WORKING POSTURES IN QUALIFIED PHYSIOTHERAPISTS.

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DECLARATION

I, Rena Claire Bernstein declare that this research report is my own work (except where acknowledgements indicate otherwise). It is being submitted for the degree of Master of Science in Medicine in the branch of Physiotherapy in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Signature: 

Date: 29/4/1998

DEDICATION

To Eric, Mark, David, Joshua and my family for their unconditional support and love.

ABSTRACT

Low back pain, which is the most common work-related musculoskeletal disorder, has a significant negative impact on the financial economy and physical wellbeing of society. Workers involved in physical work have an increased risk of suffering from low back pain. Physiotherapists are very knowledgeable about back care, many of them suffer from low back pain due to the heavy physical work required in lifting and transferring patients and the static postures adopted in treating patients. Evidence suggests that the majority of physiotherapists suffering from low back pain experience the onset of symptoms within four years of qualifying. Furthermore, different clinical settings expose the physiotherapist to different levels of risk for low back pain. This study examined the working postures of 30 qualified physiotherapists in three different clinical locations. These were OPD (out-patient physiotherapy) (n=10), REHAB (neurological rehabilitation) (n=10) and ICU (intensive care) (n=10). The Ovako Posture Analysing System (OWAS), which is a practical non-interference method for identifying and evaluating poor working postures was used. Statistical analysis using the two way table chi-squared test showed that there was a significant difference between the three groups. The REHAB group spent a significantly greater period of time in more stressful working postures than the other two groups. More than 37% of all the physiotherapists time was spent with their backs bent, twisted or bent and twisted whilst working. These are stressful back postures and are considered ergonomic risk factors for low back pain. There is a need to devise a course based on ergonomic principles which will teach physiotherapists to conduct the various aspects of physiotherapy with the least postural stress possible.

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Key words: OWAS; working posture; ergonomics; action categories;

ABBREVIATIONS

OWAS	Ovako working posture analysis system
OPD	out-patient department
ICU	intensive care unit
REHAB	neurological rehabilitation
WMD	work-related musculoskeletal disorders
FWP	fitting the work to the physiotherapist
FPW	fitting the physiotherapist to the work
MEDUNSA	Medical University of South Africa
AC	action category

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pain are economic loss, lost work time, temporary or permanent disability, decreased economic productivity and changes in the quality of life of the individual (Gunnar and Andersson 1981).

A large number of studies have been undertaken in an attempt to isolate the most important contributory factors of low back pain. Both the frequency of lifting and the movements required to lift items have been shown to trigger the onset of low back pain. Pheasant (1991) concluded that "low back pain is a predominately work-related condition" which is supported by Biering-Sørensen (1983) who found that 52-60% of participants in his study gave work as the primary cause of low back pain.

Research has shown that the onset, frequency, severity and recovery time of back pain in workers is proportional to the level of physical workload (Magora 1972). However workers who rarely or never lift weights also suffer from a greater incidence of low back pain (Magora 1972). Workers who lift weights during the day but not too frequently or infrequently show the lowest incidence of low back pain. The relationship between back pain prevalence and physical workload is bell-shaped: people in very physically demanding jobs are at risk, as are people whose work is fully sedentary; but people whose jobs involve moderate physical demands fall into a low-risk category, particularly if these jobs also have postural diversity (i.e. if the person spends part of the time sitting and part standing) (Pheasant 1994).

Jobs that involve lifting objects heavier than 11.3 kg predispose to a 3 times higher risk for low back pain in those workers. These risks increase even further when there is twisting involved; if the knees are kept straight and the back is bent or if static postures are

maintained for extended periods (Gunnar and Andersson 1981, Grandjean 1988, Pheasant 1991). When physiotherapists transfer or lift adult patients, the patients weigh more than 11.3kg.

Lifting is not always the activity that precipitates the onset of back pain. Frequently the onset of pain is insidious and the patient cannot attribute the pain to any specific cause. Von Wely (1970) showed that the constant stresses and strains of a poor working posture can lead to back problems. The supposed mechanism of injury is one of cumulative trauma or overuse of the tissues concerned (Pheasant 1994).

Prevention of back pain is an important part of the role of the physiotherapist. Ultimately, the physiotherapist wants to learn how to minimise their own exposure to the risks of back pain and to teach their patients to do the same. In order to be able to change the patients working posture in a meaningful way, the physiotherapist must first be in a position to ascertain which working postures are harmful. This requires a method of observing and measuring the postures so that a proper assessment can be made and the pertinent advice given. Furthermore, it would be beneficial to re-asses the patient to see whether there has been an improvement in their working posture.

The OWAS method of analysing posture used in this study has enormous appeal as it provides a quick and thorough method to survey gross posture and quickly identifies when the posture requires correction. This would allow the physiotherapist to firstly demonstrate to the patient exactly when he was adapting poor postural positions and secondly work out with the patient alternative postures for that particular type of work. This type of practical

"hands on" advice has a important role in trying to prevent recurrences of back pain. Patients find it easier to implement very concrete instructions on what posture is good and what is not good posture. Scholey and Hair (1989) maintain that "if the training program is to appear relevant to the learner it should be specific to the job".

Physiotherapists are commonly victims of back pain and yet have had the benefit of being educated on how to look after their backs and the correct way to lift. It seems pertinent to assess how successful physiotherapists are in adopting safe working postures whilst they are treating patients. The OWAS method of assessing postures allows the researcher to give clear feedback to the individual physiotherapists on how to improve their working postures. Thus, even physiotherapists who embark on the study believing that their working posture is good, will be able to review it and note where they have adopted poor working postures.

1.1 AIM

This study aims to assess the working postures of qualified physiotherapists in different clinical locations by using the OWAS method. These postures will be compared to asses the risk of stressful working postures in each clinical setting.

1.2 HYPOTHESIS

The null hypothesis states that there is no difference in the working postures of qualified physiotherapists who are working in three different clinical locations i.e. out-patient physiotherapy (OPD), neurological rehabilitation (REHAB) and the intensive care unit (ICU).

Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

The causes and the management of back pain is extensively covered in the literature. It is a multi-factorial problem (Nachemson 1976, Biering-Sørensen 1982) and frequently more than one factor is isolated in considering the causes of back pain (Scholey and Hair 1989). Many studies in the literature do not define back pain whilst others use varying definitions of back pain. Molumphy et al (1985) defined low back pain (LBP) as "pain below the level of T10 and the lowest rib which lasted three or more days". Bork et al (1996) differentiated between the lower back and the upper back by means of a diagram but did not anatomically define the difference between the two areas. Dwyer (1987) maintains that backache is generally interchangeable with low back pain.

Ergonomics is emerging as an important area of knowledge for physiotherapists. This discipline has great value in helping them advise patients and prevent problems. Acquiring further knowledge on ergonomics and incorporating ergonomic strategies into their patient management would improve the physiotherapists' service to their patients and render a more holistic treatment.

Michael Foster (1988) defines ergonomics as "the design of products, processes and systems to meet the requirements and capacities of those people who use them".

Ergonomics involves both science and technology. The scientific element involves the study of human behaviour and the factors which affect human activity. The technological element includes applying research findings to specific situations of man to man, man to machine and man to environmental interfaces (Foster1988). The ergonomist is interested in the physical work environment and the stresses, both physical and psychological, imposed on the worker as he operates within that environment. Ergonomics urges "fitting the work to the person/physiotherapist" FWP rather than "fitting the person/physiotherapist to the work" FPW and encourages the ergonomist to take a "comprehensive global look at all the factors which may have an influence" on the problem (Girling B, Birnbaum R. 1988)

2.2 BACK PAIN IN PHYSIOTHERAPISTS

In writing about musculoskeletal injuries at work, Pheasant (1994) lists some of the ergonomic risk factors for back pain . Heavy work involving lifting, pushing pulling, sudden maximal force exertion, bending and twisting as well as working in a stooped working posture are some of the factors. Physiotherapists encounter many of these risks associated with back pain in carrying out their work. However most of the studies investigating health care personnel and low back pain have looked at the incidence of low back pain in nurses (Videman et al 1984, Linton et al 1989, Garg et al 1992). Results indicate that nurses who are involved in lifting of patients are prone to low back pain in their earlier working years (Magora 1970). The majority of nurses with low back pain experience the onset of symptoms within the first four years of service (Molumphy et al 1985), thus the knowledge of proper lifting techniques may play an important role in the prevention of low back pain.

Stubbs and Buckle (1984) identified occupational risk factors which are associated with back pain. Some of these are frequent lifting, heavy lifting and prolonged standing. Scholey and Hair (1989) view physiotherapy as a stressful occupation in terms of these factors. Physiotherapists are exposed to an increased risk of low back pain as they often need to lift and transfer patients which involves bending and twisting motions. This risk is enhanced when the physiotherapist performs these activities alone when assistance is unavailable or when the patient makes a sudden and unexpected movement such as falling. Additionally, physiotherapists often need to sustain static postures whilst treating patients. The maintenance of a static posture has been identified as an occupational risk factor for back pain (Grandjean 1988).

In a study by Molumphy et al (1985), the authors investigated work-related low back pain in Californian physiotherapists. Twenty nine percent (n=97) of the physiotherapists who responded (n= 337) reported work-related low back pain. The majority of these had their onset in the first four years after graduating and were between the age of 21-30 years old. Scholey and Hair (1989) also found that the first episode of back pain amongst physiotherapists occurred in the age group 21-30 years which was a younger onset than in the general population.

Eighty three percent of the 97 physiotherapists who reported work-related low back pain, were treating or handling patients when they first experienced low back pain (Molumphy et al 1985). As a result of this injury, 18% of the physiotherapists changed the type of work they did and 12% reduced the number of hours spent in clinical work. Molumphy et al (1985) concluded that inexperienced physiotherapists were more vulnerable to work-related low back pain.

The study by Molumphy et al (1985) also demonstrated that as physiotherapists gained experience, so the onset of work-related low back pain decreased. The study by Bork et al (1996) concurred with these findings of decreasing WMD with increasing age. Thirty four percent of physiotherapists who were older than 50 years complained of WMD compared with 42%-52% of physiotherapists in the 25-50 year age category. Bork et al (1996) reported that they initially thought this was due to a decrease in the amount of time spent in patient care. However, their research findings did not bear this out and they advise that they now believe that these results may be related to a survivor bias. "As physiotherapists become older, the survivors are those who develop strategies for coping with the physical demands of the job and who continue to treat patients". The strategies may include modifying treatment techniques, using less strenuous techniques and therapies and getting assistance from other physiotherapists and physiotherapy assistants for the more arduous work. Physiotherapists who do not develop survival strategies may retire early, move into administration or academia or work with musculoskeletal pain (Bork et al 1996).

Furthermore, the research by Molumphy et al (1985) showed that physiotherapists in acute care facilities and rehabilitation units had a higher incidence of work-related low back pain. Scholey and Hair (1989) showed that all types of physiotherapy work had an incidence and prevalence of low back pain. However, the first incidence of low back pain occurred more frequently when physiotherapists were working in rehabilitation services than elsewhere. In a survey of 1,160 physiotherapists, Bork et al (1996) found that 45% of the respondents complained of low back problems and 28.7% of upper back problems as a WMD. Both studies agree that work-related back pain is the most frequent injury for physiotherapists.

2.3 STATIC MUSCLE WORK AND THE MECHANICS OF LIFTING

There are two types of muscular work: static and dynamic. In a dynamic contraction, the muscle contracts and relaxes rhythmically and allows the blood supply to pass through it. Static contraction is characterised by a prolonged state of muscle contraction. The muscle is unable to extend thereby remaining in a state of tension over a period of time. Because the muscles are contracted the raised extracellular hydrostatic pressure impedes blood flow through the muscle. Therefore, the onset of muscle fatigue will be much sooner and the intensity of the muscle fatigue greater in static muscle work (Grandjean 1988).

In human movement, a task can be partly static and partly dynamic and as the static component of a mixed effort is so much more arduous it thus becomes more important. Static effort can be said to be considerable if

a) a high level of effort is maintained for 10 seconds or more.

b) a moderate effort is maintained for 1 minute or more.

c) a slight effort (about one third of maximum force) is maintained for 4 minutes or more (Grandjean 1988).

There is a static component to many of the postures that physiotherapists adopt in the course of their working day. Some of the common examples are

a) bending the back forwards or sideways

b) holding patients or equipment in their arms

c) standing in one place for extended periods of time.

d) pushing and pulling heavy patients and equipment.

Physiotherapists who work in out-patient departments often spend minutes standing in one place whilst they perform mobilisations to the neck. "Prolonged standing in one place causes fatigue of the muscles which are under static load and discomfort due to insufficient return flow of the venous blood (Grandjean 1988). Bork et al (1996) found that 12% of physiotherapists who responded to his survey indicated that manual therapy was the job factor most likely to contribute to a musculoskeletal problem. The physiotherapist frequently stands for a prolonged period of time whilst using this therapy.

2.4 OVERUSE INJURIES

Static muscle effort leads to a fatigue within the muscles which if continued regularly for an extended period of time places a load on the tendons, ligaments and joints resulting in overuse injuries. A new syndrome called Cumulative Trauma Disorders (CTD) is emerging. This includes conditions such as Repetitive Strain Injuries (RSI), Repetitive Motion Injury (RMI) and Repetitive Stress Injuries (Online Animated Ergonomic Exercises 1998). The pathology underlying these conditions is repetitive overuse of the muscles and tendons without sufficient time for healing and repair. This leads to microscopic tears which cause swelling and pain. Prolonged typing on a computer is cited as a cause of this condition and programs are now available on the internet which interrupt work at timed intervals to ensure that computer users take breaks frequently enough.

According to Grandjean (1988), overuse injuries can be divided into two groups:

Group 1 - the pain is found mainly in the muscles and tendons and improves when the work is stopped.

Group 2 - the joints are also affected and the pain does not disappear when the work stops.

The pain is often associated with a particular movement or posture and can be attributed to inflammatory and degenerative changes in the overloaded tissues (Grandjean 1988).

There is a repetitive nature to the work of the physiotherapist and stresses may be encountered many times during the course of the working day. Physiotherapists who spent a large part of their time using manual therapy to treat patients were 3.5 times more likely to have musculoskeletal symptoms in their elbows and wrists than other physiotherapists (Bork et al 1996). Physiotherapists who spent a large amount of time performing neurological examinations had a higher incidence of pain in the upper and lower back and knees than physiotherapists who were not involved in neurological rehabilitation treatments and were working in other areas of physiotherapy (Bork et al 1996).

2.5 LIFTING AS A MECHANISM OF WORK-RELATED MUSCULOSKELETAL DISORDERS

"Lifting or transferring a dependant patient" was cited as one of the job factors most likely to contribute to WMD (Bork et al 1996). Lifting heavy equipment and catching a patient during a fall were other factors mentioned and 58% of physiotherapists in the Bork et al (1996) study indicated these factors as the greatest risk for injury. Molumphy et al (1985) discovered that a significant number of the physiotherapists described "lifting with maximal effort" or "bending and twisting" as their mechanism of injury. Scholey and Hair (1989) examined the incidence of low back pain amongst physiotherapists involved in back care education and compared it to a control group that was matched for age and sex. A significantly higher number of physiotherapists with low back pain attributed their back pain to work ($p < 0.01$) and to a specific incident at work ($p < 0.01$) when compared to the control

group. Lifting, bending and twisting were quoted as being precipitating factors in the physiotherapists experiencing low back pain. Hignett (1994a) stated that a physiotherapist uses a hoist far less frequently than a health care worker to lift a patient as the physiotherapists usually wishes to use the transfer as a method to treat the patient and not only to transfer the patient.

Lifting and handling loads involve a lot of static effort. One of the problems involved in handling of loads is the wear and tear on the intervertebral discs and the increased risk of back problems. Back problems are one of the leading causes for missed work and is one of the reasons why physiotherapists leave one type of work and take up a less physically challenging type of physiotherapy (Molumphy et al 1985, Bork et al 1996).

The vertebral column is in a S shape which gives the spine elasticity to absorb shocks. The loading of the spine is from above downwards and is at its greatest in the lowest five vertebrae of the spine. The vertebrae are separated by an intervertebral disc between each two vertebrae. The disc degenerates with wear and tear resulting in it flattening. This alters the mechanics of the spine so that lifting even a low weight may result in a episode of low back pain (Grandjean 1988).

Nachemson (1976) studied how the pressure on the L3/L4 intervertebral disc changed under differing circumstances. When a man lifted a 20kg weight with a straight back and bent knees the pressure increased by 220% whilst when the same weight was lifted with a bent back the pressure in the intervertebral disc increased by 400%. Lifting a load with a bent back causes a sudden and steep increase in the internal pressure of the disc and may cause overloading of the outer fibrous ring of the disc.

One of the vital functions of the trunk muscular system is to provide support and control of the joints during movement (Jull et al 1993) and it provides major support to the loaded spine during normal function (Panjabi et al 1989). If the trunk musculature is weak, this can lead to lack of support of the spine (Jull et al 1993). The prime stabilising muscles of the spine are the proximal trunk muscles and the abdominal muscle with this prime stabilising role is considered to be the transversus abdominis (Richardson and Jull 1995). Richardson and Jull (1995) state that the transversus abdominis contracts for all movements of the trunk and limbs before the other abdominal muscles and its activity pattern is different to that of the other abdominal muscles. In a study conducted by Hodges and Richardson (1995b), they found that in patients with low back pain, the contraction of transversus abdominis was delayed and this would affect the stabilisation of the lumbar spine. This loss of active stabilisation due to a delay in the contraction of transversus abdominis may be one of the possible processes involved in the development of back pain (Jull et al 1993).

2.6 PATIENT HANDLING AND TREATMENT HANDLING

Hignett (1994a) maintains that there is a difference in the way a patient is handled by a physiotherapist and a healthworker. When the healthworker transfers a patient from a bed to a chair, all the rules on the safe handling of the patient can be followed. When a physiotherapist transfers a patient from a bed to a chair, this is often part of the rehabilitation treatment procedure and the physiotherapist may have to compromise her posture in order to effectively treat the patient. The physiotherapist and the patient should operate in the "balance zone". In this situation, there is an equilibrium between the physiotherapist and the patient and the amount of support that the patient needs does not produce any strain on the

physiotherapist. The patient would be safer if the physiotherapist took more weight but that would push the physiotherapist into the danger zone and vice versa.

These aforementioned considerations are what makes treatment handling so different from other hospital care handling. The patient needs to be allowed to attempt various tasks and this often necessitates a reduction in the amount of support that the physiotherapist gives the patient so that the patient may attempt the task. There is a potential risk to the physiotherapist as if the patient suddenly loses control, the physiotherapist must provide more support rapidly. The physiotherapist moves out of the balance zone and into the danger zone as she provides the extra support for the patient. Bork et al (1996) found that 10% of the physiotherapists in his study indicated that helping patients during gait activities was the highest risk for a WMD. Although the physiotherapist strives to treat the patient in the controlled balance zone, this is not always possible. It is not surprising that back ache is featured as the most common complaint by practising physiotherapists (Molumphy et al 1985, Bork et al 1996).

2.7 ERGONOMICS AND THE PHYSIOTHERAPIST

In 1970, van Wely reported on a study that linked the design of the workplace to diseases of the musculoskeletal system. In terms of ergonomics, comfort, efficiency and health form the three points of a triangle. There is an assumption that if the workplace design is efficient and comfortable then it will also be healthy for the workers but this is not always so. Foster (1988) states that ergonomics is more prophylactic and is at the opposite end of the care spectrum to that occupied by traditional physiotherapy. Physiotherapists often see patients who incur injuries as a result of poorly designed equipment only once the injury has

occurred. Ergonomics tends to try and improve the design of the equipment. Foster (1988) maintains that physiotherapists should become more knowledgeable in the science of ergonomics and use this knowledge to advise their patients and the management hierarchy on how to avoid recurrences or occurrences of WMD.

Von Wely showed a link in his study (1970) between bad working postures and musculoskeletal symptoms that appeared after a period of time. The length of time it took for the symptoms to appear was dependent on the "anatomical and pathological condition of the joints, muscles and tendons which were being strained by the posture" amongst other factors.

The physiotherapist often has to adopt a poor working posture in order to treat the patient and is unable to alter the environment to reduce postural strain on themselves. An example of this type of working situation is a plinth with no height adjustment. The physiotherapist may then find that the work surface is either too high or too low. One of the fundamental concepts of ergonomics is that the work should be fitted to the person (Grandjean 1988). Sue Hignett (1995) undertook a study where she looked at how possible it was for the therapist to modify her work situation and still provide an effective treatment programme. The Ovako Working Posture Analysis System - OWAS - a method of recording working postures was used. The aim was to determine how much of the of the work phase of the physiotherapist was in the FWP (fitting the work to the physiotherapist) category and how much of the work phase was in the category of FPW (fitting the physiotherapist to the work). In OWAS, work postures in action category 1 are safe and require no adjustment and action categories 2,3 and 4 require increasingly more adjustments. The study showed that there were significantly more

harmful postures observed in the FPW (fitting the physiotherapist to the work category) than in the FWP (fitting the work to the physiotherapist) category. Hignett (1995) concluded that it was not always possible to match the physiotherapist and the patient in regard of shape and size to obtain an "optimal anthropometric match for treatment handling". Thus physiotherapists need to be more selective about the types of techniques used in their treatment and that there is sufficient staff to assist them. Physiotherapy is a predominately female occupation and it must be noted that physiotherapists are vulnerable in this regard (Hignett 1995).

2.8 INCIDENCE OF WORK-RELATED INJURIES IN PHYSIOTHERAPISTS

Bork et al (1996) surveyed a group of 1,160 physiotherapists who had attended the University of Iowa between 1943 and 1993. A four page questionnaire was sent, which consisted of a "symptom survey, a job-factor survey and demographic information." There was an 80% response rate and 928 questionnaires were returned. The highest prevalence of WMD amongst physical therapists were found in the following areas: low back 45%, wrist hand 29.6%, upper back 28.7%, and neck 24.7%. In regard to the physiotherapists who experienced low back pain, 2.8% missed work during the 12 month period surveyed, due to this problem. Respondents over the age of 50 years had the lowest incidence of WMD for all the different areas described. This is in keeping with the literature which shows that as physiotherapists become more experienced, they hurt themselves less in their work situation (Molumphy et al 1985).

When the results were analysed by gender, female physiotherapists had a higher incidence of symptoms in every anatomical region except for the knees. There was a greater prevalence ($p < 0.05$) of WMD in the neck, upper back, low back, wrists and hands in female physiotherapists than in male physiotherapists. Seventy three percent of female physiotherapists reported at least one musculo-skeletal problem as compared with 57% of male physiotherapists (Bork et al 1996).

Twenty five percent of the physiotherapists who replied to the questionnaire indicated that they had to change the way in which they applied treatment techniques to patients. Some of the therapists also indicated that they had to move to a different clinical location so that they could alter the type of work they did following a WMD (Molumphy et al 1985). The most frequently cited changes were altering the frequency or technique of manual therapy, avoiding stressful positions and improving body mechanics. Other changes that physiotherapists adopted to overcome the effects of the WMD were treating fewer patients, allowing an increased rest time between patients, avoiding sequential booking of patients requiring manual therapy and altering the manual therapy techniques used to reduce the amount of stress on the wrist and fingers (Bork et al 1996).

2.9 THE ROLE OF BACK CARE KNOWLEDGE AND TRAINING IN THE PREVENTION OF BACK INJURIES

Physiotherapists are considered to be very knowledgable in the care of the spine, the biomechanics of the spine and the correct way to lift and transfer a patient. They generally represent themselves as experts in the field of back care and the prevention of low back pain, yet many of them are plagued by this problem themselves (Hellsing et al 1991).

Scholey and Hair (1989) examined the incidence of low back pain in physiotherapists and compared it to a control group from the general population that was matched for age and sex. There was no statistically significant differences in the prevalence of back pain between the two groups in respect of

		Physio-therapists	Control
a)	if they had ever had back pain?	57%	54%
b)	if they had had back pain in the last year?	38%	35%
c)	if they had back pain for the first time in the last year?	14%	13%
d)	were they currently experiencing back pain?	9%	5%

Even though the physiotherapists took precautionary steps to avoid a recurrence of back pain eg back care exercises and lifting and transferring patients as correctly as possible, the study found that the recurrence rate was similar between the two groups. Thus, the physiotherapists specialized knowledge in caring for the back was shown to be insufficient in preventing back pain and its recurrence.

Ellis (1993) surveyed final year physiotherapy students at 12 physiotherapy schools in the United Kingdom to investigate their views on the effectiveness of their training in lifting and handling of patients. Her report indicated that whilst many students felt that the topic had been adequately covered theoretically, they had not had enough time to practise the techniques under supervision. Furthermore, they had not been able to internalise the techniques and thus use them without having to concentrate on every aspect of the

manoeuvres. "The physiotherapy profession is sometimes critical of the patient handling tuition received by other health care professionals. However, 27% of the sample in this study suffered low back pain as a direct result of handling patients" (Ellis 1993).

Scholey and Hair (1989) concluded that an ergonomic analysis of working postures would assist in trying to explain why a thorough knowledge of back care did not protect physiotherapists from low back pain problems. If the training program and the knowledge on how to look after one's back were not sufficient to protect physiotherapists from back problems then one is tempted to assume that there are other factors involved in the problem of low back pain. An ergonomically based analysis of a physiotherapists working posture may give us further information on some of these other factors.

2.10 POSTURAL ANALYSIS METHODS

A number of methods have been described in the literature to assess posture. "Posture is recognised as an important aspect of work loading" (Corlett et al 1979). The technique used should be simple, reliable and easy to learn. It should also record the different postures in sequence and the time spent in each posture. Corlett et al (1979) described various methods of recording posture in their article. Choreography has used methods such as Labanotation by Hutchinson (1954) and the Benesh notation (1956) to record ballet dancing movements. The disadvantage of these techniques is that they require a long learning period before the recorder is reasonably adept at using the system. Corlett at al 1979 also discuss a method proposed by Priel (1974) of recording postures that numerically defined a posture. He recorded a posture by noting the angle adopted by each limb and the position it assumed in

relation to a reference level. The drawback of this method was that it required copious numbers of entries as well as a sketch to describe a single posture. Madeley (1974) used the Labanotation method which led him to propose another system. On a diagram of the body, each part of the body was represented as a series of concentric circles. When the relevant body part departs from the standard position in the vertical plane then this is noted down on or between the concentric circles, otherwise no mark is made (Corlett et al 1979).

The Ovako Posture Analysing System (OWAS) was developed by Karhu et al (1977) and is used at the Ovako Steelworks in Finland. It has led to improvements in the working conditions as a result of modifying the working postures in a number of different types of workers e.g. bricklayers. It is a practical non-interference method for identifying and evaluating poor working postures and deals only with the load on the musculoskeletal system caused by poor working postures. The OWAS method has been successfully used in the hospital environment (Ljüngberg et al 1989, Jackson and Liles 1994, Hignett 1994a).

OWAS has great appeal because it presents a system in which observations about working postures can be rapidly made and the results classified into action categories. The action categories indicates whether a posture is safe or requires adjustment and can then form the basis for a decision on whether intervention is needed and what type of intervention is needed. Furthermore, one can then observe the working posture at a later stage to see if the intervention has been successful (Karhu et al 1981).

Jackson and Liles (1994) studied working postures of physiotherapy students using the Ovako Working Posture Analysing System (OWAS) method (Karhu et al 1977, Kivi and Mattila

1991). They compared the working postures of second and third year physiotherapy students and concluded that there was no significant difference in the postures adopted by the two groups of students. They also found that certain clinical departments showed a greater number of hazardous working postures.

SUMMARY

The literature indicates that the aetiology, prevention and treatment of back pain is multifactorial. Physiotherapy is considered a "stressful occupation" as many of the occupational factors associated with back pain are present in this occupation. In the different studies reviewed, many of the physiotherapists complained of having had or were currently experiencing back pain. The large component of static muscle work inherent in certain treatment situations can lead to overuse injuries. When the physiotherapist is unable to use safe manual handling techniques, the risk of back pain increases. Work situations where the physiotherapist has to adapt to the work environment rather than adapting the work environment to the physiotherapists requirements increases the incidence of poor working postures.

The effectiveness of back care training is questioned as it has not been shown to be effective in the prevention and recurrence of back problems amongst physiotherapists. An evaluation and analysis of the postural stresses in practising physiotherapy will give physiotherapists a greater insight into the ergonomic requirements of the profession. More pertinent manual handling training courses could then be developed, in order to prepare students more effectively for the demands of their profession.

Chapter 3

MATERIALS AND METHODS

3.1 INTRODUCTION

The physical stresses that the physiotherapists encounter during the course of their working day can be onerous and the literature indicates that more than 25% of working physiotherapists have experienced or are currently experiencing back pain. Bork et al (1996) showed that physiotherapists also commonly suffered WMD in the neck, wrists, hands and knees. This study observes the physiotherapist for a portion of their working day in order to ergonomically analyse how much of the working period the physiotherapist spend in dangerous or stressful working postures.

3.2 THE POPULATION

The working postures of 30 qualified physiotherapists were observed. The physiotherapists were working in out-patients departments (OPD) (n=10), neurological rehabilitation departments REHAB (n=10) and intensive care units ICU (n=10) at the Johannesburg Hospital, Edenvale Hospital, Natalspruit Hospital, Milpark Private Hospital and the Barney Hurwitz Rehabilitation Centre as well as private physiotherapy practices in Johannesburg. The OWAS system for coding the postures was used to record the observations. Both male (n=2) and female (n=28) physiotherapists were observed. Out-

patients (OPD), rehabilitation (REHAB) and intensive care unit (ICU) were chosen as the three clinical locations to observe physiotherapists working postures as they offered very different types of working conditions for physiotherapists. Information taken from the participants included their age, the year that they qualified and the number of years that they have been working as qualified physiotherapists.

3.3 THE CLINICAL LOCATIONS

3.3.1 OUT PATIENT CLINICAL SETTING

Where:

Private practises in the southern and north-eastern parts of Johannesburg.

The work area:

The physiotherapists treated patients on treatment couches in private cubicles. Some of the treatment plinths had a height adjustment facility whilst many of the plinths did not. Two of the physiotherapists stood on a small stool whilst treating the patients to help them adjust the height of the plinths to their needs.

Type of physiotherapy performed:

Manual therapy to the neck and back area was the main type of physiotherapy carried out by the physiotherapist in this clinical setting. When a physiotherapist performs the treatment technique of manual therapy, the patient lies on the treatment couch and the physiotherapist stands over the patient. The physiotherapist uses her hands to palpate and mobilise the joints

and her body weight to assist her in this technique. The physiotherapist often stands in one position for an extended period of time whilst using this technique in treating the patient. The treatment in the out patient clinical setting consisted of manual therapy to the neck and back area, massage and ultra sound. Occasionally, a physiotherapist demonstrated exercises to the patient for a home program.

3.3.2. REHABILITATION CLINICAL SETTING

Where:

Johannesburg Hospital, Edenvale Hospital, Natalspruit Hospital and the Barney Hurwitz Rehabilitation Centre.

The work area:

All the patients were treated on raised mats in a gymnasium setting. The patients were brought to the gymnasium in wheelchairs and the physiotherapist transferred the patient to the mat. The patient assisted where possible, otherwise, the physiotherapist managed on her own. The treatment was given with the patient in lying, in sitting, in standing and in walking.

Type of physiotherapy performed:

All the patients who were observed being treated in this category suffered from neurological conditions such as paraplegia, hemiplegia or head injuries and so the treatments observed were neurological rehabilitation treatments. The physiotherapists spent a large amount of the treatment time on their knees crouching next to the patient or sitting alongside the patient.

There were no assistants present and all the manual handling of the patient was undertaken by the physiotherapists themselves. The treatment consisted of stretching different parts of the patients body both actively and passively; positioning the patient in different postures e.g. four foot kneeling and an active exercise program. The physiotherapist also moved the patients into sitting, standing and finally walked the patients either between parallel bars, with a walker or with the physiotherapist assisting the patient.

3.3.3 INTENSIVE CARE CLINICAL SETTING

Where:

Johannesburg Hospital and Milpark Hospital.

The work area:

All the observations took place in the intensive care units of various hospitals. The patients were in hospital beds that could be adjusted for height and the top and the bottom sections of the beds could be raised and lowered independently. All the patients were in private wards and there was always a qualified sister present to assist the physiotherapist during the treatment session.

Type of physiotherapy performed:

The treatment to the patient consisted of auscultation, postural drainage, percussion and vibration of the chest and finally suctioning. The patient was sometimes turned onto their side during the treatment. The physiotherapist was always assisted by a qualified nursing sister in performing this routine. The sister also assisted the physiotherapist in transferring the patient into a chair when this was applicable and on one occasion in walking the patient.

3.4 INCLUSION CRITERIA

All participants in the study had to be qualified physiotherapists. Furthermore, they had to be working in the clinical setting that the researcher wished to observe. All the participants had to have worked in these clinical locations for longer than a month. This would ensure that they were accustomed to the clinical location.

3.5 EXCLUSION CRITERIA

There were no exclusion criteria. Physiotherapists were not excluded if they had a prior history of back problems but it was recorded. Two physiotherapists had undergone back surgery prior to the study. Pregnancy was not an exclusion criteria, but was included in the participant profile. None of the physiotherapists observed for the study were pregnant at the time of the study.

3.6 THE PROCEDURE

This research was approved by the Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand, Johannesburg. (Appendix A) The protocol number of the clearance certificate issued by the Committee for Research on Human Subjects is M950920.

The researcher approached the qualified physiotherapists working in the ICU, OPD and REHAB departments of the different hospitals mentioned previously and asked them for permission to observe them. Each participant was given an information sheet explaining the study and had to sign a consent form prior to participating in the study (Appendix B). The physiotherapists were told that they were being observed whilst they were working but were not told the exact type of data being collected.

A direct observational study was undertaken to describe the various types of postures assumed and the frequency with which these working postures were adopted by the physiotherapist during the course of their work. The length of time the physiotherapist spent in each particular posture was also recorded.

Each participating physiotherapist was observed by the researcher for fifty minutes whilst they were treating patients. The OWAS scoring method was used to document the postural changes observed for each physiotherapist. The observations were recorded every 30 seconds. A total of 100 observations for each physiotherapist were recorded. If the physiotherapist stopped for a break, the observations ceased until the physiotherapist recommenced treating patients again. The observations were recorded on a specially constructed observation recording sheet (Appendix C).

The physiotherapists were observed at different times of day. The sequence in which the observations were done was dictated by when the participants had sufficient patients and when the researcher was available. Some physiotherapists worked only in the morning or the afternoon and some worked in different clinical locations in the morning and the afternoon. Thus, the observations were done at all hours of the day and in no specific order.

3.7 THE OWAS METHOD.

The OWAS method is based on sampling the work postures of the workers by classifying the work postures of the back, arms and legs and also the load into a four digit code as explained in Table 1. Each four digit code is recorded in the same sequence i.e. the first number reflects the position of the back, the second the position of the arms, the third the position of the legs and the fourth the load (Table 1). Each number reflects the posture of the spine, the particular limb or the load at the time of observation. The load describes how much weight the physiotherapist is carrying or how much support the physiotherapist is giving at the moment of observation. If the physiotherapist is not carrying anything, then this is shown according to the classification of Table 1, as a load of 1. If the physiotherapist is transferring a dependant patient, then this is shown as a load of 3. Sampling can be conducted at a variable or constant interval (Genaidy et al 1994), thus indicating the type of posture, the frequency of the posture and the time spent in a particular type of posture. The number of four digit codes recorded for each subject is dependant on the total observation time and the number of observations within that time.

TABLE 1: CODING OF OWAS POSTURES (Jackson and Liles 1994)

CODE	BACK	ARMS	LEGS	LOAD
1	Straight	Both below shoulder level	Sitting	0 - 10 kg
2	Bent forward	One at or above shoulder level	Standing with both legs straight	10 - 20 kg
3	Twisted	Both at or above shoulder level	Standing with one leg straight	>20kg
4	Bent and twisted	_____	Standing with both legs bent	_____
5	_____	_____	Standing with one leg bent	_____
6	_____	_____	Kneeling on one or both knees	_____
7	_____	_____	Walking	_____

BACK	ARMS	LEGS	LOAD
3	2	6	1

TABLE 2: THE OWAS ACTION CATEGORIES (Jackson and Liles 1994)

Back	Arms	1 123	2 123	3 123	4 123	5 123	6 123	7 123	Legs Load
1	1	111	111	111	222	222	111	111	
	2	111	111	111	222	222	111	111	
	3	111	111	111	223	223	111	112	
2	1	223	223	223	333	333	222	233	
	2	223	223	233	344	344	334	234	
	3	334	223	333	344	444	444	234	
3	1	111	111	112	333	444	111	111	
	2	223	111	112	444	444	333	111	
	3	223	111	233	444	444	444	111	
4	1	233	223	223	444	444	444	234	
	2	334	234	334	444	444	444	234	
	3	444	234	334	444	444	444	234	

An OWAS action category is calculated for each of the four digit codes according to Table 2. (The action category denotes the risk of the posture as discussed in Table 1). Each number in the four digit code is used to determine the co-ordinate of the action category. For example, if a posture is given a code of 3261 then according to table 1, the therapists' back is twisted, one arm is at or above shoulder level, she is kneeling on one or both knees and carrying a load of 0-10kgs. According to Table 2, this code results in an action category rating of 3. The action category is calculated as follows:

BACK	ARMS	LEGS	LOAD
3	2	6	1

The first digit 3 refers to the posture of the back. The next digit 2 relates to the position of the arms. From the 3 in the back column find the 2 in the arms column that follows from the 3 in the back column. Draw a horizontal line through this row of numbers. The next digit 6 relates to the posture of the legs. This column is located as the top horizontal line of the table. The last digit 1 refers to the load and is located in the next horizontal line down below the legs line in the table. From the 6 in the legs column, find the 1 in the load line that relates to the 6. Draw a vertical line down the 1 column until it intersects the horizontal line from the back and the arms. This number is the action category for the above posture and in this case is 3. The arrows on Table 2 indicate the sequence followed to look up the action category.

The four action categories are described as follows (Jackson and Liles 1994):

ACTION CATEGORY		DEFINITION
1.	ONE	The work posture or work posture combinations are normal and natural. The postural load on the skeletal system is acceptable and there is no need for corrective measures.
2.	TWO	The work posture or work posture combinations may have some harmful effect on the musculoskeletal system. The amount of postural load is almost acceptable. No immediate corrective measures are needed but they may be needed in the foreseeable future.
3.	THREE	The work posture or work posture combinations have a harmful effect on the musculoskeletal system. The amount of postural load is high and corrective measures must be made as soon as possible.
4.	FOUR	The work posture or work posture combinations have a very harmful effect on the musculoskeletal system. The postural load is very high and corrective measures must be made immediately.

In a report by V Louhevaara and T Suurnäkki (1991), they discuss a pilot study conducted by Kivi et al (1988) to establish the validity of the OWAS action categories by measuring the physiological responses and the maximal holding times of four OWAS posture combinations using six male subjects. Two of the postures were from the action category 4 and two of the postures were from the action category 3. The maximum time that an action category 4 posture could be held varied from 255 seconds to 570 seconds and for an action category 3 posture varied from 255 to 630 seconds. Whilst the subjects were holding the different positions the measured circulatory and local muscle responses were moderate and in each case the subject stopped holding the posture due to intolerable local pain.

The OWAS method also allows the researcher to calculate action categories for the back, the arms, the legs and the load individually. These are referred to as single postures. In a single posture, the researcher only considers the various positions of the back, or the arms, or the legs or how much load is being carried. The single postures were calculated by looking at the frequency of each posture in regard to the back, the arms and the legs. It was possible to calculate how much of the treatment time observed, the physiotherapist had spent in the back straight position, the back bent position, the back twisted position and the back bent and twisted position.

The calculation of the OWAS action categories for single postures is dependant on the actual posture observed and the relative proportion of the working hour spent in that posture. According to Table 3, if a physiotherapist spends 20% of the working time observed in a bent back posture, that posture is awarded an action category 1 status. If, however, the physiotherapist spends 38% of the working hour in the same bent back posture, then that posture is awarded an action category 2 status.

TABLE 3: THE OWAS ACTION CATEGORIES FOR SINGLE POSTURES

(Louhevaara V. and Suurnäkki T. 1991).

OWAS	Postures	% of the working hours									
		0	20	40	60	80	100				
BACK	1 straight	1	1	1	1	1	1	1	1	1	1
	2 bent forward	1	1	1/2	2	2	2	2	2/3	3	3
	3 twisted	1	1/2	2	2	2/3	3	3	3	3	3
	4 bent & twisted	1/2	2	2/3	3	3	3	3/4	4	4	4
ARMS	1 both arms below shoulder level	1	1	1	1	1	1	1	1	1	1
	2 one arm at or above the shoulder level	1	1	1/2	2	2	2	2	2/3	3	3
	3 both arms at or above the shoulder level	1	1/2	2	2	2	2	2/3	3	3	3
LEGS	1 sitting	1	1	1	1	1	1	1	1	1/2	2
	2 standing with both legs straight	1	1	1	1	1	1	1	1/2	2	2
	3 standing with one leg straight	1	1	1/2	2	2	2	2	2/3	3	3
	4 standing with both legs bent	1/2	2	2/3	3	3	3	3/4	4	4	4
	5 standing with one leg bent	1/2	2	2/3	3	3	3	3/4	4	4	4
	6 kneeling on one or both knees	1	1/2	2	2	2/3	3	3	3	3	3
	7 walking	1	1	1	1	1	1	1	1/2	2	2
		0	20	40	60	80	100				

3.8 STATISTICAL ANALYSIS

To test for the overall association between the groups and the OWAS action categories a chi-squared test for two way tables was applied. This particular test was used as the data had been categorised and it was frequency data.

Each action category was then regarded separately and a chi-squared test for two by two tables was used to identify differences between the different groups.

Each aspect of the posture ie. the back, arms, legs and load were then regarded separately and a chi-squared test for two by two tables was used to identify differences between the different groups.

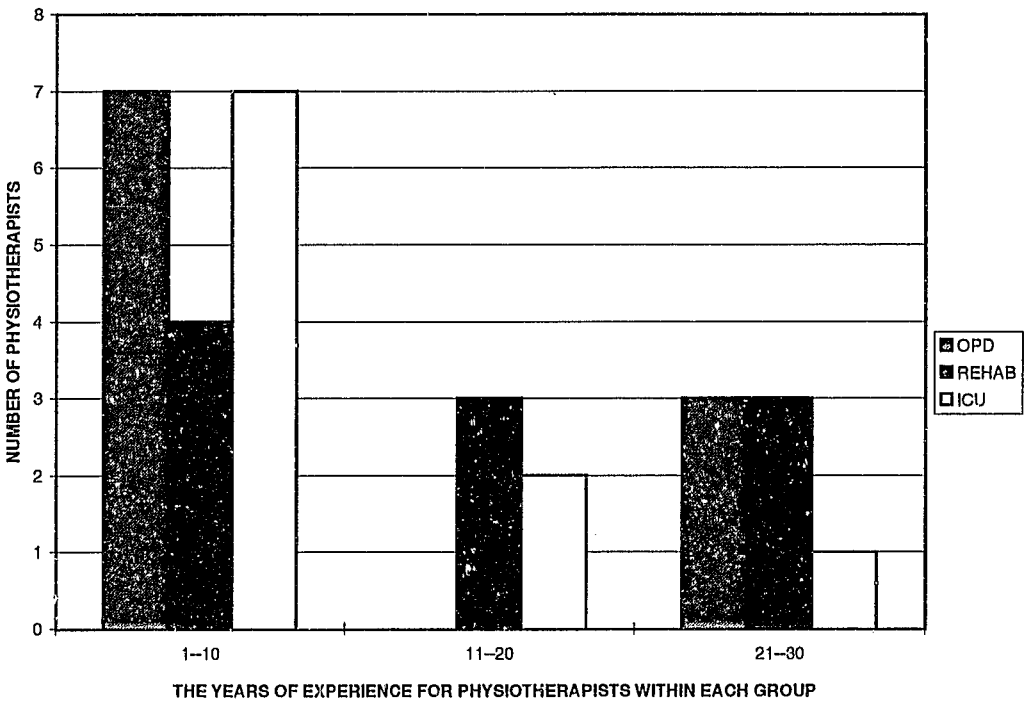
The action category 4 postures that occurred in all three groups were identified and their frequency calculated.

Transfers were noted when they occurred during the observation period and these were accorded an action category. The frequency of transfers for each action category was calculated for each of the groups.

3.9 CONCLUSION

The method of selecting participants for this study was discussed. The various locations used for observing the working postures of physiotherapists were listed as well as a description of the type of physiotherapy work each group was doing. The OWAS method was introduced and explained. The method for establishing the action categories for the whole working posture as well as the action categories for single postures was described. Finally, there was a brief description of the statistical analysis undertaken for this study.

GRAPH 1: THE NUMBER OF PHYSIOTHERAPISTS AND THEIR YEARS OF EXPERIENCE



Chapter 4

RESULTS

The composition of the physiotherapy population is briefly discussed in terms of age and years of experience. The results are presented under the relevant headings and consist of three aspects: each set of results is presented in paragraph form; the statistical analysis of the results is set out in table form; graphs are presented as a visual confirmation of the results.

4.1 THE POPULATION

The age of the physiotherapists observed ranged from 23 years to 50 years and the mean age of the 30 physiotherapists was 30.5 years (SD 7.83). The mean number of years experience was 10.97 years (SD 8.36) and the range of years of working experience ranged from 2 years to 29 years (Graph 1).

4.2 OWAS ACTION CATEGORIES OBSERVATIONS

The action categories for all the posture and load combinations observed were calculated for the three different groups. The majority of the time (>50%) for all the groups was spent in action category 1. More than 25% of the rest of the time was spent in action category 2. (Table 4) (Graph 2).

TABLE 4: FREQUENCY OF THE OWAS OBSERVATIONS AND THE PERCENTAGE OF TIME SPENT IN EACH CATEGORY.

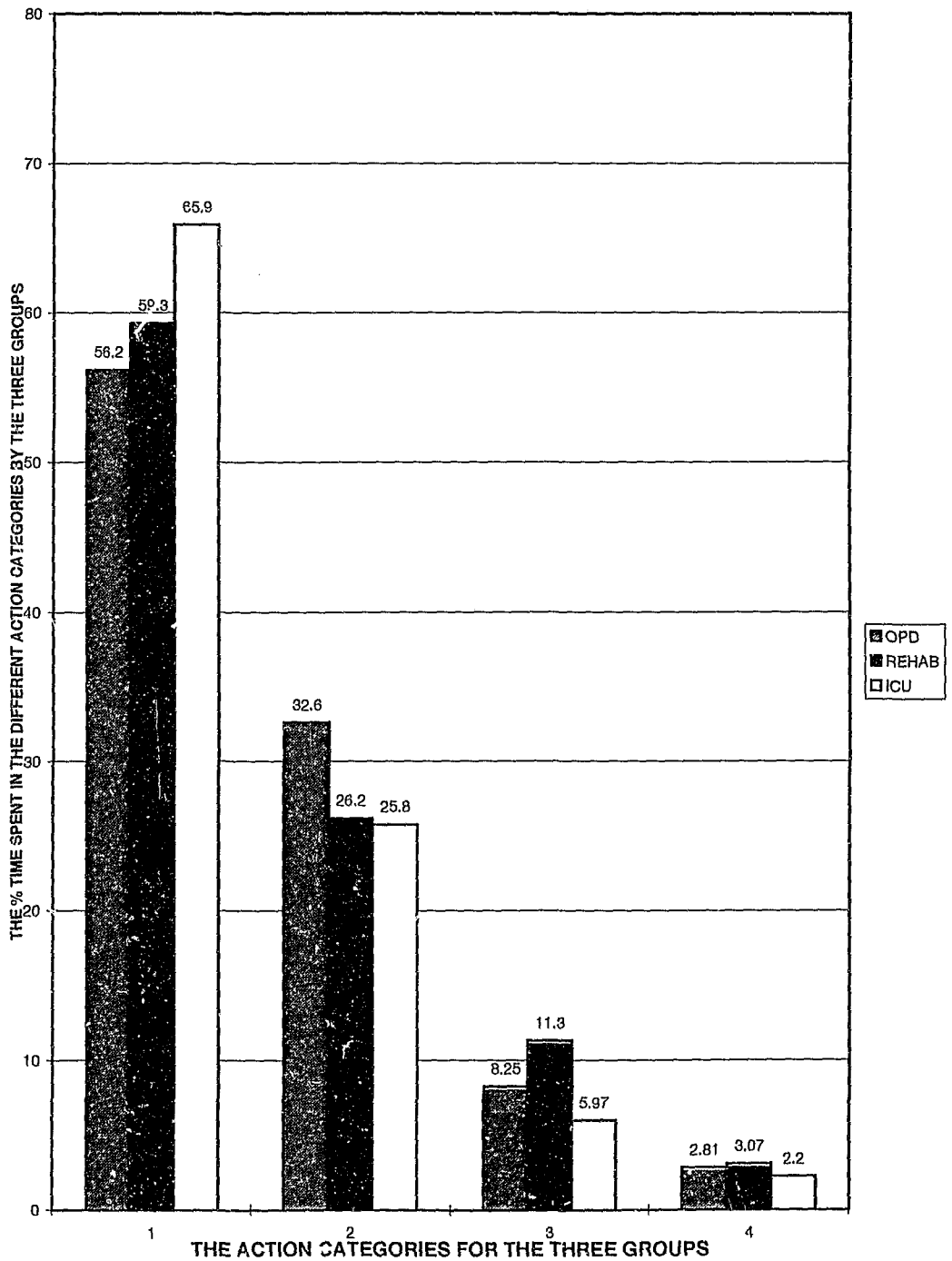
ACTION CATEGORY	OPD	*% TIME*	REHAB	*% TIME*	ICU	*% TIME*
1	595	*56*	653	*59*	711	*66*
2	349	*33*	290	*26*	278	*26*
3	89	*8*	125	*12*	67	*6*
4	*29*	*3*	33	*3*	24	*2*
TOTAL OBSERVATIONS	1062	*100*	1101	*100*	1080	*100*

4.3 ASSOCIATION BETWEEN AND WITHIN THE GROUPS WITH REFERENCE TO THE ACTION CATEGORIES

4.3.1. DIFFERENCES WITHIN THE GROUPS

The two way table chi-squared test showed a significant association ($p<0.01$) for all the different action categories in each of the groups. This test was performed to see if there was a close association between the four action categories within each group. Within each group i.e. OPD, REHAB and ICU, there was a significant difference in the frequency for each action category. In all the groups, the maximum time was spent in action category 1 and the least amount of time in action category 4 (Graph 2).

GRAPH 2: THE PERCENTAGE TIME THE GROUPS SPENT IN EACH ACTION CATEGORY



4.3.2. DIFFERENCE BETWEEN THE GROUPS USING A TWO WAY TABLE χ^2 TEST FOR ALL THE ACTION CATEGORIES.

Having ascertained that there was a close association within the groups the next test was to analyse the differences between the groups. This was done with reference to each action category. Analysis of the difference between the groups with reference to action category 1 showed that the ICU group experienced a significantly greater ($p<0.01$) proportion of time in action category 1 when compared to both the REHAB and OPD groups. (Table 5)(Graph 2). There was no difference in the proportion of time in action category 1 between the OPD and REHAB groups (Table 5)(Graph 2).

The OPD group experienced a significantly greater ($p<0.01$) proportion of time in action category 2 when compared with both REHAB and ICU (Table 5)(Graph 2). There was no significant difference in the proportion of time in the action category 2 between the REHAB and ICU groups (Table 5)(Graph 2).

Analysis of the difference between the groups in action category 3 showed that REHAB experienced a significantly greater proportion of time in this category when compared with ICU ($p<0.01$) and OPD ($p<0.05$)(Table 5)(Graph 2).

There was no significant difference between any of the groups when looking at the proportion of time spent in action category 4 (Table 5)(Graph 2).

TABLE 5: TWO BY TWO TABLE WITH TWO OF THE THREE GROUPS USED AS FACTORS IN EACH INSTANCE

ACTION CATEGORY	GROUP	χ^2	p VALUE	SIGNIFICANCE
1	OPD vs ICU	21.6415	<0.01	**
1	OPD vs REHAB	2.38763	>0.05	-
1	ICU vs REHAB	9.90392	<0.01	**
2	OPD vs ICU	13.1179	<0.01	**
2	OPD vs REHAB	11.0498	<0.01	**
2	ICU vs REHAB	0.101547	>0.05	-
3	OPD vs ICU	3.75721	>0.05	-
3	OPD vs REHAB	5.35924	<0.05	*
3	ICU vs REHAB	18.0086	<0.01	**
4	OPD vs ICU	0.573709	>0.05	-
4	OPD vs REHAB	0.137975	>0.05	-
4	ICU vs REHAB	1.28677	>0.05	-

** $p<0.01$

* $p<0.05$

4.4 SINGLE POSTURES: THE ASSOCIATION BETWEEN THE GROUPS WITH REFERENCE TO INDIVIDUAL POSTURES.

Single postures refer to the posture of the back, or the arms, or the legs or the load. Within the single posture of the back, it was possible to calculate the duration the physiotherapist spent in the back straight position, the back bent position, the back twisted position and the back bent and twisted position.

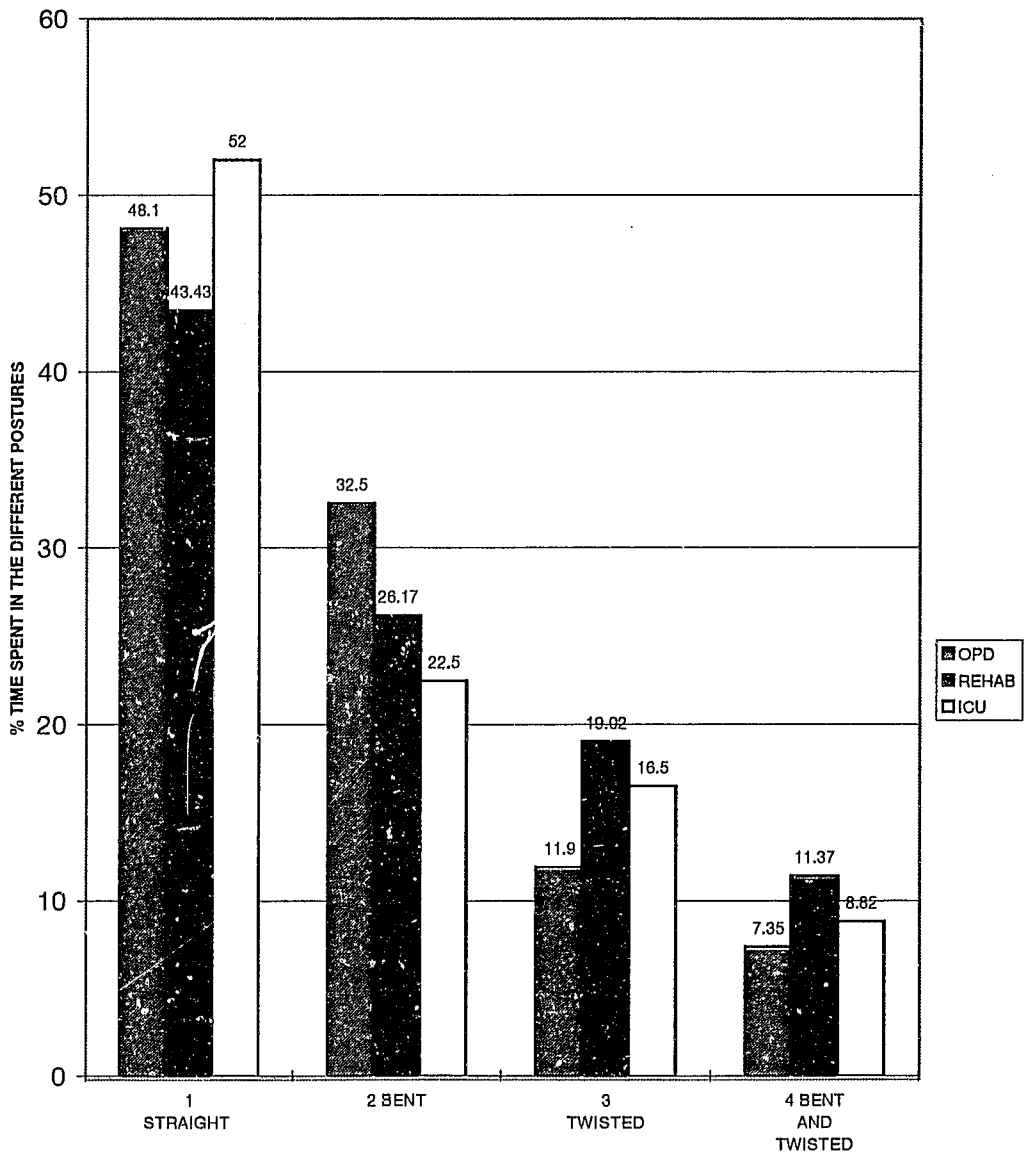
It was also possible to calculate the duration the individual physiotherapists spent in single postures e.g. kneeling, standing or sitting when considering the posture of the legs. The amount of time that the back, arms and legs spent in each of the different positions was calculated and expressed as a percentage (Table 6).

TABLE 6: THE PERCENTAGE OF TIME SPENT IN EACH POSTURE FOR THE BACK, ARMS, LEGS AND LOAD.

SINGLE	POSTURE	OPD %TIME	*AC*	REHAB %TIME	*AC*	ICU %TIME	*AC*
BACK							
1	Straight	48.1	*1*	43.43	*1*	52.0	*1*
2	bent forward	32.5	*2*	26.17	*1*	22.5	*1*
3	twisted	11.9	*1*	19.02	*2*	16.5	*1*
4	bent & twisted	7.35	*2*	11.37	*2*	8.82	*2*
ARMS							
1	both below shoulder	97.2	*1*	94.6	*1*	93.9	*1*
2	one arm at or above shoulder level	2.15	*1*	4.87	*1*	4.83	*1*
3	both arms at or above shoulder level	0.58	*1*	0.57	*1*	1.17	*1*
LEGS							
1	sitting	6.74	*1*	22.63	*1*	0	*1*
2	st - both legs straight	39.2	*1*	16.12	*1*	41.5	*1*
3	st - one leg straight	28.4	*2*	12.14	*1*	41.5	*2*
4	st - both legs bent	6.97	*2*	10.53	*2*	3.09	*1*
5	st - one leg bent	6.12	*2*	1.62	*1*	4.20	*1*
6	kn - on one or both knees	1.27	*1*	19.74	*2*	0.39	*1*
7	walking	11.2	*1*	17.23	*1*	9.25	*1*
LOAD							
1	0 -10kg	95.1		69.95		87.4	
2	10 - 20kg	4.72		20.51		10.0	
3	> 20kg	0.09		9.55		2.47	

AC- action category; st - standing; kn - kneeling

GRAPH 3:SINGLE OWAS POSTURE OBSERVATIONS FOR THE BACK



4.4.1 THE BACK POSTURE.

In the OW method, the position of the back is indicated using the numerical digits 1 - 4.

1. STRAIGHT BACK

In respect of the back posture, analysis shows that both the ICU group ($p < 0.01$) and the OPD group ($p < 0.05$) spent significantly greater time in this posture compared with REHAB (Table 7) (Graph 3). There was no significant difference between OPD and ICU (Table 7).

2. BACK BENT FORWARD

The OPD group spent significantly more time ($p < 0.01$) in this position compared with both REHAB and ICU (Table 7) (Graph 3). There was no significant difference in the amount of time spent in this position between the other two groups (Table 7).

3. BACK TWISTED

Both the REHAB group and the ICU group spent significantly greater time ($p < 0.01$) in this position compared with the OPD group (Table 7) (Graph 3). There was no significant difference between REHAB and ICU when compared for this posture (Table 7).

4. BACK TWISTED AND BENT FORWARD

The OPD group spent significantly less time ($p < 0.01$) than the REHAB group in this position but there was no significant differences compared with the ICU group (Table 7) (Graph 3). There were no significant differences between REHAB and ICU in this position (Table 7).

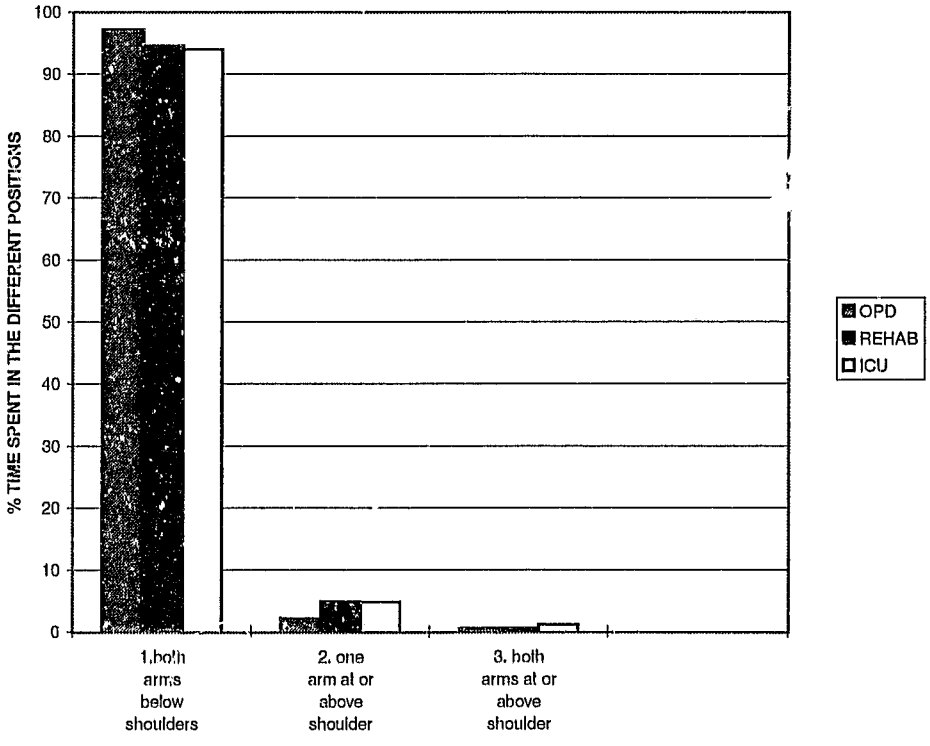
TABLE 7: THE SIGNIFICANCE BETWEEN THE GROUPS FOR SINGLE OWAS POSTURE OBSERVATIONS OF THE BACK.

	POSTURE OF THE BACK	GROUP	χ^2	p VALUE	SIGNIFICANCE
1	straight	OPD vs REHAB	4.90126	<0.05	*
1	straight	OPD vs ICU	3.32057	>0.05	-
1	straight	REHAB vs ICU	16.5578	<0.01	**
2	bent forward	OPD vs REHAB	9.72254	<0.01	**
2	bent forward	OPD vs ICU	25.2417	<0.01	**
2	bent forward	REHAB vs ICU	3.74017	>0.05	-
3	twisted	OPD vs REHAB	21.5485	<0.01	**
3	twisted	OPD vs ICU	8.71663	<0.01	**
3	twisted	REHAB vs ICU	2.99007	>0.05	-
4	twisted and bent forward	OPD vs REHAB	8.38384	<0.01	**
4	twisted and bent forward	OPD vs ICU	1.25578	>0.05	-
4	twisted and bent forward	REHAB vs ICU	3.25701	>0.05	-

** $p<0.01$

* $p<0.05$

GRAPH 4: SINGLE OWAS POSTURE OBSERVATIONS FOR THE ARMS



4.4.2 THE POSITION OF THE ARMS.

1. BOTH ARMS BELOW SHOULDER LEVEL

The OPD group experienced a significantly greater ($p < 0.01$) proportion of time in this position when compared to both the REHAB and ICU groups (Table 8) (Graph 4). There was no difference in the proportion of time in this posture between the REHAB and ICU groups (Table 8).

2. ONE ARM AT OR ABOVE SHOULDER LEVEL.

The OPD group experienced a significantly less ($p < 0.01$) proportion of their time in this posture when compared with both REHAB and ICU (Table 8) (Graph 4) . There was no significant difference in the proportion of time for this posture between REHAB and ICU (Table 8).

3. BOTH ARMS AT OR ABOVE SHOULDER LEVEL.

There was no significant difference between any of the groups when looking at the proportion of time spent in this position (Table 8) (Graph 4).

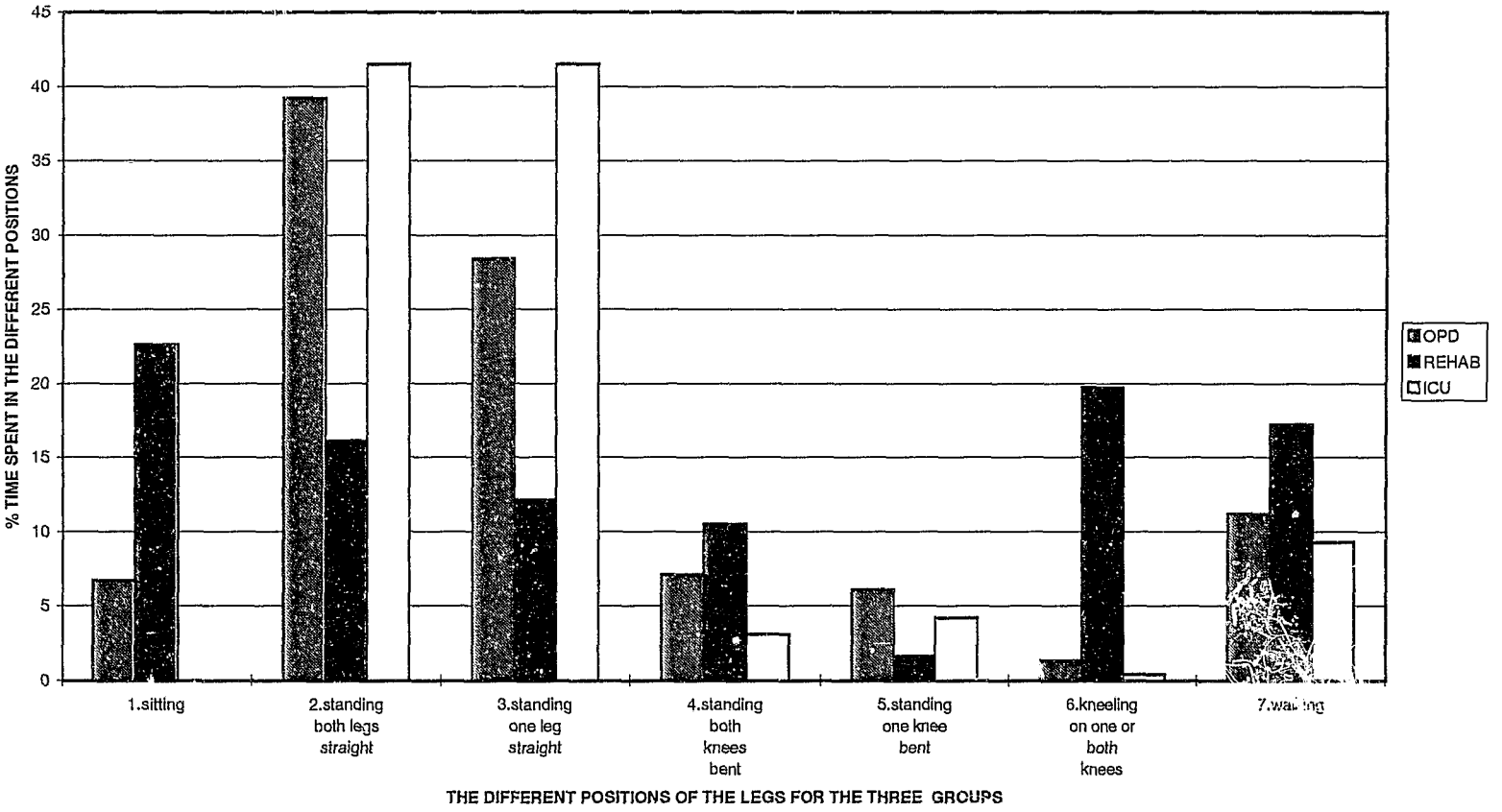
TABLE 8: THE SIGNIFICANCE BETWEEN THE GROUPS FOR SINGLE OWAS POSTURE OBSERVATIONS OF THE ARMS.

	POSTURE OF THE ARMS	GROUP	χ^2	p VALUE	SIGNIFICANCE
1	both arms below shoulder level	OPD vs REHAB	10.3645	<0.01	**
1	both arms below shoulder level	OPD vs ICU	16.6592	<0.01	**
1	both arms below shoulder level	REHAB vs ICU	0.840305	>0.05	-
2	one arm at or above shoulder level	OPD vs REHAB	12.1322	<0.01	**
2	one arm at or above shoulder level	OPD vs ICU	14.1524	<0.01	**
2	one arm at or above shoulder level	REHAB vs ICU	0.0899033	>0.05	-
3	both arms at or above shoulder level	OPD vs REHAB	0.00407398	>0.05	-
3	both arms at or above shoulder level	OPD vs ICU	2.35618	>0.05	-
3	both arms at or above shoulder level	REHAB vs ICU	2.60836	>0.05	-

**$p<0.01$

*$p<0.05$

GRAPH 5: SINGLE OWAS POSTURE OBSERVATIONS FOR THE LEGS



4.4.3 THE LEG POSTURE

1. SITTING

Analysis of the differences between the groups with reference to the sitting posture showed that the REHAB group experienced a significantly greater ($p<0.01$) proportion of time in this posture when compared to both the OPD and ICU groups (Table 9) (Graph 5). The OPD group spent a significantly greater ($p<0.01$) proportion of time sitting than ICU (Table 9). The ICU group had a level of significance of ($p<0.01$) compared to the other two groups and spent no time in sitting at all.

2. STANDING WITH BOTH LEGS STRAIGHT

Both the ICU group and the OPD group experienced a significantly greater ($p<0.01$) proportion of time in this posture when compared with REHAB (Table 9) (Graph 5). There was no significant difference ($p>0.05$) in the proportion of time that ICU and OPD spent in this posture (Table 9).

3. STANDING WITH ONE LEG STRAIGHT

The ICU group spent a significantly greater ($p<0.01$) proportion of time compared with both REHAB and OPD (Table 9) (Graph 5). The OPD group spent a significantly greater ($p<0.01$) proportion of time in this posture than REHAB (Table 9) and REHAB spent a significantly less ($p<0.01$) proportion of time in this posture (Table 9) (Graph 5).

4. STANDING WITH BOTH KNEES BENT

The REHAB group spent a significantly greater ($p < 0.01$) proportion of time in this position when compared with both the OPD and ICU groups (Table 9) (Graph 5). The OPD group spent a significantly greater ($p < 0.01$) proportion of time in this posture than ICU (Table 9) (Graph 5).

5. STANDING WITH ONE KNEE BENT

The proportion of time the OPD group spent in this posture was significantly greater ($p < 0.01$) when compared to the REHAB group and was also significantly greater ($p > 0.05$) when compared to the ICU group (Table 9) (Graph 5). The proportion of time the ICU group spent in this posture, was significantly greater ($p < 0.01$) when compared with the REHAB group (Table 9) (Graph 5).

6. KNEELING ON ONE OR BOTH KNEES

The proportion of time that the REHAB group spent in this position was significantly greater ($p < 0.01$) when compared to both the OPD and the ICU groups (Table 9) (Graph 5). The proportion of time that ICU spent in this position was significantly less ($p < 0.05$) when compared to the OPD group (Table 9) (Graph 5).

7. WALKING

The REHAB group spent significantly greater ($p < 0.01$) time compared to both the OPD and the ICU groups walking (Table 9) (Graph 5). There was no significant difference between the proportion of time spent in this position between the OPD and the ICU groups (Table 9).

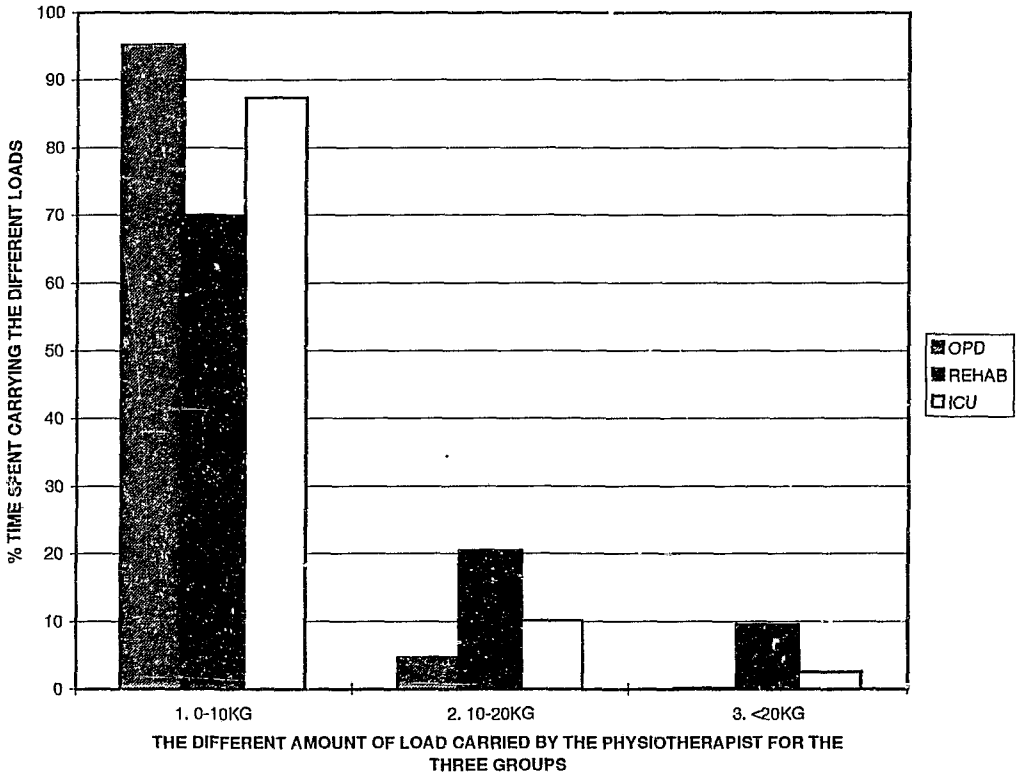
TABLE 9: THE SIGNIFICANCE BETWEEN THE GROUPS FOR SINGLE OWAS POSTURE OBSERVATIONS OF THE LEGS.

POSTURE OF THE LEGS		GROUP	χ^2	p VALUE	SIGNIFICANCE
1	sitting	OPD vs REHAB	110.628	<0.01	**
1	sitting	OPD vs ICU	74.9595	<0.01	**
1	sitting	REHAB vs ICU	280.924	<0.01	**
2	standing both legs straight	OPD vs REHAB	146.996	<0.01	**
2	standing both legs straight	OPD vs ICU	0.876731	>0.05	-
2	standing both legs straight	REHAB vs ICU	171.545	<0.01	**
3	standing one leg straight	OPD vs REHAB	91.4297	<0.01	**
3	standing one leg straight	OPD vs ICU	40.9035	<0.01	**
3	standing one leg straight	REHAB vs ICU	245.929	<0.01	**
4	standing both knees bent	OPD vs REHAB	189.271	<0.01	**
4	standing both knees bent	OPD vs ICU	16.4424	<0.01	**
4	standing both knees bent	REHAB vs ICU	46.2653	<0.01	**
5	standing one knee bent	OPD vs REHAB	29.2799	<0.01	**
5	standing one knee bent	OPD vs ICU	3.85846	<0.05	*
5	standing one knee bent	REHAB vs ICU	13.0723	<0.01	**
6	kneeling on one or both knees	OPD vs REHAB	193.501	<0.01	**
6	kneeling on one or both knees	OPD vs ICU	5.12652	<0.05	*
6	kneeling on one or both knees	REHAB vs ICU	227.021	<0.01	**
7	walking	OPD vs REHAB	15.6001	<0.01	**
7	walking	OPD vs ICU	2.22932	>0.05	-
7	walking	OPD vs REHAB	29.8016	<0.01	**

**p<0.01

*p<0.05

GRAPH 6: SINGLE OWAS POSTURE OBSERVATIONS FOR THE LOAD



5.4.4 THE LOAD CARRIED BY THE PHYSIOTHERAPISTS.

1. LOAD 0 - 10 kg

There was a significant difference in the proportion of time that all three groups spent in this posture. The OPD group spent a significantly greater ($p<0.01$) proportion of time when compared to REHAB and ICU (Table 10) (Graph 6). The ICU group spent a significantly greater ($p<0.01$) proportion of time in this posture than the REHAB group (Table 10) (Graph 6) and REHAB spent a significantly less ($p<0.01$) proportion of time in this posture (Table 10) (Graph 6).

2. LOAD 10 - 20 kg

The REHAB group spent a significantly greater ($p<0.01$) proportion of time in this posture when compared with both OPD and ICU (Table 10) (Graph 6). The ICU group spent a significantly greater ($p<0.01$) proportion of their time in this posture than OPD (Table 10) (Graph 6) and OPD spent a significantly less ($p<0.01$) proportion of time in this posture when compared with both other groups (Table 10) (Graph 6).

3. LOAD >20 kg

The REHAB group spent a significantly greater ($p<0.01$) proportion of time compared with both ICU and OPD (Table 10) (Graph 5). The ICU group spent a significantly greater ($p<0.01$) proportion of time in this posture than OPD (Table 10) and OPD spent a significantly less ($p<0.01$) proportion of time in this posture when compared to the other two groups (Table 10) (Graph 5). Only one load category 3 was observed in the OPD group.

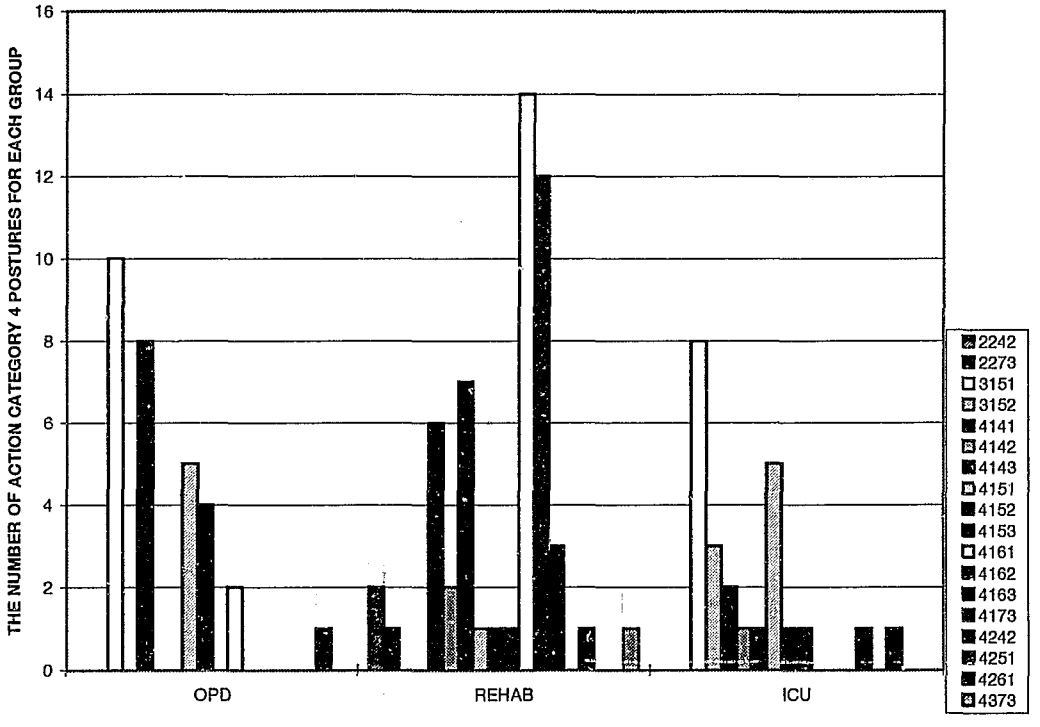
TABLE 10: THE SIGNIFICANCE BETWEEN THE GROUPS FOR SINGLE OWAS POSTURE OBSERVATIONS OF THE LOAD.

	LOAD	GROUP	χ^2	p VALUE	SIGNIFICANCE
1	0-10kg	OPD vs REHAB	235.330	$p<0.01$	**
1	0-10kg	OPD vs ICU	47.3028	$p<0.01$	**
1	0-10kg	REHAB vs ICU	89.5742	$p<0.01$	**
2	10-20kg	OPD vs REHAB	121.5020	$p<0.01$	**
2	10-20kg	OPD vs ICU	28.3291	$p<0.01$	**
2	10-20kg	REHAB vs ICU	38.9144	$p<0.01$	**
3	>20kg	OPD vs REHAB	114.710	$p<0.01$	**
3	>20kg	OPD vs ICU	23.5387	$p<0.01$	**
3	>20kg	REHAB vs ICU	47.1999	$p<0.01$	**

**$p<0.01$

*$p<0.05$

GRAPH 7: OWAS ACTION CATEGORY 4 POSTURE OBSERVATIONS



INCIDENCE OF ACTION CATEGORY 4 POSTURES IN THEIR GROUPS

MOST COMMON ACTION CATEGORY 4 POSTURES

3151 The back is twisted, the arms are below the shoulders, the physiotherapist is standing on one bent leg and carrying a load of 0-10kg.
4161 The back is bent and twisted, both arms are below the shoulders, the physiotherapist is kneeling on one or both knees and carrying a load of 0-10 kg.
4162 The posture is the same as 4161 except the physiotherapist is carrying a load of 10-20 kg.

4.5 ACTION CATEGORY 4

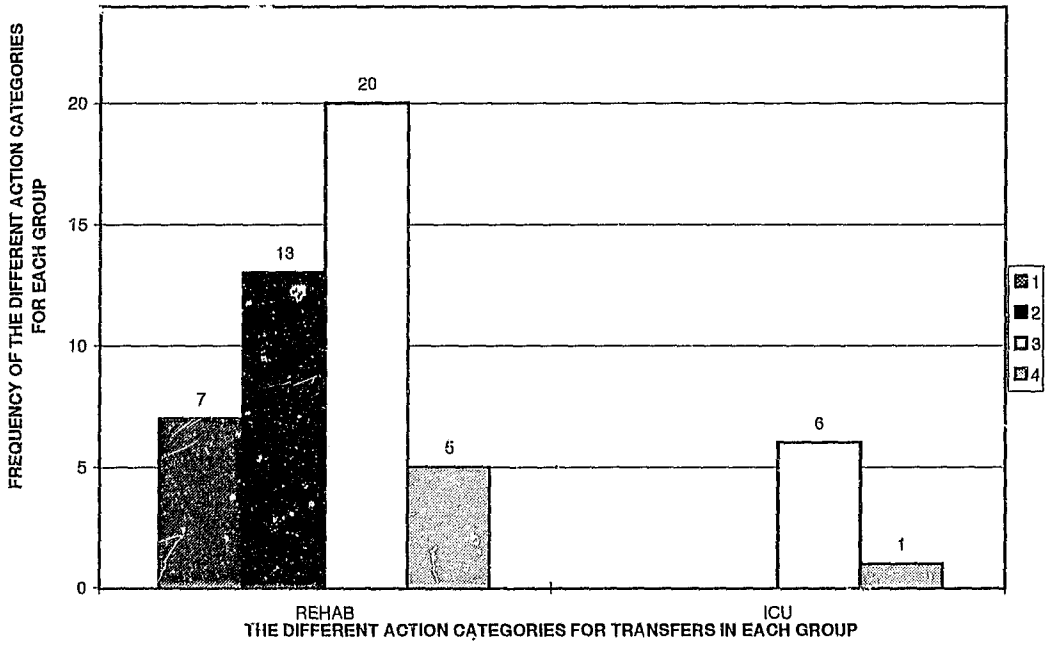
There was no significant difference between the three groups in the amount of time spent in action category 4 postures (Table 5) (Graph 2). In OPD there were 30 observations of action category 4 postures. Twelve observations came from one physiotherapist, who has had more than twenty years of work experience, and ten observations came from another physiotherapist. The remaining eight observations came from five other physiotherapists. Three physiotherapists did not have any action category 4 posture observations. One of these physiotherapists had had previous back surgery.

In REHAB there were 52 observations of action category 4 postures. Eighteen observations came from one physiotherapist and two other physiotherapists had eight observations each. The remaining 18 observations came from six other physiotherapists in the group. The tenth physiotherapist in the group did not have any action category 4 observations. She had also had previous back surgery.

In ICU there were 24 action category 4 observations. One physiotherapist had six observations, two others had five observations each and the remaining eight observations came from the seven other physiotherapists in the group.

The most frequently occurring action category 4 postures for all the groups are shown in Graph 8. Both OPD and ICU spent 33.3% of their time in posture 3151. The REHAB group spent the majority of their time in action categories 4161 and 4162 where the only difference in the posture relates to the load.

GRAPH 8: OWAS POSTURE OBSERVATIONS FOR TRANSFERS



4.6 TRANSFERS

No transfers took place in the OPD group. There were 36 transfers in the REHAB group and 7 transfers in the ICU group. The transfers were accorded action category ratings by using the posture combinations that were observed during the transfer. In both groups, the majority of transfers were in action category 3 (Graph 8). There were no transfers in action category 1 and 2 for the ICU group. The most frequently observed posture combination during a transfer was 2143 ie back bent, knees bent, arms below shoulder level and a load of >20 kg being carried. This has an action category rating of 3. No hoists or lifting aids were seen being used. All the transfers observed were standing transfers.

Chapter 5

DISCUSSION

5.1 INTRODUCTION

The main aims of this study were to assess the working postures of qualified physiotherapists in different clinical locations and then compare them. The main finding of the study was that there were significant differences in the time spent in the different working postures in the different clinical settings. Research has shown that the risk of cumulative injury resulting in back pain increases as a worker spends a longer time in more stressful postures (Pheasant 1994).

5.2 DESCRIPTIVE PROFILE OF THE PARTICIPANTS

The descriptive profile of the participants showed that the majority of the physiotherapists who participated in this study were educated at South African universities. Six of the participating physiotherapists trained in England and Europe. The majority of the South African trained physiotherapists had received their qualifications from the Universities of Witwatersrand, Cape Town and MEDUNSA.

There was a wide age distribution amongst the participants in their years of experience. Four of the physiotherapists had only two years of postgraduate experience whilst three of the

participants had more than 25 years of experience. The majority of the participants had worked as physiotherapists for more than six years and were thus considered to be experienced physiotherapists.

5.3 OWAS ACTION CATEGORIES OBSERVATIONS

The OWAS method allowed all work postures to be described and the work activities causing the stress to be identified. The observer did not hinder the work activities of the participants but was still able to record the working postures.

In all of the groups, more than 50% of the participants time was spent in action category 1. This is the safest possible action category and does not require any adjustment. In the study undertaken by Jackson and Liles (1994), where they observed the working postures of physiotherapy students using the OWAS method, they found that more than 50% of the students time was spent in action categories 2, 3 and 4. Molumphy et al (1985) and Scholey and Hair (1989) found that as the worker gains in experience, the incidence of injury decreases. Molumphy et al (1985) found that physiotherapists experienced the greatest number of work-related injuries in the four years after qualifying and then there was a decrease as the physiotherapists learnt how to look after themselves and avoid injuries. In this study, the physiotherapists were all qualified and the majority had more than 4 years experience. This finding agrees with the literature that physiotherapists learn to look after themselves as they gain in experience.

5.4 DIFFERENCES BETWEEN THE GROUPS

The physiotherapists who worked in the intensive care units spent 66% of their time in action category 1 postures. This was significantly longer than the time spent by the other two groups spent in this category. The physiotherapists who worked in the intensive care units always had the assistance of a qualified nursing sister with them whenever they treated a patient. Lifting or transferring a patient was always undertaken by two people and this was reflected in the results as these participants spent only 6% of their time in action category 3 and 2% of their in action category 4 postures. This was lower than in the other two groups.

The physiotherapists in OPD spent 33% of their time in action category 2 compared with both the other groups who spent 26% of their time in this category. The physiotherapists who worked in OPD frequently had to adopt a poor working posture to treat the patients. The plinths were not always height adjustable and so the physiotherapist had to bend over the plinth. Hignett (1995) describes fitting the physiotherapist to the work (FPW) when the situation does not allow fitting the work to the physiotherapist (FWP) and this is what a lot of the physiotherapists in the OPD group had to do. The physiotherapists in this group also spent the most time in the back bent position often maintaining this posture for periods of up to 4 minutes whilst treating patients. This was frequently due to them needing to bend over the patient on an unadjustable plinth whilst performing manual mobilisations to the cervical spine. Baty and Stubbs (1987) described the bent over posture as a factor in increased postural stress. Maintaining this posture for an extended period (longer than 90seconds) causes fatigue of the back extensors as a result of the static muscle work.

The physiotherapists in REHAB spent 12% of their time in action category 3 compared with OPD (8%) and ICU (6%). Scholey and Hair (1989) observed that the younger less experienced physiotherapists (21-30 years) had a higher incidence of back pain. This corresponds with the finding by Molumphy et al (1985). In the study by Scholey and Hair (1989), it was mainly younger physiotherapists who worked in neurological rehabilitation. The patients in this clinical location are frequently heavily dependant patients. They suggest that this may be a factor in the higher incidence of low back pain found in the younger physiotherapists.

In this study, the age spread of the physiotherapists in the REHAB group was evenly distributed and yet this group still showed a higher incidence of stressful working postures. It may be that working in certain types of work is more stressful and that irrespective of how knowledgeable and well trained and experienced a physiotherapist is, it is very difficult to avoid stressful working postures (Scholey and Hair 1989), and that in order to perform certain tasks, the physiotherapist is forced to adopt more stressful working postures.

When considering the differences in the working postures between the groups, certain factors are relevant. The ICU physiotherapists always had a qualified nursing sister to assist them in their patient handling. The REHAB group of physiotherapists did not have an assistant easily available. If the physiotherapist required help, then another physiotherapist or physiotherapy assistant had to stop the work they were doing in order to help. The patients in the OPD group were totally mobile and the OPD physiotherapists did not have to assist the patients.

5.5 SINGLE POSTURES

BACK

All three groups spent more than 20% of their working time with their backs bent in the "top heavy" position. Jackson and Liles (1994) mention the "top heavy" concept of movement described by Vasey and Crosier (1982). The upper part of the body moves first and the lower limbs are stiffened and the concern is the primary activity rather than the movement needed to achieve it. Grandjean (1988) states that bending the back whilst keeping the legs straight increases the stress on the discs in the lumbar region. All three of the groups spent a considerable part of their working time in this stressful position. All three groups spent more than 10% with their backs twisted and REHAB spent almost 20% of the time in this position. Finally, all the groups spent more than 7% of their time in the back bent and twisted posture. All these positions are listed by Pheasant (1994) as ergonomic risk factors for back pain. The three groups spent more than 37% of their time in very stressful back postures and the REHAB group of physiotherapists spent 56% of their working time with their backs bent, twisted or bent and twisted. This could explain why 45% of the physiotherapists in the survey conducted by Bork et al (1996) complained of back pain which was the most common WMD described in that study.

ARMS

All of the groups arms postures for the three positions were in action category 1 for single postures. The OPD group spent the most time with both arms below shoulder level. The patients were lying on plinths and the physiotherapists positioned themselves above the patient so that they could use their body weight in performing the manual therapy techniques. This enabled the physiotherapists to keep their arms below their shoulders. Both REHAB

and ICU groups spent more time with one arm at or above the shoulder than the OPD group. In REHAB, the physiotherapist often had to support the patients' lower trunk and legs with one hand and stabilise the upper trunk with the other arm. This would frequently lead to the physiotherapist having to lift the stabilising arm above shoulder level. In ICU, the physiotherapist often had to lift her arm over equipment attached to the patient, who was lying in bed, in order to reach the patient.

LEGS

As mentioned previously, Grandjean (1988) states that bending the back whilst keeping the legs straight increases the stress on the discs in the lumbar region. The OPD and ICU physiotherapists spent more than 67% of their time with their legs straight and more than 37% of their time with their backs bent, twisted or bent and twisted. The REHAB physiotherapists working time was spent sitting for 22% and kneeling for almost 20% as well as being in the back bent, twisted or bent and twisted position for 56% of their time. Although the individual single postures had action categories of 1 and 2, it was the combination of stressful postures that created these poor working postures. Spending such a long portion of the working time in a combination of stressful positions may be a factor in the constant stresses and strains of a poor working posture that can lead to back pain (Von Wely 1970).

LOAD

The REHAB physiotherapists also had to carry a load heavier than 20kg for 9.55% of their treatment time whilst the OPD physiotherapists carried a load this heavy only 0.09% and the ICU physiotherapists 2.47% of their treatment time. This is significant as heavy physical work is cited by Pheasant (1994) as an ergonomic risk factor in back pain. If a physiotherapist has to adopt poor working postures in order to treat the patients and then has the added strain of a heavy physical load for almost 10% of the working time, the likelihood of a cumulative injury increases (Pheasant 1994).

5.6 ACTION CATEGORY 4

Eighteen different postural combinations occurred in action category 4. The most commonly occurring posture in the OPD and ICU group was 3151. In this posture, the physiotherapist is standing supported on one bent leg and their back is twisted. In order for a physiotherapist to stand right next to a bed and face the patient, the physiotherapist usually has to twist round slightly as otherwise the physiotherapist is at 90° to the patient. The physiotherapists were observed to frequently transfer their weight from one leg to the other when they stood for extended periods of time; and they often rocked forwards and backwards as they attempted to relieve the pressure of extended standing.

In the REHAB group, the most frequently occurring postures in action category 4 were 4161 and 4162 where the only difference between these two postures is in respect of the load carried by the physiotherapist. In both these postures, the physiotherapist is kneeling on one or both knees and the back is bent and twisted. The difference in the load was decided by how much support the physiotherapist was giving to the patient at the time of observation.

In all the groups there was an uneven distribution in the frequency of the action category 4 postures observed. In the OPD group of physiotherapists, 22 of the action category 4 observations came from two of the physiotherapists and the remaining eight observations came from another five of the physiotherapists. Three of the physiotherapists did not have any action category 4 postures. In the REHAB group, 34 of action category 4 postures observed came from three of the physiotherapists. The remaining 18 action category 4 postures came from the rest of the group of seven physiotherapists. In the ICU group, three of the physiotherapists had a higher frequency of action category 4 postures than the rest of the group. There was a skewed contribution to the action category 4 results. The high frequency of action category 4 postures in each group was caused by a minority of physiotherapists and the majority had a low incidence of action category 4 postures. This indicates that it is possible to treat patients in all the clinical locations in less stressful working postures as the majority of the members of all the groups had a low incidence of action category 4 postures.

5.7 TRANSFERS

There was a total of 43 patient transfers observed. There were no transfers in the OPD group, 36 transfers were observed in the REHAB group and seven transfers were observed in the ICU group. All the transfers in the ICU group were undertaken by two people. All the transfers in the REHAB group were undertaken by the physiotherapist alone. The physiotherapists in this study had all studied at different universities and had different amounts of instruction and training in manual handling skills as well as different levels of experience. The REHAB group of physiotherapists spent more of their time carrying heavier loads than the other two groups. Additionally, they did not have the assistance of another worker to help cope with the heavy work load. More assistance should be made available to REHAB physiotherapists so that they can reduce the postural stress associated with this clinical location.

No physiotherapist was observed using lifting aids or hoists in transferring patients in this study. This is in agreement with the literature which stated that physiotherapists rarely use lifting aids or hoists when transferring a patient as they frequently transfer the patient as part of the treatment plan (Hignett 1994, 1995). When a physiotherapist transfers a patient from a bed to a chair or from a chair to the treatment mat, they are trying to facilitate the patients active assistance and using a lifting aid or hoist would prevent this.

5.8 LIMITATIONS OF THE STUDY

The various references in the literature refer to back pain or low back pain. Very few of the references define exactly what they mean when they refer to back pain or low back pain. This makes it difficult to extrapolate the findings of a study and to compare results between the various studies.

A limitation of the OWAS method is that it is difficult to distinguish between dynamic muscle action and static muscle action using a 30 second interval observation technique. Furthermore, future studies using the OWAS method should include a posture observation of the position of the head and neck as well as the position of the back.

A sample of convenience was used. This ensured that the type of work the physiotherapist performed whilst the working posture was observed was the same within each group. A limitation of the study is that it was a sample of convenience.

It would have been preferable to have only used physiotherapists with more than four years working experience. This was not possible

A repeatability study was performed by the researcher using a video.

Chapter 6

CONCLUSION AND RECOMMENDATIONS

The main finding in this study is that there is a difference in the working postures of qualified physiotherapists in the three different clinical settings. The different clinical settings required different working postures to be adopted in order to treat the patients. However, although each groups working postures differed, they were all found to be stressful.

Physiotherapists list back pain as their main WMD. They are exposed to an increased risk of back pain due to the nature of their work. The physic demands of this profession are high especially in clinical locations such as neurological rehabilitation but ergonomic risk factors for low back pain are encountered in all three clinical locations. Actions such as lifting, bending, twisting and transferring dependant patients are all part of the physiotherapists work load. Cumulative injury from adopting stressful and frequently static working postures for extended periods of time also increase the risk of back pain. Adoption of safer working postures could help offset this risk. Many of the work situations are unique to the practise of physiotherapy and there is a need to devise methods, based on ergonomic principles, which will enable physiotherapists to conduct the many varied aspects of physiotherapy with as little postural stress possible.

RECOMMENDATIONS

Following the outcome of this study, a recommendation is made that a questionnaire type study on the physiotherapists of this country is undertaken to ascertain what is the incidence of WMD and what are the consequences. This information is becoming increasingly sought after as physiotherapists claim disability payments from their insurers as a result of WMD.

A manual handling course relevant for physiotherapists should be developed using the information contained in this report as a source of information. Task groups from OPD, REHAB and ICU physiotherapists should be convened to analyze the action category 3 and 4 postures that were adopted by the physiotherapists and develop posturally less stressful ways of treatment handling patients.

A future study could be conducted once this has been completed to ascertain whether this has been successful in reducing the amount of stressful working postures adopted by physiotherapists in the three groups.

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Appendix A

Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

COMMITTEE FOR RESEARCH ON HUMAN SUBJECTS (MEDICAL)
Ref: R14/49 Bernstein

CLEARANCE CERTIFICATE PROTOCOL NUMBER M 950920

PROJECT Working postures in qualified physiotherapists

INVESTIGATORS Mrs R C Bernstein

DEPARTMENT Physiotherapist, Tregoning St, Linksfield

DATE CONSIDERED 950929

DECISION OF THE COMMITTEE *

Approved unconditionally

DATE 951004

CHAIRMAN. .....(Professor P E Cleaton-Jones)

* Guidelines for written "informed consent" attached where applicable.

c c Supervisor: Mr L Cohen
Dept of Physiotherapy, University

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DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Secretary at Room 10001, 10th Floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

DATE.....SIGNATURE .....

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix B

Information Sheet and Consent Form

INFORMATION SHEET AND CONSENT FORM

Dear Associate,

I am investigating working postures in qualified physiotherapists. This is to be a research report to fulfill the requirements for a Masters of Science in Physiotherapy.

Research shows that physiotherapists suffer from low back pain as a result of the heavy physical work involved in the profession. It also appears that the incidence of work related low back pain decreases as the physiotherapist gains in work experience. Statistics show that the onset of this problem is usually in the first four years after qualifying as a physiotherapist Thus; it would appear that as physiotherapists gain work experience, they also gain the knowledge and the techniques on how to lift and transfer patients without adopting potentially hazardous postures for themselves.

I wish to observe the way you work and the way you handle patients for 1 hour. I will not intrude on the therapy session in any way. Please continue in your normal routine.

You may at any time refuse to participate or to withdraw your consent and discontinue participation from the study without any prejudice. All information will remain annonymous for the purpose of this research and all information will be confidential.

Your participation in this project would really be appreciated. Your results will be discussed with you on completion of the study.

RENA BERNSTEIN
BSc.PHYSIO; BA

I have read the information sheet and understand the procedures detailed. I acknowledge that my participation is purely voluntary and I may withdraw at any time.

_____RESEARCHER

_____PARTICIPANT

_____DATE

Appendix C

Recording Sheet for OWAS Observations

OVAKO WORKING POSTURE ANALYSING SYSTEM

NO............

Back	Arms	Legs	Load	A.C.	ACTION

Back	Arms	Legs	Load	A.C.

Table 1: Coding of OWAS postures

Code	*Back*	*Arms*	*Legs*	*Load*
1	Straight	Both below shoulder level	Sitting	0 – 10 kg
2	Bent forward	One at or above shoulder level	Standing with both legs straight	10–20 kg
3	Twisted	Both at or above shoulder level	Standing with one leg straight	> 20 kg
4	Bent and twisted	——	Standing with both legs bent	——
5	——	——	Standing with one leg bent	——
6	——	——	Kneeling on one or both knees	——
7	——	——	Walking	——

Back	A[illegible]s	Legs	Load	A.C.	ACTION

Appendix D

Research Proposal

WORKING POSTURES IN QUALIFIED PHYSIOTHERAPISTS

RESEARCH REPORT

PROPOSAL SUBMITTED BY

RENA BERNSTEIN

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS

OF

MASTERS OF SCIENCE (PHYSIOTHERAPY)

SEPTEMBER 1995

INTRODUCTION

Back Pain in Workers

Various studies have shown that low back pain affects 62%-80% of all people at some time in their lives (Molumphy et al 1985). Men and women are equally affected but there is a different age distribution. Peak incidence of low back pain occurs at an earlier age in men than in women. Kelsey et al (1984) found that back problems were the most frequent cause of activity limitation in people under 45 years and the third most frequent cause in the 45-64 years age group.

Low back pain is the most common of the work related musculoskeletal disorders and is extremely costly. Time off for low back pain is second only to upper respiratory infections as causes of absenteeism (Rowe 1969). Consequences of low back pain are lost work time, temporary or permanent disability, decreased economic productivity and changes in the quality of life of the individual (Gunnar and Andersson 1981).

Research has shown that the onset, frequency, severity and recovery time of back pain in workers is proportional to the level of physical workload. Additionally, Magora (1972) proposed that workers who rarely or never lift weights also suffer from a greater incidence of low back pain. Therefore, it can be stated that workers who lift weights during the day but not too frequently or infrequently show the lowest incidence of low back pain.

Jobs that involve lifting objects greater than 11.3kg contribute a 3 times higher risk for low back pain in workers. These risks increase even further when there is twisting involved, if the knees are kept straight and the back is bent and if static postures are maintained for extended periods (Grandjean 1988, Pheasant 1991, Gunnar and Andersson 1981).

Both the frequency of lifting and the movements required to lift items have been shown to trigger the onset of low back pain. Pheasant (1991) concluded that "low back pain is a predominately work-related condition" which is supported by Biering-Sorensen (1983) who found that 52-60% of participants in his study gave work as the primary cause of low back pain. When physiotherapists transfer or lift patients, the patients seldom weigh less than 11.3kg.

Back Pain in Physiotherapists

Many of the risks discussed above are encountered by physiotherapists. However most of the studies investigating health care personnel and low back pain have looked at the incidence of low back pain in nurses. Results indicate that nurses who are involved in lifting of patients are prone to low back pain from an earlier age (Magora 1970). The majority of nurses with low back pain experience the onset of symptoms within the first four years of service, thus the knowledge of proper lifting techniques may play an important role in the prevention of low back pain.

Physiotherapist are exposed to an increased risk for low back pain as they often need to lift and transfer patients which involves bending and twisting motions. This risk is enhanced when the physiotherapist performs these activities alone eg. when assistance is unavailable or the patient makes a sudden and unexpected movement such as falling. Additionally, physiotherapists often need to sustain static postures whilst treating patients.

Physiotherapists are considered to be very knowledgable in the care of the spine, the biomechanics of the spine and the correct way to lift and transfer a patient. They generally represent themselves as experts in the field of back care and the prevention of low back pain, yet many of them are plagued by this problem themselves (Hellsing et al 1991).

In a study by Molumphy et al (1985), the authors looked at work related low back pain in physiotherapists. Twenty nine percent of the physiotherapists questioned (n= 337) reported work related low back pain. The majority of these had their onset in the first four years after graduating and were between the ages of 21-30 years old. Eighty three percent were treating or handling patients when they first experienced low back pain. Significant proportions of the physiotherapists in the study cited "lifting with maximal effort" or "bending and twisting" as their mechanisms of injury. As a result of this injury, 18% of the physiotherapists changed the type of work they did and 12% reduced the number of hours spent in clinical work. Molumphy et al(1985) concluded that inexperienced physiotherapists were more vulnerable to incurring work-related low back pain. Furthermore, their research showed that physiotherapists in acute care facilities and rehabilitation units had a higher incidence of work-related low back pain. Their study also showed that as physiotherapists gained experience, so the onset of work-related low back pain decreased.

Ellis (1993) surveyed final year physiotherapy students at 12 physiotherapy schools in the United Kingdom to discover their views on the effectiveness of their training in lifting and handling of patients. Her report indicated that whilst many students felt that the topic had been adequately covered theoretically, they had not had enough time to practise the techniques under supervision. Furthermore, they had not been able to internalise the techniques and thus use them without having to concentrate on every aspect of the manoevres. These factors may have contributed to 27% of the total respondants (n=84) reporting work related low back pain.

Jackson and Liles (1994) studied working postures of physiotherapy students using the Ovako Working Posture Analysing System (OWAS) method (Karhu et al 1977, Kivi and Mattila 1991). They compared the working postures of second and third year physiotherapy students and concluded that there was no significant difference in the postures adopted by the two groups of students. They also found that certain clinical departments showed a greater number of hazardous working postures.

The OWAS Method

The Ovako Posture Analysing System [OWAS] is a practical non-interference method for identifying and evaluating poor working postures. The OWAS method has been successfully used in the hospital environment (Ljungberg et al 1989, Jackson and Liles 1994). It is based on sampling the work postures of the workers by classifying the work postures of the back, arms and legs and also the load into a four digit code according to Table 1. Each four digit code is recorded in the same sequence ie. the first number reflects the position of the back, the second the position of the arms, the third the position of the legs and the fourth the load. Each number is determined by the posture of the spine, the particular limb or the load at the time of observation. Sampling is conducted at a variable or constant interval (Genaidy et al 1994), thus indicating the type of posture, the frequency of the posture and the time spent in a particular type of posture. The number of four digit codes recorded for each subject is dependant on the total observation time and the number of observations within that time.

TABLE 1: CODING OF OWAS POSTURES (Jackson and Liles 1994)

CODE	BACK	ARMS	LEGS	LOAD
1	Straight	Both below shoulder level	Sitting	0 - 10 k
2	Bent forward	One at or above shoulder level	Standing with both legs straight	10 - 20 k
3	Twisted	Both at or above shoulder level	Standing with one leg straight	>20kg
4	Bent and twisted	_____	Standing with both legs bent	_____
5	_____	_____	Standing with one leg bent	_____
6	_____	_____	Kneeling on one or both knees	_____
7	_____	_____	Walking	_____

An OWAS action category is calculated for each of the four digit codes according to Table 2. The action category denotes the risk of the posture as discussed by Jackson and Liles (1994). Each number in the four digit code is used to determine the co-ordinate of the action category. eg.if a posture is given a code of 3261 then according to table 1, the therapists' back is twisted, one arm is above shoulder level, they are kneeling on one or both knees and carrying a load of 0-10kgs. According to Table 2, this code results in an action category rating of 3. The action category is calculated as follows:

BACK	ARMS	LEGS	LOAD
3	2	6	1

TABLE 2: THE OWAS ACTION CATEGORIES (Jackson and Liles 1994)

Back	Arms	1 123	2 123	3 123	4 123	5 123	6 123	7 123	Legs Load
1	1	111	111	111	222	222	111	111	
	2	111	111	111	222	222	111	111	
	3	111	111	111	223	223	111	112	
							↓		
2	1	223	223	223	333	333	222	233	
	2	223	223	233	344	344	334	234	
	3	334	223	333	344	444	444	234	
							↓		
3	1	111	111	112	333	444	111	111	
	2	223 →	111 →	112 →	444 →	444 →	333	111	
	3	223	111	233	444	444	444	111	
4	1	233	223	223	444	444	444	234	
	2	334	234	334	444	444	444	234	
	3	444	234	334	444	444	444	234	

The four action categories are described as follows (Jackson and Liles 1994):

ACTION CATEGORY	DEFINITION

1. The work posture or work posture combinations are normal and natural. The postural load on the skeletal system is acceptable and there is no need for corrective measures.

2. The work posture or work posture combinations may have some harmful effect on the musculoskeletal system. The amount of postural load is almost acceptable. No immediate corrective measures are needed but they may be needed in the foreseeable future.

3. The work posture or work posture combinations have a harmful effect on the musculoskeletal system. The amount of postural load is high and corrective measures must be made as soon as possible.

4. The work posture or work posture combinations have a very harmful effect on the musculoskeletal system. The postural load is very high and corrective measures must be made immediately.

OWAS has great appeal because it presents as a system in which observations about working postures can be rapidly made and the results classified into action categories. These can then form the basis for a decision on whether intervention is needed and what type of intervention is needed. Furthermore,one can then observe the working posture at a later stage to see if the intervention has been succesful (Karhu et al 1981).

AIM

Research has shown that as a physiotherapist matures and gains work experience, the risk of onset of work-related low back pain decreases. This study aims to assess the working postures of qualified physiotherapists in different clinical locations by using the OWAS method. These postures will be compared to asses the risk of low back pain in each clinical setting.

THE SAMPLE

The study will consist of 30 qualified physiotherapists working in intensive care units (n=10), rehabilitation departments (n=10) and out patients departments (n=10) of the Johannesburg Hospital, Hilbrow Hospital and private hospitals as well as selected private physiotherapy practices.

The researcher will approach the physiotherapists working in the aforementioned departments and ask them to volunteer. Each participant will be given an information sheet explaining the study and will be asked for their signed consent to participate in the study (Appendix 1). The participating physiotherapists will be told that they are being observed whilst they are working but will not be told the exact type of data being collected.

THE PROCEDURE

A direct observational study which will be undertaken to describe the type, the frequency of the working postures adopted by the physiotherapist during their work. Additionally, the length of time the physiotherapist spends in each posture will be recorded.

Each physiotherapist will be observed for sixty minutes whilst they are working in their clinical department. OWAS will be used to describe their work posture, the observations will be recorded every 30 seconds. Thus, the researcher will record a total of 120 observations for each physiotherapist. If the physiotherapist stops for a break, the observations will cease until work is started again.

The observations will be recorded on a specially constructed observation recording sheet (Appendix 2). The time required to gather the data and to complete the observations is 2 months.

Statistical Analysis

Data will be analysed to determine whether it approximates a normal distribution using a chi-squared test. If the data approximates a normal distribution then an analysis of variance will be performed. If the data does not approximate a normal distribution, then a non-parametric Kruskal-Wallis statistic will be used. Working postures, the frequency of high risk positions, static postures and lifting will be compared between the groups.

Conclusion

Risk of low back pain is a recognised factor in amongst the working population Physiotherapists are exposed to increased risk due to the nature of their work, however this risk could be offset by adopting safer working postures. This study aims to analyse current working postures in qualified physiotherapists in order to detect hazardous positions and thereby make suggestions for improved safety.

SUPERVISOR

Mr Larry Cohen	Department of Physiotherapy
Mrs C Eales	Department of Physiotherapy

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5	——	——	Standing with one leg bent	——
6	——	——	Kneeling on one or both knees	——
7	——	——	Walking	——

Back	Arms	Legs	Load	A.C.	ACTION

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Back	Arms	Legs	Load	A.C.	ACTION

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