). However, unlike our study, these other studies involved non-individualized low-intensity exercises in water, without the integration of other effective land-based techniques, manual therapy or health education.

The results also coincide with other studies involving similar interventions, which showed mean intra-group changes in pain of 19 mm (95% CI, 2.5-1.3) (Frost et al 1998), 15 mm (95% CI, 2.3-0.7) (Bendix et al 2003). More specific trials with similar interventions to those here found similar results for the reduction in the disability score by 3.5 (95% CI, 1.3-6.2) (Niemisto et al 2003), 3.9 (95% CI, 2.0-5.8) (Niemisto et al 2003), 5.2 (95% CI, 3.6-6.7) (Cairns et al 2006), and 1.8 (95% CI, 0.9-2.7) (Frost et al 1998). These treatments, like the present study, are based on exercise programs with the integration of health education techniques and manual therapy.

The results of this study and evidence from earlier studies suggest that the increase in effect size may be favored by exercise based on the motor control of the local system of trunk stability (Ferreira et al 2006), due to the intensity of active training (Liddle et al 2004), the incorporation of educational aspects and the combination of the various effective modes of physiotherapy in CLBP (Moseley, 2002).

Our results showed a positive response in both groups, not only statistically but also clinically. A 20% reduction in pain score is considered to be a clinically relevant improvement (Van der Roer et al 2006). The effect size of the intervention on CLBP was 0.70 in the EBP+DWR experimental group, 0.59 in the EBP control group. This enabled us to evaluate the addition of DWR as an added value to the procedure regarding pain reduction, suggesting that physiotherapeutic treatment can be enriched with a predominantly aerobic exercise for CLBP, as is DWR.

Unlike pain, however, a reduction of just 10% in the disability scale is considered a clinically relevant improvement (Van der Roer et al 2006). Significant differences were found in both groups when compared with baseline values, and these were clinically relevant in the experimental group.

The effect of the intervention in disability in CLBP was 0.48 in the EBP+DWR group, 0.32 in the EBP group. The inter-group effect was not relevant, though both groups experienced a relevant effect as compared with the baseline values. Of note, too, was the effect size of 0.48 in the experimental group, very close to being clinically very relevant for reduction in disability. These results are similar to those reported for the clinical relevance of non-surgical treatment of low back pain, where the effect size of the treatment with physical exercise was 0.22 for disability (Keller et al 2007).

Following the recommendations of Deyo et al (Deyo and Jarvik 2003), the present study incorporated the evaluation of the general state of physical health in the physiotherapeutic interventions of CLBP. As with the disability score, clinically relevant improvement is considered to be a 10% increase in the general state of health (Keller et al 2007). The effect size in physical health state was clinically relevant compared to baseline values, with an effect of 0.20 in the EBP+DWR experimental group and 0.19 in the EBP control group. The effect size in mental health state was clinically relevant for the EBP+DWR experimental group (0.12), and irrelevant for the EBP control group (0.03).

The intragroup results for the physical health state are in agreement with those of other studies, showing a effect size in the EBP+DWR experimental group of 10.59 points (95% CI, 17.46-3.72) and in the EBP control group of 8.93 points (95% CI, 3.26-1.97) on the SF-12, versus the results of Cairns et al. (2006) of 8.5 (95% CI, 4.7-12.3). The intragroup mental health state showed no significant differences, like the study by Cairns et al. (2006).

Our study is in consonance with recent other studies on the classification of CLBP concerning the magnitude of the clinical relevance, given the variability of each individual in the different strategies of physiotherapeutic intervention. This variability is considered to be inter-subject, which explains the need for the initial individual evaluation as a base upon which to decide the physiotherapeutic strategy for each person.
There is also an intra-subject variability, associated with the changes produced in the different functional capacities at various times (O’Sullivan P and Beales D 2007). Our aim was to evaluate, as others have suggested in earlier studies, the implantation of manual interventions at the start (Assendelft et al 2004), the progression in motor learning of the motor control of the local system of trunk stability (Ferreira 2006), the progression of loads in resistance and muscle strength, and the progressive adaptation in AT during DWR in the experimental group, as the choice way of increasing the clinical effect from baseline.

In both groups, the results of all the functional variables (mobility, strength, resistance and motor control) showed significant improvement as compared with baseline values. The differences were highly significant for both groups regarding the improvement in muscle resistance, for strength in the EBP+DWR experimental group, and for improvement of mobility and strength in the EBP control group. These findings were to be expected after the controlled and supervised individual exercise program (Liddle et al 2004). However, the merit of the intervention centers on the mean individual differences between the values at baseline and those after the exercise program, as this way the progress of each individual person can be analyzed.

The results are influenced by the intervention variables. Strengthening assumes great importance, especially that of the lumbar and hip extensors (Vuori, 2001). Abdominal strengthening, particularly the deep system (transverse and internal oblique), has often been considered to facilitate stabilization of the trunk, with a recent systematic review concluding that, as compared with general medical practice, it improves pain and disability in patients with CLBP (Ferreira et al, 2006). However, the clinical relevance of this method of isolated strengthening has a effect of 0.4, compared with the baseline pain (Cairns et al. (2006) versus the 0.7 found in our study, thanks to the combination of the different strategies.

Our results are in consonance with those of a randomized clinical trial on CLBP that incorporated any system to improve mobility, for example, by manual therapy, joint mobilization, or stretching, and integrating them under different names like conventional physiotherapy (Cairns et al 2006), functional restoration (Bendix et al 2000), or generically, under the headings of manual therapy or therapeutic exercise (UK BEAM Trial Team 2004). In one way or another, they all use a similar combination to that used here, where educational strategies were also included.

Our results are greater than those of other studies that compared isolated procedures with a predominance of one system of physical therapy. One clinical trial that compared three active options of therapeutic exercise (active physiotherapy, muscle reconditioning on training devices, and low-impact aerobic exercise) showed no significant differences between the three groups (Cairns et al 2006, Moseley L 2002, Niemisto et al 2003).

**STUDY LIMITATIONS**
- Future studies should involve larger samples and undertake a long-term follow-up.
- Future studies should to determine differences in the efficacy of the two interventions described in this study in participants with acute low back pain.
- The variability between participants indicates the need to establish different strategies for each intervention. Future studies should therefore include valid, reliable and precise functional evaluations for decisions to be taken when treating CLBP.
- The different times to assimilate the response to the intervention for each modality used in this study indicates the need to include clinical and functional evaluations during the experimental stage.
- The relative contribution to the clinical results of the various components of the intervention provides more information on the degree of contribution of each component in the intervention used in this study.
- Cost-effectiveness analyses should be included, due to the variable costs to achieve similar results in persons with CLBP.

**CONCLUSIONS**
A complement to EBP of DWR at an intensity of the AT don’t produces a significant improvement in pain, general health state and disability in patients with CLBP over EBP alone.

The present procedure of EBP with an approach that combines the three strategies of physiotherapy produces a very relevant effect size for pain and a relevant effect for disability and general physical health in patients with CLBP.

Due to the variability between persons with CLBP, better results are achieved with an individualized plan of strategies according to the initial situation and the evolution of each patient.

The neuro-endocrine modulation of CLBP may be favored by aerobic exercise at the AT.

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The effect of isokinetic and proprioception training on strength, movement and gait parameters after acute supination injury of the ankle ligaments

ABSTRACT: The effects of a three-week isokinetic training compared to typical proprioceptive training on parameters of strength, movement and gait function after acute ankle ligament sprain were investigated.

Thirty-nine patients were randomly allocated to two comparison groups. In group 1 (n=20) a proprioceptive training and in group 2 (n=19) an isokinetic strength training (Cybex 6000®) were administered. The patients of both groups underwent training five times a week for three weeks. Before and at the end of the treatment course, in both groups isokinetic strength was tested, the range of motion in the ankle joint was recorded and gait was analyzed (multicomponent strength measurement platform, Henschel-System®). The maximum isokinetic torque (60°/s) [Nm] and the contact time (monopedal support time) of the injured leg during gait cycle were the basis for evaluation.

The data obtained show that in group 2 a significantly greater increase of the maximum isokinetic torque was attained in almost all range of motion of the ankle joint in the course of treatment. At the same time, in group 2 the shortening of the contact time in the stance phase of the injured leg could be compensated. The active range of motion in the ankle joint was less at the end of treatment in group 2 than in group 1. The isokinetic training obviously did not only lead to better strength regeneration, but also to a functionally more stable ankle joint with a rhythmically more evenly balanced stance phase of the gait cycle. These results suggest that the used isokinetic training had positive effects on functional stability after acute ankle sprain.

KEYWORDS: ANKLE JOINT, SUPINATION INJURY, REHABILITATION, PROPRIOCEPTIVE VERSUS ISOKINETIC TRAINING.

INTRODUCTION

Supination injuries of the ankle ligaments are common injuries as Berlemann et al (2000), refer and the most frequent injuries in sports. However, a ligament rupture (mostly to the anterior talo-fibular ligament) occurs in only 10% of all traumata. Good results under conservative treatment have been described by Mattacola and Dwyer (2002) for mild and moderately severe injuries of the lateral ligament apparatus of the ankle joint. Early mobilization that entails supporting measures such as taping, bandaging, orthotics and if necessary plaster cast is thought to promote healing after only a brief phase of immobilization. Early mobilization is intended above all to stimulate neuromuscular control of the foot, which is why proprioceptive training is strongly recommended in the exercise protocol of Matsusaka et al (2001). However van der Wees et al (2006) demonstrated that these exercise programs are effective in the prevention of recurrent ankle sprains only. In a review of recent studies Zöch et al (2003) came to the result, that a combination of different exercises, including strengthening of the peroneal musculature, leads to better results and allows earlier return to the activities of daily life.

Strengthening of the peroneal musculature is also recommended by Uh et al (2000). Weinstein (1993) demonstrated that insufficient strength of the peroneal muscles is associated with chronic ankle instability and recurrent injury. Whereas numerous studies have been published on proprioceptive training, studies on the effect of specific muscle training can hardly be found in the literature. The need arises for studies that test the effects of an isokinetic training program on discrete parameters of regeneration after acute supination injury of the ankle joint which will be compared with the more commonly used proprioceptive training programmes.

The aim is to investigate whether an isokinetic strength training leads to better effects on parameters of functional stability after acute ankle sprain than the commonly used proprioceptive training.

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Patients and Methods

Thirty-nine patients with acute supination injury of the ankle ligaments have been examined in two selected surgical centers, where the diagnose fibular capsule ligament lesion grade II was made and functional treatment started. After four weeks these patients were randomly assigned to two different rehabilitation programs for further three weeks in our rehabilitation center.

Patient consent was secured in compliance with the institution’s clinical research and investigations committee guidelines. The guidelines for the following rehabilitation programs were established with the treating therapists prior to initiating the study. In accordance with rehabilitation protocols of Chaiwanichsin et al (2005) in group 1 (n=20) the exercise program focused on proprioception training (balance exercises, wobble board training, walking and running exercises on soft floor, mats, inclined plane with variations of pace. In group 2 (n=19), isokinetic strength training was conducted. The Cybex 6000® was used for isokinetic strength training; the exercise positions also corresponded to the test positions. Plantar flexion and dorsal extension exercises were from the prone position with extended leg. The inversion and eversion exercises were performed in the prone position with flexed hip and knee joints. Exercise and test rate were set at 60°/s. The treatment took place in both groups in synchrony with working days five times a week.

The time for each session takes 30 minutes. On admission, patients' demographic data and case history were taken, especially with regard to the injury and its treatment in the surgical centers.

At the beginning and at the end of the three-week controlled treatment course, the following were investigated: isokinetic strength test, gait analysis parameters and range of motion.

In the isokinetic strength test, the maximum isokinetic torque (60°/s) [Nm] was calculated, since it is regarded as a reliable parameter in isokinetic strength measurements like stated by Kaminiski et al (2003). It enables the greatest strength development during one exercise cycle. The maximum torque also constitutes the basis for other strength parameters. In accordance with the recommendations on Lelie et al (1990) five movements were measured as a basis for calculating the arithmetic mean. The range of motion was registered according to the neutral 0 method in the ankle joint with the Cybex 6000®. Gait was analyzed using two multi-component strength measurement platforms (Henschel System®) set into the floor, which enabled a two-step analysis. Several parameters of the gait cycle registered indicated that the contact time (monopedal support time) was the most important parameter. Cochran (1988) demonstrated that it reacts particularly sensitively to the post-traumatic gait disorders. The data obtained were evaluated with the software program PROVEC®. At the two examination times, the tests were carried out on the injured side and in the final examination on the healthy side, too. In this way, differences between the sides that were still present were to be identified.

The statistical analysis of the data obtained was carried out with the SPSS program system. For dependent random samples, the paired t-test was used. For independent random samples, analysis of variance with repeat measurements. p<0.005 was taken as the probability of error.

<table>
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<th>Table 1: Range of motion in the ankle joint in the comparison groups at the final examination (T2)</th>
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Figure 1: Maximum isokinetic torque in plantar flexion of the injured ankle in the comparison groups at the beginning of the investigation (T1) and at the end of the investigation (T2) (□o = maximum isokinetic torque on the uninjured side).
RESULTS

Thirty-nine patients (12 women and 27 men) with an average age of 25 ± 7.2 years were included in the investigation. The majority of these patients had suffered a sport accident (27% football, 19% volleyball) and the remainder had everyday accidents or had engaged in various kinds of recreational sport. According to the data from the case history, all the patients had a fresh supination injury with a fibular capsule ligament lesion (grade II) that was given conservative functional treatment. Four weeks after the trauma, the patients were included in the study and assigned to the two reference groups: 20 patients to group 1 and 19 patients to group 2. Since one patient of group 2 had to discontinue the control therapy for family reasons, the results of only 18 patients were evaluated in group 2.

The maximum isokinetic torque for the individual motion amplitude at the injured ankle joint is shown in Figures 1 - 4 for both groups. Apart from that in inversion, a very much greater increase of the maximum isokinetic torque could be attained in group 2, which underwent isokinetic strength training, than in group 1, in which the typical proprioceptive training was continued. The difference was especially pronounced and statistically significant (p<0.05) in range of dorsi extension and in eversion. In the final examination (T2), group 2 achieved a maximum isokinetic torque on the injured side, which corresponded to that of the healthy side. In contrast, in group 1, it was still substantially below that of the healthy side. The increase of the maximum isokinetic torque in both groups was roughly the same only for the range of inversion.

Table 1 shows the range of motion in the ankle joint of the two groups. At the end of treatment, group 2 showed slightly smaller amplitudes in almost all range motions than group 1. The most striking difference was in the extent of inversion.

Figure 5 shows the mean contact time on the injured side in the comparison groups at the time of the first (T1) and the second (T2) examination. The mean contact time could be prolonged after three weeks of therapy in both groups.
but the prolongation was more pronounced in group 2, in which it was indeed almost the same as that on the healthy side. The prolongation of the contact time in group 2 was statistically significant (p<0.05).

**DISCUSSION**

With respect to their age and gender distribution and the cause of the injury, patients in this investigation largely corresponded to those reports in epidemiological studies of Lohrer et al (2000) and Rammelt et al (2003). Typically, the supination injury of the ankle joint mainly occurred in young patients as a result of a sport accident and was more frequent in men than in women.

Treatment in primary surgery departments with conservative functional treatment comprised the typical three phases: short immobilization in elevation of the leg, cooling and compression of the injured ankle and subsequent early mobilization with adaptations of weightbearing and with supporting taping, bandages or orthoses. Four weeks after the injury, the patients entered the study and were assigned to one of the two therapy groups. In the course of the study lasting three weeks, the treatments in the groups were carried out by the same therapists. In group 1, the exercise structure mainly comprised exercises for proprioception in accordance with the recommendations of rehabilitation protocols of Chaiwanichsin et al (2005). These were supplemented by balance, gait and coordination exercises as well as strength exercises for the peroneal musculature and performed in the form of circuit training. In group 2, isokinetic training on the Cybex 6000® took place instead. This was also carried out with 60°/s just like the diagnostic strength tests, since this training rate is generally considered especially suitable for the purposes of rehabilitation.

Besides the improvement of proprioception, the need to increase the strength of the lower-leg musculature that actively stabilizes the ankle joint, especially that of the peroneal muscles, is referred to by Berlemann et al (2000) and is also taken into consideration in the rehabilitation protocols of Zöch et al.

![Figure 4: Maximum isokinetic torque in the inversion of the injured ankle in the comparison groups at the beginning of the investigation (T1) and at the end of the investigation (T2) (○ = maximum isokinetic torque on the uninjured side).](image1)

![Figure 5: Contact time of the stand leg on the injured side during the gait in the comparison groups at the beginning of the investigation (T1) and at the end of the investigation (T2) (○ = contact time during gait on the uninjured side in the therapy groups at the end of treatment).](image2)
ankle joint in group 2. Since Freeman (1965) drew attention to the term functional ankle instability, interest has been focused almost exclusively on proprioceptive training in acute ankle sprains and in chronic ankle joint instability. However, Bosien et al (1995) demonstrated a weakness of the peroneal musculature that indicates chronic ankle joint instability. Larsen and Lund (1991) could show that strength training of the peroneal musculature improves the control of the foot position as well as the neuromotor activity of these muscles. In animal experiments, Waterson et al (2001) observed that passive exercises are indeed able to reduce a strength deficit. To what extent a strength deficit is simultaneously associated with a deficit in proprioception can hardly be established from the investigations up to now. However, it could be assumed from the results of the above authors that there may be a reciprocal relationship between the two phenomena. The present results indicate that a rehabilitation protocol that concentrates on proprioception training is unable to compensate for the strength deficit of the ankle musculature to a satisfactory extent and this is noticeable in dorsal extension and eversion motion (Fig. 2 and 3) that still showed pronounced deficits in the final test (T2) in group 1 compared to the healthy side. On the basis of the present investigation protocol, it is uncertain whether there were also demonstrable proprioception differences between the groups. However, the result of the significantly prolonged contact time (Fig. 5) in group 2 indicates that the weightbearing ability of the injured leg could be demonstrably optimized compared to group 1 after isokinetic strength training in group 2. The results that were attained in these investigations were practically the same on each side. This indicates that there is a better loading function during the gait cycle which is likely to be attributable to an enhanced functional stability of the affected ankle joint. The range of motion at the second examination (Tab. 1) also indicates further postural control of the ankle joint in group 2.

Since proprioception training was conducted during the first four post-traumatic weeks in all patients, its effects must also be considered in group 2. In the subsequent three weeks of treatment, however, the targeted isokinetic training in this group brought about a better enhancement of strength with compensation of the post-traumatic side-to-side difference and at the same time a side-to-side compensation of the shortened contact time of the injured leg in the exercise phase. These results indicate that stabilizing strength exercises are likely to be of particular significance in the ankle joint just as in instabilities of other joints. Likewise, it shows that proprioception is improved. It must be tested in further investigations to what extent the proprioception and strength at the ankle joint are interdependent.

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Reliability of ultrasound imaging for the measurement of abdominal muscle thickness in typically developing children

ABSTRACT: Introduction: Abdominal muscles are key to both posture and gait in both children with typical development (TD) and with disabilities. Ultrasound (US) imaging is a potential non-invasive method for investigating activity in these muscles. This study therefore aimed to determine the inter-tester and intra-tester reliability of B-mode US for investigating transverse abdominus (TrA), rectus abdominus (RA) and external- (EO) and internal oblique (IO) muscle activity in children with TD. Design: A prospective correlational descriptive study. Participants: Eighty six, 6-13 year old children from one private and one public mainstream school. Outcome measures: Two sets of B-mode US images where captured per subject during rest and during head-up, resisted head-up and resisted sling activities. Intra-class Correlation Coefficients (ICC) and standard error of measurement (SEM) were used to analyse the data. Results: Good correlation was found for both test - retest conditions for all four muscles tested during rest: 0.91(TrA); 0.90(IO); 0.91(EO); 0.94(RA) for intra-tester reliability and 0.74(TrA); 0.88(IO); 0.74(EO); 0.83(RA) for inter-tester reliability. Repeatability of thickness measures during activity however showed variation in recruitment patterns. A significant correlation was found between age and BMI and resting abdominal muscle thickness (p<0.001). Conclusion: The study supports the reliability of US measurement of resting abdominal muscles and of the RA under active conditions in children aged six to 13. However the stability of measurement of the other muscles under active conditions still needs to be established.

KEYWORDS: ULTRASOUND IMAGING, RELIABILITY, ABDOMINAL MUSCLES, CHILDREN.

INTRODUCTION
The incidence of children presenting with motor dysfunction ranging from minimal developmental coordination disorder (Dewey and Wilson 2001, Peters et al 2001) to the more severe types of cerebral palsy (Odding et al 2006, Reddihough and Collins 2003) is increasing. Assessment of these children suggests poor postural control and balance (Miyahara 1994, Roncesvalles et al 2002, Rose et al 2002). As good postural control relies on trunk muscle stability and the ability to provide a stable base of attachment for the limbs, effective abdominal action is essential (Shumway-Cook and Woollacott 2001). However, detailed descriptions of abdominal muscle activity in children and its contribution to core stability, balance and motor performance are sparse.

There are limited reliable, feasible instruments for investigating abdominal muscle activity in children. Observational movement analysis is widely used when assessing abdominal function children in the clinical environment. Electromyography (EMG) using self-adhesive surface electrodes, has been used by some researchers to investigate superficial trunk muscle activity in rectus abdominus (RA) and erector spinae (ES) muscles in groups of children with poor balance (Brogren et al 1998, Van der Heide et al 2005). Investigation of the other, deeper abdominal muscles – transverse abdominus (TrA), internal (IO) and external oblique (EO) requires insertion of fine-wire electrodes in order to avoid interference from surrounding muscles (Park and Harris 1996). This technique is well described and used in adults for investigating the response of the trunk muscles to perturbation as well as during abdominal hallowing. Although this technique has been used in adults (Carpenter et al 2008, Urquhart et al 2005) invasive techniques in children require a high degree of skill and may be ethically unacceptable.

Ultrasound (US) imaging is increasingly being used to diagnose dysfunction and measure impact of interventions targeting the trunk stabilisers in adults (Bunce et al 2004, Ferreira et al 2004, Kiesel et al 2007, Richardson et al 2002). Changes in TrA, IO and EO muscle thickness have shown a strong to moderate correlation with sub-maximal static and dynamic contractions (Bunce et al 2002, Hides et al 2007, McMeeken et al 2004). Ultrasound imaging of the abdominal muscles is a quick,
non-invasive and relatively cost effective instrument. If the method were found to be reliable in children, it would provide a feasible measure for the assessment of activity in these muscles. This study therefore explored the reproducibility and repeatability of abdominal muscle thickness measures using US imaging in typically developing children.

METHOD

Subjects: A sample of convenience of 86 typically developing children between the ages of six and 13 was recruited from two local primary schools, one private school and one public school, ten children from each grade. Children that were present and healthy on day of testing and those with a body mass index (BMI) of less than 25kg/m² were included in the study. Children were excluded if they had any confirmed diagnosis affecting motor function.

Instrumentation: Anthropometric and demographic variables (age, height, weight, grade) were recorded at baseline. A Siemens® Accusonic X150 US imaging machine with a 5.5cm wide band linear array frequency of 5Hz was used to capture B-mode (2-D) real-time images of the four abdominal muscles. Conductive gel was used between the transducer and the skin. The research assistants who had some anatomical and research background, underwent training in the operation of the ultrasound machine, followed by practice sessions to ensure correct positioning of and pressure on the US head. A pilot study on ten children was conducted. One person operated the transducer head, while the other gave instructions to the child and applied resistance when indicated. The study was approved by the Medical Research Ethics Committee of the University of Cape Town. Parental or legal guardian consent and child assent was obtained from all participants.

Capturing images

Subjects were positioned in supine on a plinth, their arms resting along their sides and knees supported on a cushion, keeping their hips in approximately 20° to 30° of flexion to allow for relaxation whilst maintaining the spine’s neutral lumbar curvature. A resting image for capturing Tra, IO and EO was captured on end-inspiration, as observed by the tester. The second image was captured during a sub-maximal contraction as the child tucked in the chin and lifted the head. Following a one minute rest, a third image was recorded during a resisted isometric ‘sling’ activity, in which moderate resistance was applied by the second tester at the level of the knee of the contra-lateral leg against hip flexion and adduction while the hip and knee where kept off the plinth in about 45° to 55° of flexion. Following a two minute rest, the process was repeated in order to capture resting and head up activity images for RA. Instead of resisted sling, resisted head up was performed by applying moderate resistance to the forehead at the end of the head lift eliciting a stronger isometric contraction.

For the TrA, IO and EO muscles, the transducer was positioned initially in line with the umbilicus either 3cm from the midline for smaller children or 6cm for bigger children. The position of the transducer was modified slightly if necessary to ensure that the medial edge of the TrA was ±2cm away from the edge of the image on screen when the subject was relaxed. This position was then marked on the skin to ensure that the transducer was kept in the same position for all of the measures. Measurements were all taken on the left. For the RA the transducer was positioned 2cm above the umbilicus straddling the midline. The transducer position was modified by moving 1-2cm away from the midline towards the left if necessary to ensure an optimal screen image and then marked to ensure the transducer was kept in the same position for all the measures.

All images were stored for later analysis. Machine cursors were used to measure (in mm) the muscle thickness within the fascial boundaries. A similar procedure for measuring thickness as described by Ferreira et al (2004) was followed in the current study. As the thickness of the muscle varies along the length of the muscle and to accommodate the natural curvature of the abdominal wall, three measures were taken for TrA, IO and EO – 10mm, 15mm and 20mm from the medial edge of the TrA. The mean was then recorded for analysis. Similarly three measures were taken for RA at 10mm, 15mm and 20mm from the medial border and averaged (Figure 1). The full procedure was repeated by the second rater on the same day. To reduce possible bias, half of the children were first tested by Rater 1 and the other half tested by Rater 2. The third measurement session was conducted two to four days later, on 23 learners who were available for the re-testing. The participant was measured by the same rater as on one of the previous occasions.

Statistical analysis

Statistica Version 8 (2008) was used for data analysis. A sample size of 17 was required to detect an expected correlation of r=0.7, with a probability of .05 and a power value of 90%. However, as the data were to be used in a related study, a minimum of ten were recruited from each grade. BMI was calculated using the formula mass(kg)/height(㎡). As the Kolmogorov-Smirnov test indicated a normal distribution of all variables, parametric tests were utilised throughout. Values exceeding >1.96*SD of the mean difference between the two raters for each muscle and activity were excluded from further analysis of those particular variables to ensure that one or two inaccurate measurements, which were clearly outliers, did not unduly influence the results. The Intra-Class Correlations (ICC) and the standard error of measurement (SEM) which is the root mean square of the within subject/rater variance (SD/v(sample size)) (Bland and Altman 2007, Altman and Bland 2005) were calculated. The smallest real difference (SRD) (Beckerman et al 2001) was calculated (1.96 x √2 x SEM) to determine the effect size for consideration for change. It was furthermore decided a priori that an ICC value of more than .70 and a difference between the two scores of less than 7.5% of the mean of rater 1’s value would constitute reliability for this measure.

RESULTS

Eighty six subjects were recruited to the study of which 45 were male and 41 female. The mean age was 9.6 years (SD 1.83) and the mean BMI was 17.22
(SD 2.55). The same children were not used for both parts of the study. The images of 63 children where used to determine intra-rater reliability and the images of a further 23 children where used for investigating inter-rater reliability.

Table 1 lists the thickness of all four abdominal muscles for raters for each condition. Although 252 US images where captured for 63 subjects (4 each), approximately 5% of these were of poor quality and eliminated prior to analysis. All resting measurements met the a priori criteria for reliability, as did all measures of the RA. However, the measures of activity for TrA and EO, for head up and resisted movements did not demonstrate reliability, with the exception of IO resisted sling.

Table 1 also lists the results of Rater 1 recorded on two separate days. Almost perfect agreement was found for all four muscles at rest with ICC scores of 0.91 for TrA, 0.90 for IO, 0.91 for EO and 0.94 for RA. For the head up activity, the estimate for precision of EO exceeded 7.5% and was therefore not considered a reliable measure while for TrA, IO and RA, thickness measures during the head up activity all fulfilled the criteria for reliability. For the resisted sling activities however, only the thickness measure for IO could be considered reliable.

Significant correlations existed between age and resting abdominal muscle thickness measures with (p<0.001). Significant correlations existed between BMI and resting abdominal muscle thickness measures (p<0.001).

### DISCUSSION

All the criteria for reliability set at the onset of the study i.e. an ICC value of more than 0.70 and a difference between the two scores of less than 7.5% of the mean of Rater 1’s value, were met for measuring the resting thickness of the four abdominal muscles and the active contractions of RA. As is often the case, analysis showed lower ICC scores (r <.90) for inter-rater reliability than for intra-rater reliability (r >.90). Hides et al (2007) highlights that the experience of the tester effects reliability of repeated measures. Therefore relative inexperience of the raters in this study may have contributed to the somewhat lower ICC values than those reported in studies investigating reliability of US imaging in adults.

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Activity</th>
<th>N</th>
<th>Rater 1</th>
<th>Rater 2</th>
<th>Difference</th>
<th>ICC (95%CI)</th>
<th>SEM (mm)</th>
<th>SRD (mm)</th>
<th>Diff/ rater 1 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inter-rater</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TrA</td>
<td>resting</td>
<td>58</td>
<td>2.44 (0.61)</td>
<td>2.49 (0.66)</td>
<td>0.05 (0.47)</td>
<td>0.74 (0.60; 0.84)</td>
<td>0.32</td>
<td>1.39</td>
<td>2.00</td>
</tr>
<tr>
<td>IO</td>
<td>resting</td>
<td>58</td>
<td>4.76 (1.70)</td>
<td>4.74 (1.67)</td>
<td>0.01 (0.87)</td>
<td>0.88 (0.80; 0.93)</td>
<td>0.59</td>
<td>1.75</td>
<td>0.20</td>
</tr>
<tr>
<td>EO</td>
<td>resting</td>
<td>59</td>
<td>3.06 (0.88)</td>
<td>2.86 (0.73)</td>
<td>0.20 (0.58)</td>
<td>0.74 (0.57; 0.84)</td>
<td>0.39</td>
<td>0.72</td>
<td>6.50</td>
</tr>
<tr>
<td>RA</td>
<td>resting</td>
<td>59</td>
<td>4.79 (1.04)</td>
<td>4.71 (1.10)</td>
<td>0.07 (0.76)</td>
<td>0.83 (0.72; 0.89)</td>
<td>0.43</td>
<td>1.08</td>
<td>1.50</td>
</tr>
<tr>
<td>TrA</td>
<td>head up</td>
<td>59</td>
<td>2.75 (0.74)</td>
<td>2.92 (0.87)</td>
<td>0.17 (0.72)</td>
<td>0.57 (0.30; 0.68)*</td>
<td>0.77</td>
<td>1.36</td>
<td>6.20</td>
</tr>
<tr>
<td>IO</td>
<td>head up</td>
<td>52</td>
<td>5.31 (1.81)</td>
<td>4.72 (1.65)</td>
<td>0.59 (1.21)</td>
<td>0.72 (0.50; 0.84)</td>
<td>0.87</td>
<td>2.22</td>
<td>11.1*</td>
</tr>
<tr>
<td>EO</td>
<td>head up</td>
<td>57</td>
<td>2.70 (0.87)</td>
<td>2.42 (0.88)</td>
<td>0.28 (0.74)</td>
<td>0.66 (0.42; 0.80)*</td>
<td>0.48</td>
<td>2.13</td>
<td>10.4*</td>
</tr>
<tr>
<td>RA</td>
<td>head up</td>
<td>56</td>
<td>7.07 (2.30)</td>
<td>7.50 (1.99)</td>
<td>0.42 (1.23)</td>
<td>0.82 (0.70; 0.90)</td>
<td>0.87</td>
<td>3.74</td>
<td>5.90</td>
</tr>
<tr>
<td>TrA</td>
<td>resisted sling</td>
<td>57</td>
<td>2.81 (0.96)</td>
<td>2.98 (0.98)</td>
<td>0.17 (0.79)</td>
<td>0.45 (0.22; 0.63)*</td>
<td>1.13</td>
<td>1.8</td>
<td>6.00</td>
</tr>
<tr>
<td>IO</td>
<td>resisted sling</td>
<td>57</td>
<td>5.14 (1.94)</td>
<td>5.22 (1.88)</td>
<td>0.08 (1.17)</td>
<td>0.84 (0.73; 0.90)</td>
<td>0.78</td>
<td>1.39</td>
<td>1.60</td>
</tr>
<tr>
<td>EO</td>
<td>resisted sling</td>
<td>59</td>
<td>2.93 (1.12)</td>
<td>2.83 (1.05)</td>
<td>0.1 (1.01)</td>
<td>0.62 (0.44; 0.76)*</td>
<td>0.65</td>
<td>2.33</td>
<td>3.40</td>
</tr>
<tr>
<td>RA</td>
<td>resisted head up</td>
<td>59</td>
<td>6.75 (2.04)</td>
<td>6.91 (1.94)</td>
<td>0.16 (1.21)</td>
<td>0.81 (0.71; 0.89)</td>
<td>0.86</td>
<td>2.38</td>
<td>2.40</td>
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<td><strong>Intra-rater</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TrA</td>
<td>resting</td>
<td>21</td>
<td>2.70 (0.68)</td>
<td>2.63 (0.58)</td>
<td>0.07 (0.27)</td>
<td>0.91 (0.79; 0.96)</td>
<td>0.19</td>
<td>0.53</td>
<td>2.59</td>
</tr>
<tr>
<td>IO</td>
<td>resting</td>
<td>22</td>
<td>4.93 (1.45)</td>
<td>4.83 (1.35)</td>
<td>0.10 (0.63)</td>
<td>0.90 (0.78; 0.96)</td>
<td>0.45</td>
<td>1.25</td>
<td>2.03</td>
</tr>
<tr>
<td>EO</td>
<td>resting</td>
<td>22</td>
<td>3.19 (1.05)</td>
<td>3.04 (1.01)</td>
<td>0.15 (0.42)</td>
<td>0.91 (0.79; 0.96)</td>
<td>0.30</td>
<td>0.83</td>
<td>4.70</td>
</tr>
<tr>
<td>RA</td>
<td>resting</td>
<td>23</td>
<td>5.39 (1.34)</td>
<td>5.56 (1.33)</td>
<td>0.16 (0.43)</td>
<td>0.94 (0.87; 0.98)</td>
<td>0.30</td>
<td>0.83</td>
<td>2.97</td>
</tr>
<tr>
<td>TrA</td>
<td>head up</td>
<td>20</td>
<td>2.85 (0.75)</td>
<td>2.86 (0.66)</td>
<td>0.01 (0.35)</td>
<td>0.88 (0.72; 0.95)</td>
<td>0.25</td>
<td>0.69</td>
<td>0.35</td>
</tr>
<tr>
<td>IO</td>
<td>head up</td>
<td>22</td>
<td>5.54 (1.90)</td>
<td>5.59 (1.94)</td>
<td>0.10 (0.63)</td>
<td>0.86 (0.68; 0.94)</td>
<td>0.74</td>
<td>2.05</td>
<td>1.79</td>
</tr>
<tr>
<td>EO</td>
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<td>20</td>
<td>2.59 (0.91)</td>
<td>2.87 (1.04)</td>
<td>0.28 (0.38)</td>
<td>0.89 (0.61; 0.96)</td>
<td>0.27</td>
<td>0.75</td>
<td>10.81*</td>
</tr>
<tr>
<td>RA</td>
<td>head up</td>
<td>21</td>
<td>7.11 (2.06)</td>
<td>7.60 (2.37)</td>
<td>0.49 (0.92)</td>
<td>0.90 (0.63; 0.98)</td>
<td>0.65</td>
<td>2.27</td>
<td>6.89</td>
</tr>
<tr>
<td>TrA</td>
<td>resisted sling</td>
<td>9</td>
<td>2.81 (0.80)</td>
<td>3.02 (0.77)</td>
<td>0.21 (0.71)</td>
<td>0.60 (-0.03;0.89)*</td>
<td>0.50</td>
<td>2.38</td>
<td>7.47</td>
</tr>
<tr>
<td>IO</td>
<td>resisted sling</td>
<td>9</td>
<td>5.17 (2.06)</td>
<td>5.42 (2.29)</td>
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<td>0.84</td>
<td>3.13</td>
<td>-5.03</td>
</tr>
<tr>
<td>EO</td>
<td>resisted sling</td>
<td>9</td>
<td>2.74 (1.23)</td>
<td>3.39 (1.24)</td>
<td>0.65 (1.22)</td>
<td>0.49 (-0.07;0.85)*</td>
<td>0.86</td>
<td>2.16</td>
<td>23.72*</td>
</tr>
<tr>
<td>RA</td>
<td>resisted head up</td>
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<td>0.71 (0.41; 0.87)</td>
<td>0.82</td>
<td>1.8</td>
<td>3.33</td>
</tr>
</tbody>
</table>

# Number of subjects included in the final analysis following further exclusion of those variables where the difference between the two raters exceeded >1.96*SD.

*criteria for reliability not met
When interpreting correlation coefficients the deviation of the sample means from the standard deviation (Altman and Bland 2005) should also be taken into account. The SEM is an indication of the precision of the measure. The smaller the SEM, the more accurate/repeatable the measure can be considered. In the current study the SEM values were relatively small - ranging from 0.19mm for resting TrA to 0.86mm for IO during the resisted sling activity - when the same tester repeated the measure, suggesting that there was little uncertainty about the estimate of the mean and that the rater was precise in his/her measurements. Similarly the SEM suggests that both raters were precise in their measurements.

Further benefit to be derived from the SEM is the calculation of the smallest real difference (SRD). For researchers or clinicians the calculation of this value (Table 1) is important in determining and interpreting significance of change between pre and post measures (Beckerman et al 2001). For example when investigating the effect of an intervention the difference in thickness measures of resting TrA must exceed 0.53mm at post measurement to be considered different from the baseline measure.

Apart from consistency in measurement, reliability of a measure requires stability of the attribute being measured. RA measurement showed reliability but the other muscle groups did not meet the two criteria set for reliability under all conditions. It is suggested that, rather than error in measurement, the large variation within individuals in patterns of recruitment of the abdominal muscles is responsible for the lack of reproducibility. This variation has been noted during upper and lower limb activities in the adult literature (Ng et al 2003, Hodges and Richardson 1997) and in this study there was considerable variation in muscle thickness during the supine positioned head up and resisted sling activities for TrA, IO and EO muscles. This variation was not noted during the pilot trial but could possibly have been reduced by standardising the amount of resistance offered by the tester across attempts.

As in adults (Rankin et al 2006), increasing body size and age were all found to be correlated with resting muscle thickness. This finding supports the responsiveness of the measure. As BMI was found to correlate will all measures, it is suggested that BMI rather than age be used to normalise measures enabling comparison between individuals.

**CONCLUSION**

The current study supports the reliability of US measurement of resting abdominal muscles and of the RA under active conditions in children aged six to 13. However the protocol for measurement of the other muscles under active conditions still needs to be refined. Intra-tester reliability is greater than inter-tester reliability. Abdominal muscles are key to both posture and gait, in both typically developing children and in children with disabilities. US can provide a useful non-invasive, economical and ethical acceptable adjunct to other techniques of investigating muscle function in children and in so doing clarifying the development of the structure and function of these muscles over time.

**RECOMMENDATIONS**

When interpreting change in thickness measures on US images, consideration of the SRD values should be given and can be used for sample size calculation for future studies. Reliability of US imaging in other positions such as in sitting or standing should also be determined in order to develop a better understanding of the role of these muscles in postural control. In order to allow for comparison between children with pathology, reliability for US imaging in these populations would also still need to be determined.
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26 SA JOURNAL OF PHYSIOTHERAPY 2009 VOL 65 NO 3
INTRODUCTION

The high prevalence of obesity and its strong link with major predictors of a number of life-threatening and debilitating conditions has made it a subject of considerable and primary concern on the agenda of the public health (U S Department of Health and Human Services, 2001). The World Health Organisation recognises obesity as a risk factor for non-communicable diseases in which more than one billion adults worldwide are overweight, of which approximately 300 million are obese (World Health Organisation, 2006). Its prevalence in Western nations such as the United States is as high as 27 % in men and 32 % in women above the age of 20 years (World Health Organisation, 2006). Its prevalence in Western nations such as the United States is as high as 27 % in men and 32 % in women above the age of 20 years (World Health Organisation, 2006). However, the burden of being overweight and obese is not only to be found in the Western world, as countries undergoing economic transition such as South Africa, Brazil, and China have also been implicated (Pouane et al., 2002). Pouane et al. (2002) estimated that the prevalence of overweight and obese people in South Africa is high with more than 29 % of men and 56 % of women being classified as overweight or obese. The impact of obesity on the health of individuals is critical, as it puts the individual in danger of a shorter life expectancy and at risk for developing chronic diseases of lifestyle, which include diabetes, cardiovascular disease and musculoskeletal disorders such as arthritis and back pain. Widespread negative attitudes towards obese people have been observed which are equally prevalent among health care professionals. This study was based on the need to determine the knowledge and attitudes towards obese people among physiotherapy students, as they are well suited to address the intricacies of obesity and its related conditions. One hundred and seventy five students from a university in the Western Cape, South Africa, completed a structured, self-administered questionnaire that was adopted from the Obesity Risk Knowledge and Fat Phobia Scale. The study sample demonstrated average levels of knowledge regarding obesity with scores ranging from 3 to 9 on a scale of 10 with a mean score of 6.05. An overwhelming majority of the participants (> 80%) viewed obesity as largely a behavioural problem while nearly all the participants (97.6%) characterised obese people as lazy, unattractive, insecure and with lower self-esteem. This study has reinforced the need for a more focussed approach to the education of physiotherapy students about obesity and obesity-related conditions, as well as the management thereof.

KEYWORDS: OBESITY, ATTITUDES, KNOWLEDGE, PHYSIOTHERAPY, STUDENTS.

ABSTRACT: Obesity has been recognised as a risk factor for non-communicable diseases, with more than one billion adults worldwide who are overweight, of which approximately 300 million are obese. Obesity puts an individual in danger of a shorter life expectancy and at risk for developing chronic diseases of lifestyle, which include diabetes, cardiovascular disease and musculoskeletal disorders such as arthritis and back pain. Widespread negative attitudes towards obese people have been observed which are equally prevalent among health care professionals. This study was based on the need to determine the knowledge and attitudes towards obese people among physiotherapy students, as they are well suited to address the intricacies of obesity and its related conditions. One hundred and seventy five students from a university in the Western Cape, South Africa, completed a structured, self-administered questionnaire that was adopted from the Obesity Risk Knowledge and Fat Phobia Scale. The study sample demonstrated average levels of knowledge regarding obesity with scores ranging from 3 to 9 on a scale of 10 with a mean score of 6.05. An overwhelming majority of the participants (> 80%) viewed obesity as largely a behavioural problem while nearly all the participants (97.6%) characterised obese people as lazy, unattractive, insecure and with lower self-esteem. This study has reinforced the need for a more focussed approach to the education of physiotherapy students about obesity and obesity-related conditions, as well as the management thereof.

KEYWORDS: OBESITY, ATTITUDES, KNOWLEDGE, PHYSIOTHERAPY, STUDENTS.
There is a concern that this negative attitude towards people who are obese among the healthcare professionals will not only compromise their clinical judgements but also dissuade obese clients from seeking medical help (Puhl & Brownell, 2001). Furthermore, the consequence of such negative perception will also result in the under-utilization of healthcare services and increased obesity mortality (Thomas et al., 2007).

Obese and overweight individuals experience a number of problems which may contribute to a lack of function, such as muscle weakness, joint pain, difficulty with walking and climbing stairs (Peltonen, Lindroos & Torgerson, 2003). As primary health care professionals, physiotherapists are ideally suited to individualize exercise regimens within the functional limitations of obese patients (Canadian Physiotherapy Association, 2008). Furthermore physiotherapists have received training in therapeutic exercises, biomechanics, exercise prescription and physiological and anatomical mechanisms of health and disease. Various physiotherapy associations are in agreement that due to these varied skill sets physiotherapist are well suited to address the intricacies of obesity and its related conditions (Australian Physiotherapy Association, 2009; Canadian Physiotherapy Association, 2008). For physiotherapists to do this effectively, they must be able to recognize the complex nature of obesity aetiology and be aware of their attitudes towards obese individuals. Therefore, the motivation for this study was based on the need to determine the knowledge and attitudes towards obese people among physiotherapy students.

METHODS

The study employed a cross-sectional, quantitative design. The population included 220 full time undergraduate and postgraduate physiotherapy students registered for the 2008 academic year at a university in the Western Cape, South Africa. Of these students, 79.5% were undergraduates and 20.5% were postgraduates. All students were invited to participate in the study.

Permission and ethical clearance were granted by the relevant authorities. The questionnaires were administered to participants in a class setting. At the beginning of each session the purpose of the study was clearly explained by the researcher to the participants. Signed, informed consent was obtained from all the participating students and an information sheet provided, explaining their right of voluntary participation, confidentiality and withdrawal as entrenched in a standard research protocol.

Data were collected by means of a structured, self administered questionnaire consisting of two scales for measuring knowledge and attitudes towards obese people. The first scale, Obesity Risk Knowledge (ORK-10), developed and validated by Swift, Glazebrook, and Macdonald (2006) was used to measure the knowledge of the health risks associated with obesity. It is designed to be a ‘norm referenced’ as opposed to ‘criteria referenced’, which means that there is no cut-off point to say that knowledge is either high or low. Scores on the ORK-10 scale ranges between 0 and 10 with higher scores indicating higher levels of knowledge. The second scale, the Fat Phobia Scale (FPS) was developed and validated by Bacon, Scheltema, and Robinson (2001), and was used to determine students’ attitudes towards obese people. The FPS consists of 14 items using a 5-point Likert scale ranging from 1 to 5. Based on the score design, a score of 2 or less indicates neutral attitudes towards obese individuals. A score of 2.5 or more indicates a more negative or positive attitude respectively.

Data obtained from the questionnaire were analyzed using the Statistical Package for the Social Sciences (SPSS) version 16.0. Descriptive statistics were employed to summarize the data using frequency tables and were expressed as percentages, means, and standard deviations. The differences between socio-demographic variables and specific variables (knowledge and attitudes) were tested using the Chi-square. The correlation co-efficient was used to test the strength of the relationship between knowledge and attitudes and the alpha level was set at p < 0.05.

RESULTS

One hundred and seventy five (175) participants completed and returned the questionnaires. The authors decided not to include questionnaires in the analysis if more than 50% of the items were incomplete. Five questionnaires were thus considered invalid. The overall response rate was thus 77.3%. The final sample consisted of 73.5% (n = 125) females and 26.5% (n = 45) males. The participants’ age ranged from 17-49 years with a mean age of 21.5 years (SD = 4.9). More than half of the participants (56%) had a normal weight using a self-reported body weight and height for body mass index (BMI). Overall, the majority of the study participants (85%) reported that they did not receive education regarding obesity and about 23% were confident in treating and counselling obese clients.

KNOWLEDGE OF OBESITY

The scores of the study sample based on the ORK-10 ranged from 3 to 9 (mean score = 6.08, SD = 1.35). More than half of the participants (51.1%) achieved scores of 5 and 6 on a scale of 10. Table 1 presents the responses to the general knowledge questions (ORK-10) concerning the health risks that are associated with obesity. Participants could select ‘True’ or ‘False’ for the different statements. The majority of the participants (96.5%) knew that obesity is a risk factor for hypertension. Furthermore, 89% of the participants agreed that there is a health benefit for obese individuals to lose weight and 67.1% of the participants underestimated the risk of breast cancer after menopause in obese individuals.

The association between knowledge items and gender ($\chi^2 = 0.78, p > 0.05$) and year of study ($\chi^2 = 0.78, p > 0.05$) was very low and not statistically significant. Very few individual knowledge questions had significant associations with the year of study as illustrated in Table 2. There was a significant association between the year of study and the notion that obesity increases the risk of getting bowel cancer with postgraduate participants less likely to recognize this ($\chi^2 = 17.18, P < 0.05$). Furthermore, participants in their final year were more
Table 1: Knowledge of health risks associated with obesity of study sample (n= 170).

<table>
<thead>
<tr>
<th>Questions</th>
<th>Correct (%)</th>
<th>Incorrect (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity does not increase the risk of developing high blood pressure (False)</td>
<td>96.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Obese people can expect to live as long as non-obese people (False)</td>
<td>90.0</td>
<td>10.0</td>
</tr>
<tr>
<td>There is no health benefit if an obese person who gets diabetes, loses weight (False)</td>
<td>89.4</td>
<td>10.6</td>
</tr>
<tr>
<td>Obesity increases the risk of getting food allergy (False)</td>
<td>77.2</td>
<td>22.8</td>
</tr>
<tr>
<td>Obesity increases the risk of getting bowel cancer (True)</td>
<td>65.9</td>
<td>34.1</td>
</tr>
<tr>
<td>A person with a ‘beer belly’ shaped stomach has an increased risk of getting diabetes (True)</td>
<td>65.7</td>
<td>34.3</td>
</tr>
<tr>
<td>It is better for a person’s health to have fat around the hips and thighs than around the stomach &amp; waist (True)</td>
<td>54.7</td>
<td>45.3</td>
</tr>
<tr>
<td>Obesity increases the risk of getting breast cancer after the menopause (True)</td>
<td>32.9</td>
<td>67.1</td>
</tr>
<tr>
<td>An obese person who gets diabetes needs to lose at least 40% of their body weight for clear health benefits (False)</td>
<td>24.3</td>
<td>75.7</td>
</tr>
<tr>
<td>Obesity is more of a risk to health for people from South-Asia (e.g. India) than it is for White Europeans (True)</td>
<td>14.1</td>
<td>85.9</td>
</tr>
</tbody>
</table>

All responses expressed as percentages.

Table 2: Associations between the year of study and knowledge of health risks of obesity (n = 170).

<table>
<thead>
<tr>
<th></th>
<th>Yr. 1</th>
<th>Yr. 2</th>
<th>Yr.3</th>
<th>Yr.4</th>
<th>PG (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A person with a ‘beer-belly’ shaped stomach has an increased risk of getting diabetes.</td>
<td>True</td>
<td>70.7</td>
<td>67.7</td>
<td>65.9</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>29.3</td>
<td>32.3</td>
<td>34.1</td>
<td>33.3</td>
</tr>
<tr>
<td>Obesity increases the risk of getting bowel cancer.**</td>
<td>True</td>
<td>75.6</td>
<td>74.2</td>
<td>71.8</td>
<td>61.5</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>24.4</td>
<td>25.8</td>
<td>28.2</td>
<td>38.5</td>
</tr>
<tr>
<td>An obese person who gets diabetes needs to lose at least 40% of their body weight for clear health benefits.</td>
<td>True</td>
<td>85.4</td>
<td>63.3</td>
<td>82.9</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>14.6</td>
<td>36.7</td>
<td>17.1</td>
<td>35</td>
</tr>
<tr>
<td>Obese people can expect to live as long as non-obese person. **</td>
<td>True</td>
<td>4.9</td>
<td>16.1</td>
<td>4.9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>95.1</td>
<td>83.9</td>
<td>95.1</td>
<td>95</td>
</tr>
<tr>
<td>Obesity increases the risk of getting breast cancer after menopause.</td>
<td>True</td>
<td>29.3</td>
<td>31</td>
<td>35.9</td>
<td>36.8</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>70.7</td>
<td>69</td>
<td>64.1</td>
<td>63.2</td>
</tr>
<tr>
<td>Obesity is more of a risk to health for people from South-Asia (e.g. India and Pakistan) than it is for White European.**</td>
<td>True</td>
<td>4.9</td>
<td>12.9</td>
<td>14.6</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>95.1</td>
<td>87.1</td>
<td>82.9</td>
<td>87.5</td>
</tr>
<tr>
<td>There is no major health benefit if an obese person who gets diabetes loses weight.</td>
<td>True</td>
<td>9.8</td>
<td>19.4</td>
<td>7.3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>90.2</td>
<td>80.6</td>
<td>92.7</td>
<td>95</td>
</tr>
<tr>
<td>Obesity does not increase the risk of developing high blood pressure**</td>
<td>True</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>95</td>
</tr>
<tr>
<td>It is better for a person’s health to have fat around the hips and thighs than around the stomach and waist.*</td>
<td>True</td>
<td>43.9</td>
<td>51.6</td>
<td>41.5</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>56.1</td>
<td>48.4</td>
<td>58.5</td>
<td>25</td>
</tr>
<tr>
<td>Obesity increases the risk of getting a food allergy.</td>
<td>True</td>
<td>31.7</td>
<td>16.7</td>
<td>9.8</td>
<td>28.2</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>68.3</td>
<td>83.3</td>
<td>85.4</td>
<td>71.8</td>
</tr>
</tbody>
</table>

* Significant differences between groups at P< 0.05.
likely to state correctly that it is better to for a person’s health to have fat around the hip and thighs than around the stomach and waist (χ²= 13.33, P < 0.05).

ATTITUDES TOWARDS OBESITY
A substantial number of respondents (97.6%) had a score that was greater than 2.5, and approximately 2.4% achieved a score of less than 2.5 on the Fat Phobia Scale. Table 3 summarizes the mean scores of the study sample based on the Fat Phobia Scale. Assessing individual attitude items on the Fat Phobia scale found that the majority of participants (> 60%) thought of obese people as being slow and insecure, having low self-esteem and poor self-control, were lazy, and unattractive. A significant difference was found between attitude items and gender, with females more likely to characterize obese individuals as having poor self-control (χ² = 11.69, p < 0.05) and low self-esteem (χ² = 17.86, p < 0.05). Furthermore, the association between the participants own body mass index (BMI) and attitudes showed that significantly more underweight participants (75.8%) were more likely to view obese people as having no endurance (χ² = 14.79, p < 0.05) and self-indulgent (χ²= 12.41, p < 0.05).

DISCUSSION
There is a growing concern that despite healthcare professionals recognizing obesity as a life-threatening medical condition, they are often confused about the effectiveness of their interventions and advice. Several studies have concluded that lack of knowledge of the causes of obesity among healthcare professionals is known to mitigate the capacity to effectively intervene or advise (Block et al., 2003). The present study highlights that physiotherapy students demonstrated average levels of knowledge regarding obesity with scores ranging from 3 to 9 on a scale of 10 with a mean score of 6.05. This classification was based on the Obesity Risk Knowledge (ORK-10) with higher scores indicating professionals to be in better positions to direct the future of obesity prevention and intervention (Swift et al., 2006). The success of their role in obesity prevention and intervention depends on their ability to recognize the consequence of obesity and to show a willingness to engage in obesity interventions (Kristeller & Hoerr, 1997).

The levels of knowledge demonstrated by the study sample are consistent with the study by Swift, Sheard and Rutherford (2007) conducted in the United Kingdom, which found an average level of knowledge among medical students (mean = 6.5), postgraduate nursing students (mean = 6.0) and undergraduate nursing students (mean = 5.7). The results of the study by Swift et al. (2007) and that of the present study indicate that students may not be well equipped to offer advice to obese patients as they do not have adequate knowledge regarding obesity. These findings confirm that a gap in students’ knowledge exists. A more focused approach regarding the role of physiotherapists in the prevention and management of obesity and its associated conditions from undergraduate to postgraduate levels thus seems warranted to improve students’ knowledge.

Studies have consistently shown that negative attitudes towards obese people among healthcare professionals increase the tendency for obesity-related behaviours and will likely result in differential treatment that will affect equal access to healthcare facilities (Puhl & Brownell, 2003). The current study highlighted the fact that a substantial number of participants (97.6%) possess negative attitudes towards obese people. This is consistent with several studies among healthcare professionals who describe obese people as lazy, lacking self-control, over-indulgent, and less attractive (Loomis et al., 2001). This result is of great concern in that the vast majority of physiotherapy students failed to recognise that obesity is a product of many factors rather than predominantly a behavioural problem, thus putting the blame mainly on obese patients. This again highlights the fact that education related to obesity for physiotherapy students should be more focussed on their role in the management of obesity and its associated conditions. This is important as there is evidence of the effectiveness of physiotherapy management in musculoskeletal conditions (Altman, Hochberg, Moskowitz & Schnitzer, 2000), type 2 diabetes (Aas et al., 2005) and respiratory problems (Satta, 2000) in the obese individual.

The current study explores the influence of the knowledge of physiotherapy students around issues regarding obesity and how it affects their attitudes towards

### Table 3: Mean scores (SD) of the study samples on the Fat Phobia Scale (n = 170).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3.84</td>
<td>0.70</td>
</tr>
<tr>
<td>Female</td>
<td>3.99</td>
<td>0.55</td>
</tr>
<tr>
<td>Year of study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>4.124</td>
<td>0.51</td>
</tr>
<tr>
<td>Year 2</td>
<td>4.08</td>
<td>0.688</td>
</tr>
<tr>
<td>Year 3</td>
<td>3.92</td>
<td>0.09</td>
</tr>
<tr>
<td>Year 4</td>
<td>3.80</td>
<td>0.49</td>
</tr>
<tr>
<td>Post graduate</td>
<td>3.69</td>
<td>0.59</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>4.14</td>
<td>0.73</td>
</tr>
<tr>
<td>Normal</td>
<td>3.95</td>
<td>0.55</td>
</tr>
<tr>
<td>Overweight</td>
<td>3.91</td>
<td>0.49</td>
</tr>
<tr>
<td>Obese</td>
<td>3.69</td>
<td>0.59</td>
</tr>
<tr>
<td>Overall sample</td>
<td>3.95</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Mean SD
people who are obese. The study demonstrated that the relationship between knowledge of the causes of obesity and attitudes towards obese people was not significant. This finding concurs with the study of Fogelman et al. (2002), which found that physicians were aware of the risk factors for obesity, but that such knowledge was not enough to improve their attitudes. This could be interpreted that students had limited knowledge about the causes of obesity. Therefore, they were less likely to express positive attitudes towards obese individuals if they view the cause of obesity to be largely within the control of the obese person.

CONCLUSION
This study has reinforced the need for a more focused approach to the education of physiotherapy students related to obesity and obesity related conditions, and the management thereof. Education should also emphasise the vital role of physiotherapy in the management and treatment of obese individuals.

REFERENCES

Aas AM, Bergstad I, Thorsby PM, Johannesen O, Solberg M & Birkeland KI 2005 An intensified lifestyle intervention programme may be superior to insulin treatment in poorly controlled Type 2 diabetic patients on oral hypoglycaemic agents: Results of a feasibility study. Diabetic Medicine, 22: 316-322.


Block JP, Desalvo KB, & Fisher WP 2003. Are physicians equipped to address the obesity epidemic? Knowledge and attitudes of internal medicine residents. Preventive Medicine, 36(6), 669-675.


The use of information and communication technology by South African physiotherapy students

ABSTRACT: The global shift toward the use of information and communication technology (ICT) in health education and practice has been shown to enhance both the educational opportunities and the support provided to students and healthcare professionals. This study aimed to investigate the use of ICT by South African physiotherapy students and what their experiences and perceptions were regarding their use of ICT as part of their studies. The study design was a cross-sectional, descriptive survey using a self-administered questionnaire. The survey population included all of the undergraduate physiotherapy students from six of the eight universities offering the physiotherapy degree in South Africa (N=1105). The sample size consisted of 529 students from the survey population who completed and returned questionnaires, indicating a response rate of 48%. The results of the study showed that the use of ICT by South African physiotherapy students varied according to task, racial group and university attended. Furthermore, the reported use of ICT for communication, research and continuing professional development was low. In conclusion, this study indicates that with a move toward the use of ICT to enhance health education and practice in South Africa, certain groups of physiotherapy students may be at a disadvantage if required to make use of ICT as a means of improving communication, enhancing education, participating in lifelong learning opportunities and accessing support.

KEYWORDS: INFORMATION AND COMMUNICATION TECHNOLOGY, PHYSIOTHERAPY, STUDENTS, SOUTH AFRICA, EDUCATION.

INTRODUCTION
The use of information and communication technology (ICT) in all spheres of human endeavour has become increasingly evident over the past decade, with people of all ages making use of computers and the Internet to interact, communicate and do business on a daily basis (Louw & Hamner, 2002). In South Africa, the increasing availability of broadband Internet access has resulted in the rise of social networking, online consumer forums and multimedia on demand services that are changing the way we communicate and engage with each other. However, while the use of ICT in many aspects of society has increased, not everyone has equal access to technology, partly as a result of the policies of apartheid prior to 1994 (Bozalek et al, 2007). This has led to a phenomenon known as the “digital divide”, or the gap between those with access to technology and those without (Samuel et al, 2004).

Despite this, the use of ICT to facilitate learning has found support among many scholars (Oblinger & Oblinger, 2005; Rohleder et al, 2007). The South African government has also indicated that ICT has the potential to improve the quality of education and training and has pledged to “...invest in national initiatives to increase access...and provide electronic resources of the highest quality...” to students in South Africa (Department of Education, 2004, p. 11). This investment in technology is essential, as today’s students in higher education are part of the first generation to have access to the vast resources of the Internet and who use it regularly. There is also evidence that they are not only comfortable with technology, but that it has fundamentally changed the way they communicate and learn (Barnes et al, 2007). This change has led to educators in higher education questioning how their institutions are adapting to take advantage of these new tools and the new methods of teaching that they enable (Oblinger & Oblinger, 2005).

Social constructivism is one theoretical approach that advocates the use of ICT in education, as it facilitates active student engagement with content, educators and each other, enhances problem-based learning, improves information gathering skills, improves communication between educators and students, ensures the accessibility of coursework and enhances administrative tasks (Johns, 2003; Oblinger & Oblinger, 2005;
Rohleder et al., 2007). The use of ICT in education has also been shown to increase the channels of communication and facilitate collaborative learning (Boulos et al., 2006), creating a framework for the social construction of knowledge. These characteristics of the use of ICT in education allow students to take greater responsibility for learning, and for educators to act as facilitators of learning.

The use of ICT in clinical practice has been shown to facilitate evidence based practice (EBP); improve the opportunities for continuing professional development (CPD); and enhance communication between colleagues (Rowe, 2008). However, while many physiotherapists support the concept of EBP in principle, many found it hard to implement due to a lack of access to literature and isolation from their peers (Grimmer-Somers et al., 2007). These issues with EBP have been identified as ones which could potentially be addressed through the use of ICT (Hill & Alexander, 1996; Mitchell et al., 2001; Taylor & Lee, 2005). Therefore, if ICT is going to be the means by which clinicians gain access to the latest evidence as part of their practice, it indicates a need for healthcare students to be literate in it’s use. In fact, computer literacy has been recognised as an essential skill for future healthcare professionals to function effectively in an increasingly digital workplace (Samuel et al., 2004; Kingsley & Kingsley, 2009).

In terms of the actual acquisition of these skills, doctors in the United Kingdom (UK) have reported that self-directed learning was the means by which they learned how to use a computer (National Health Service, 1998). With a lack of access to ICT resources in South Africa (Bozalek, 2007), self-directed learning as a means of acquiring these skills may not be a feasible solution. Other studies have identified more problems with the use of ICT in medical education, including the fact that there is often poor engagement with content when materials are poorly designed, both staff and students need adequate training in order to make use of computer assisted learning tools, and there is often resistance to change (Greenhalgh, 2004; Kingsley & Kingsley, 2009). Together with the high cost of developing digital resources and the poor time management that is often associated with e-learning and distance learning (Martin, 2007), it is evident that the implementation of ICT in healthcare education should be undertaken with caution and careful deliberation.

**Aim of the study**

While there is a significant worldwide shift towards the use of ICT to enhance healthcare education and clinical practice, its use among South African physiotherapy students has not been well documented. Thus, the aim of the study was to determine which ICT resources South African physiotherapy students use during their undergraduate education, and what their experiences and perceptions were regarding that use.

**METHODOLOGY**

A cross-sectional, descriptive survey was used to determine the use of ICT among physiotherapy students at six of the eight training institutions in South Africa, in 2007. The population for the study included all registered undergraduate physiotherapy students in the country. However, for logistical reasons the Universities of the Free State and Pretoria were unable to participate, with the Universities of Cape Town, KwaZulu-Natal, Limpopo, Stellenbosch, Western Cape and Witwatersrand yielding a sample of 1105 students. No exclusions were made.

As no validated, reliable instrument could be found, a self-developed questionnaire was used, which was based on questionnaires used in similar studies identified in the literature, as well as the authors personal experiences. The questionnaire was divided into three sections that were based on the areas in which information was sought and that would satisfy the objectives of the study. The sections included: demographic information; use of ICT at university and at home; students’ experiences and perceptions of support; and use of ICT. A combination of Likert scales, “Yes/No” answers and one open-ended question were used to gather information. A pilot study was conducted with a small group of newly qualified physiotherapists, in order to improve the content validity of the questionnaire. Irrelevant or ambiguous questions were either modified or removed so that reliability could be improved. The response rate was maximised by using stamped, self-addressed envelopes; including cover letters; sending reminders to participants; and offering book vouchers to three randomly selected participants. Questionnaires were hand-delivered to the three physiotherapy departments in the Western Cape Province, and posted to the departments in other provinces.

Questionnaires and cover letters explaining the study were sent to class co-ordinators in each physiotherapy department, which they distributed to their respective classes. Students were asked to complete the questionnaires and return them to the researcher by post. Data were captured and coded using the OpenOffice spreadsheet application and descriptive and inferential statistical analysis was performed using the Statistical Package for Social Science (SPSS), version 16. Statistical significance was set at $p$ equal to or less than 0.05.

Ethical clearance to conduct the study was obtained from the University of the Western Cape, and permission obtained from the heads of each physiotherapy department who agreed to participate. Consent was implied by completing and returning the questionnaire and anonymity was ensured by not collecting personally identifiable data. Class co-ordinators were asked to inform students that participation was voluntary and that their anonymity would be ensured by not gathering any personally identifiable information. There were no risks in participating in the study.

**RESULTS**

The demographic data of the participants are presented in Table 1, with 529 respondents representing a response rate of 48%.1 Eighty two percent of respon-

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1 Percentages in the text have been rounded off to the nearest whole number.
Students were female, 41% were White and more than half (51%) were between 16 and 20 years old.

Most participants (92%) reported using ICT at university, with 74% using it at least weekly. There was a significant relationship between race and the frequency of ICT use at university (p=0.000), with Black students being the most frequent users (91% using it at least weekly), then Coloured and Indian students (79% and 77% respectively) and White students using ICT the least (61% at least weekly). It was also found that the university attended was a significant factor in the frequency of ICT use (p=0.000), as shown in Figure 1. Few Black students reported having access to the Internet when they were in high school (18%) and at home (15%), prior to attending university, which is in stark contrast to the 60% of White students who had Internet access at high school, and 78% who had access at home.

Table 2 indicates that using online search engines was the most common use of the Internet at university (85%), and accessing the departmental website the least common use. The use of online databases (53%) and journals (48%) was found to be low. The use of email while at university was also reported to be low (48%), with only 26% of these respondents reporting using it to communicate with their peers and lecturers (not shown

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>432</td>
<td>81.7</td>
</tr>
<tr>
<td>Male</td>
<td>97</td>
<td>18.3</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>270</td>
<td>51</td>
</tr>
<tr>
<td>20-25</td>
<td>244</td>
<td>46.1</td>
</tr>
<tr>
<td>26-30</td>
<td>11</td>
<td>2.1</td>
</tr>
<tr>
<td>31-35</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>35-40</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>Race*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>117</td>
<td>22.1</td>
</tr>
<tr>
<td>Coloured</td>
<td>126</td>
<td>23.8</td>
</tr>
<tr>
<td>Indian</td>
<td>64</td>
<td>12.1</td>
</tr>
<tr>
<td>White</td>
<td>219</td>
<td>41.4</td>
</tr>
</tbody>
</table>

* The use of racial categories recognises the socio-economic impact of the policy of apartheid prior to 1994. The categories used in this study were based on the government’s racial classification system during that time. In the past, population group was based on a legal definition, but it is now based on self-perception and self-classification. Coloured in this context is a population of mixed ancestry.

<table>
<thead>
<tr>
<th>Online activities</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online search engines</td>
<td>447</td>
<td>84.5</td>
</tr>
<tr>
<td>Online library</td>
<td>332</td>
<td>62.8</td>
</tr>
<tr>
<td>Physiotherapy-related websites</td>
<td>322</td>
<td>60.9</td>
</tr>
<tr>
<td>Online databases</td>
<td>280</td>
<td>52.9</td>
</tr>
<tr>
<td>Online journals</td>
<td>255</td>
<td>48.2</td>
</tr>
<tr>
<td>Course-related email</td>
<td>252</td>
<td>47.6</td>
</tr>
<tr>
<td>Department websites</td>
<td>217</td>
<td>41</td>
</tr>
</tbody>
</table>

Figure 1: Frequency of ICT use at university (N=529)
There was a significant relationship between the activities performed online (see Table 2) and the university attended \((p=0.000)\). The most common reason given for using the Internet at university was to prepare assignments \((83\%)\), which was followed by academic development \((43\%)\). The least common reason was to seek clinical advice or guidance \((23\%)\). Forty eight percent of students used the Internet at university for personal interest.

Table 3 shows that most physiotherapy students \( (>70\%) \) reported that they were confident in performing searches on the Internet, sending email, printing documents, writing letters or records, preparing presentations and for professional development. Research, gaming, forum discussion and exercise prescription are the activities that physiotherapy students reported being uncertain or not confident in performing. Additionally (not shown in table), most respondents indicated a preference for face-to-face contact as the means by which support could be accessed, which was in agreement with Rohleder et al (2007) who found a similar preference for face-to-face interaction between students and staff in higher education. When considered alongside the findings by Stiller et al (2007), who reported that Australian physiotherapists would prefer a model for clinical education that discouraged more, not less, face-to-face contact time, it seems that ICT should not be used to reduce face-to-face contact time, as has been suggested by Eksteen (2005).

Most students reported using the Internet to find information for assignments and projects, and this was the most common use of ICT at university by a margin of more than 20\%, which is in agreement with at least one UK-based study (Devitt & Murphy, 2004). The fact that students are using the Internet to find information should be seen as a positive step towards self-directed learning. However, while students may be comfortable with finding information online, there was no indication of the quality or credibility of this information. When considered together with the reported low use of email at university, this suggests that South African physiotherapy students use ICT primarily as a means of finding information, rather than as a means of communication.

Despite this low reported use, most students indicated that ICT can improve communication between lecturers and peers and felt confident to use it. While email has been shown to be a reliable, efficient and cost-effective means of communication, South African physiotherapy students do not use it as part of their studies, losing out on the potential of enhanced levels of engagement with each other and their lecturers.

Although most students agreed that ICT could improve the level of support they receive, very few respondents

<table>
<thead>
<tr>
<th>Activity</th>
<th>Confident n</th>
<th>Confident %</th>
<th>Uncertain n</th>
<th>Uncertain %</th>
<th>Not confident n</th>
<th>Not confident %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet search</td>
<td>441</td>
<td>83.4</td>
<td>21</td>
<td>4</td>
<td>10</td>
<td>1.9</td>
</tr>
<tr>
<td>Email</td>
<td>438</td>
<td>82.3</td>
<td>17</td>
<td>3.2</td>
<td>6</td>
<td>1.1</td>
</tr>
<tr>
<td>Printing documents</td>
<td>412</td>
<td>77.9</td>
<td>26</td>
<td>4.9</td>
<td>11</td>
<td>2.1</td>
</tr>
<tr>
<td>Writing letters/records</td>
<td>381</td>
<td>72</td>
<td>33</td>
<td>6.2</td>
<td>24</td>
<td>4.5</td>
</tr>
<tr>
<td>Preparing presentations</td>
<td>380</td>
<td>71.8</td>
<td>60</td>
<td>11.3</td>
<td>15</td>
<td>2.8</td>
</tr>
<tr>
<td>Professional development</td>
<td>376</td>
<td>71.1</td>
<td>69</td>
<td>13</td>
<td>18</td>
<td>3.4</td>
</tr>
<tr>
<td>Research</td>
<td>227</td>
<td>42.9</td>
<td>145</td>
<td>27.4</td>
<td>47</td>
<td>8.9</td>
</tr>
<tr>
<td>Games</td>
<td>225</td>
<td>42.5</td>
<td>44</td>
<td>8.3</td>
<td>14</td>
<td>2.6</td>
</tr>
<tr>
<td>Forum discussion</td>
<td>180</td>
<td>34</td>
<td>75</td>
<td>14.2</td>
<td>35</td>
<td>6.6</td>
</tr>
<tr>
<td>Exercise prescription</td>
<td>121</td>
<td>22.9</td>
<td>150</td>
<td>28.4</td>
<td>33</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Discrepancies in percentage totals are a result of missing data.
reported using ICT tools to seek advice or guidance. This finding is in contrast to the literature, which has identified ICT as offering a means of both improving communication and peer support (Johns, 2003; Rohleder et al, 2007; Mitchell et al, 2001). This highlights the potential to improve this aspect of communication between lecturers and students. This suggests that while South African physiotherapy students are aware of the potential of ICT to improve the support they receive, they do not actually use it. While it was beyond the scope of this study to investigate reasons for this, it may be that students only use the channels of communication that are available to them.

It is a concern that research was highlighted as the area in which more than a third of students were either “Uncertain” or “Not confident”. However, even though 83% of students reported feeling confident using the Internet to perform online searches, they did not make the connection between using the Internet to find information for assignments and using the same techniques to inform their education and practice through research. With a move towards self-directed learning practices in undergraduate education (Oblinger & Oblinger, 2005), students may not have the insight to use the skills they possess to more effectively learn.

The university attended was found to be a significant factor in the frequency and reasons for ICT use, with respondents at two particular universities using ICT resources more often and for a greater number of activities than respondents at other universities. This suggests that the university a student attends will influence both the frequency of ICT use and the activities they use it for. Thus, it seems clear that the role of the university is important both in terms of providing access to technology, as well as in better preparing students for its use. Two particular areas should be highlighted. With the evidence indicating that students’ use of ICT is focused on online search, universities should take measures to ensure that they are able to differentiate between high quality, credible information on the internet, and poor quality articles. The other area in which there is potential for improvement, is in communication, with universities opening up further channels for communication between students and lecturers.

The results of this survey indicate that while South African physiotherapy students are aware of the potential benefits of using ICT as part of their studies, they do not always make the best use of them. The reasons for this discrepancy were not within the scope of this study, but may include the fact that not all institutions or departments facilitate or require students to use ICT resources. With the move towards the provision of physiotherapy community-based health services in rural areas where professional support may be lacking, certain groups of South African physiotherapy students may be disadvantaged when it comes to the use of ICT in these environments. As a result of poor access to ICT prior to attending university, Black South African physiotherapy students in particular may struggle to take advantage of the benefits of ICT as a means of improving communication and accessing support. While Coloured and Indian students also reported reduced access to computers and the Internet prior to attending university, this was not as high as Black students.

CONCLUSION AND RECOMMENDATIONS

The use of ICT has been shown to be a feasible means of improving the professional education and support of physiotherapy students, mainly through improved communication and greater access to information. However, it is recognised that a shift to an ICT-enabled physiotherapy curriculum will bring with it several challenges, not least of which is the issue of racial differentiation in access and equity prior to attending university. The implications of this for South African physiotherapy education is significant, in that more attention must be paid to the needs of certain groups of students and the input they require, especially when using ICT resources. It was also shown that most South African physiotherapy students use ICT as a means of gathering information, rather than to obtain support through improved communication with educators, clinicians and their peers.

It is recommended that physiotherapy departments at universities should develop and implement a comprehensive ICT strategy, focusing on the use of ICT to improve communication between students and lecturers. However, educators must be aware of the differences in ICT experience between some groups of students and adapt their teaching strategies accordingly. They must take cognizance of the fact that not all students have had the same advantages prior to entering university and that their teaching methodology cannot assume an even distribution of ICT experience. Educators should also aim to link the ICT skills that students already possess, to activities related to their education and professional practice. Finally, universities must provide ongoing training for staff and students to make effective use of emerging technologies to enhance teaching and learning practice.

REFERENCES


Eksteen C 2005 The role of e-Learning in Physiotherapy education. Oral presentation at
How to Submit:

1. Complete questionnaire and insert the correct answers in the spaces provided.
2. Ensure that you have included your full details as requested.
3. Only original questionnaires will be considered therefore please cut out and submit to SASP Head Office at: SASP CPD Questionnaire, P.O Box 752378, Gardenview, 2047 by 31 January 2010.
4. In order to capture your CPD points at the HPCSA your submission must be accompanied by a proof of payment to the value of R20.00 (no cash).

Payments can be made by EFT to SASP Head Office

CPD Questions

1. Which is the correct answer?
   a) Supination injuries of the ankle ligaments are extremely rare injuries.
   b) Supination injuries of the ankle are the most frequent injuries in sports
   c) A ligament rupture occurs in over 60%
   d) A ligament rupture occurs in over 90%

2. Which of the following statements are true?
   a) Sprains of the ankle will be classified into three grades
   b) All injury grades of the ankle ligaments should be treated operatively
   c) Grade III injury of the ankle ligaments should be treated nonoperatively
   d) Grade I injuries or grade II injuries of the ankle ligaments should be treated nonoperatively

3. Name 3 problems experienced by obese individuals which physiotherapists can address.

4. Does adequate knowledge of obesity improve attitudes towards obese individuals? Yes / No

5. What are the components of this multimodal physical therapy program?

6. Stroke patients accessing Community Health Centre in the Cape Town Metro District receive physiotherapy, occupational therapy and speech therapy. True/ False

7. The SPO rehabilitation framework is also known as the structure process and outcomes framework. True/False

8. The intensity of rehabilitation received by stroke patients in the Western Cape equals that received by stroke patients in the United Kingdom and Europe. True/False

9. Ultrasound imaging for the measurement of resting abdominal muscle thickness in children with typical development is reliable for within-day and between day measures. True/False

10. What is the most common use of ICT among South African physiotherapy students, in terms of their education?

For any queries regarding the submission of questionnaires, email Florrie at membership@saphysio.co.za.