The Effect of Personality on Recovery from Total Hip Replacement and Total Knee Replacement in Patients with Osteoarthritis

Clare Naomi Gibson BSc (Hons)

This thesis has been submitted for the Degree of Doctor of Philosophy

School of Health and Related Research,
University of Sheffield

October 2007

Background: Total hip replacement (THR) and total knee replacement (TKR) are increasingly common procedures to treat the pain and disability associated with osteoarthritis. There is a large variability in time to achieve functional milestones following these procedures and of success of surgery measured by pain and functional ability. Factors which affect outcome are poorly understood, but research in health psychology suggests psychological variables may play an important role.

Objectives: To explore the relationships between selected psychological variables with pain and function pre-operatively in patients awaiting THR and TKR, on achievement of key functional milestones as an inpatient post-operatively, and of pain and function three-months post-operatively.

Design: A correlational study of patients undergoing primary unilateral THR and TKR as a result of osteoarthritis.

Subjects: 105 THR, 70 TKR.

Psychological Measures: NEO-Five Factor Inventory, Multi-dimensional Health Locus of Control Questionnaire, Coping Strategies Questionnaire.

Outcome Measures: Oxford Hip Score, Harris Hip Score, Oxford Knee Score, Knee Society Knee Score, key functional physiotherapy milestones.

Results:

Hip Study: Catastrophizing was a significant predictor of greater pain and worse function both pre-and post-operatively. Pain control efficacy was predictive of less pain and better function pre- and post-operatively. In addition, conscientiousness was a predictor of worse pre-operative function. Few psychological variables were predictive of physiotherapy outcome measures.

Knee Study: Neuroticism was found to be a predictor of worse pain both pre- and post-operatively. Pre-operatively openness to experience was predictive of less pain and better function. Post-operatively, a chance locus of control was predictive of worse functioning. Few psychological variables were predictive of physiotherapy outcome measures.

Conclusions: Psychological variables influence pain and function both pre- and post-operatively in THR and TKR. The psychological variables may exert their actions through pain control efficacy. There is scope to develop an intervention targeting negative psychological variables and improve outcome.

Contents

List of Tables

List of Figures & Graphs

Introduction

This study explored the relationships between selected psychological variables (broad personality, locus of control, and pain coping strategies) with pain and function pre-operatively in patients awaiting THR and TKR, on achievement of key functional milestones as an inpatient post-operatively, and of pain and function three-months post-operatively.

Chapter One explores the current knowledge regarding the incidence and epidemiology of osteoarthritis before discussing medical and demographical factors which affect outcome of surgery. Chapter Two introduces the current research on the relationship between health and broad personality domains, locus of control and pain coping strategies. Chapter Three sets out the methodology used in the studies and introduces the instruments used as outcome measures.

Chapters Four discusses the relationship between impairment and activity limitation and participation restriction. Chapter Five to Seven provide the results of hip study (for the three time points: baseline, inpatient physiotherapy and three-month post-operatively). A discussion of the results takes place in Chapter Eight. Chapters Nine to Eleven provide the results of the knee study which are discussed in Chapter Twelve. Chapter Thirteen compares and contrasts the findings of the hip and knee studies. Clinical implications and future directions of research are discussed in Chapter Fourteen, whilst limitations of present study are discussed in Chapter Fifteen. A brief summary is provided in Chapter Sixteen.

Chapter 1: Introducing Osteoarthritis of the Hip and Knee, Surgery and Rehabilitation

This chapter discusses:

- The incidence of osteoarthritis.
- The epidemiology of osteoarthritis of the hip and knee.
- Treatment options for osteoarthritis.
- Total joint arthroplasty
    - Variability in outcome in terms of length of stay, function, pain and quality of life
    - Demographic and medical factors impacting on outcome.

Incidence of Arthritis

There are no clear figures as to the number of people in the UK suffering from arthritis. The Arthritis Research Campaign (2002) commissioned research in 2001 from two different sources to gain more information on the incidence and epidemiology of arthritis in the UK. Market and Opinion Research International (MORI) estimated that around 13 million people have arthritis in the UK. This figure is near double the estimate of 7 million provided by the ARC Epidemiology Unit in Manchester. The difference in estimates between these two sources is, in part, a result of the difference in sampling method. MORI would have been assessing prevalence of arthritis in the general population whilst the Epidemiology Unit would have gathered data based on demand for healthcare relating to arthritis. Elderly individuals suffering from arthritis may expect that it is something that happens with age and may not bother reporting it to their general practitioner especially if they do not want any intervention to take place.

The focus of this thesis is on osteoarthritis (OA), so the figures regarding prevalence of this shall now be discussed. ARC (Arthritis Research Campaign 2002) estimate that in the UK, 550,000 individuals have moderate to severe OA of the knee, and 210, 000 individuals have moderate to severe OA of the hip. However, given the huge variability in estimates of numbers of individuals in the UK with arthritis, it is likely that these figures are inaccurate. More information is known about factors which affect the prevalence and severity of OA; these shall now be discussed.

Epidemiology of Osteoarthritis of the Hip and Knee

Age

The incidences of osteoarthritis of the hip and knee both increase with advancing age. Dawson et al. (1994) reported that "*age is the most powerful risk factor for OA*" with an exponential increase in risk of OA over the age of 50. ARC (Arthritis Research Campaign 2002) estimate that there are around 18,000 adults in the UK aged between 25 and 44 with moderate to severe OA of the hip, compared to 31,400 adults aged between 45-64, and 154,000 individuals who are over 65 years of age. A similar pattern is seen in OA of the knee; the ARC estimate that moderate to severe OA of the knee is seen 27,000 adults aged 25-44, 91,000 adults aged 45-64, and 370,000 aged over 65.

Gender

Gender is also thought to impact on the incidence of OA, although there is some disagreement as to the size of the difference between different sources. ARC (2002) reported that in moderate to severe OA of the hip (for which there is radiographical evidence), the incidence is even between the two sexes. Contrastingly, Dawson et al. (1994) reported that in individuals aged between 45 and 64, there is a greater incidence of OA of the hip in males than females. OA of the knee is known to be more common in females than males. However, the female to male ratio is under dispute. Dawson et al. (1994) report that the ratio is between 1.5:1 and 2:1, whereas ARC (2002) reported the ratio as 4:1 in favour of males. Severity of OA is also influenced by gender. Hawker et al. (2000)[1] completed a large-scale community survey in Ontario, Canada regarding hip and knee pain. They found that women reported more severe symptoms and greater disability than men.

[1] The setting, number of participants and study type all have an influence on the robustness of the data. Appendix pages 412-461 summarise this information along with a summary of strengths and weaknesses for each of the studies included in the literature review. The implications of including studies with varying settings, small sample size etc. is discussed further in the literature searching strategy and methods section in Chapter 3 – Methodology.

Ethnicity

OA of the hip is more common in White than Black than Asian Individuals (Dawson et al. 1994;Arthritis Research Campaign 2002) but the precise epidemiology remains unknown. The relationship between ethnic origin and prevalence of OA of the knee is less clear. Dawson et al. (1994) stated that there are few ethnic differences in the observed rates of OA of the knee. Contrastingly, ARC (2002) reported that in America, women of African origin have a higher prevalence of OA of the knee than White American women, but it is unknown whether this relationship is observed in the UK.

Social Class and Education

Socio-economic status based on education level has been associated with self-report of OA, with individuals of a lower economic status reporting a greater incidence of OA (Dieppe 2006). In addition, Peters et al. (2005b) demonstrated that a lower social class is associated with a greater deterioration in symptoms of knee pain over a seven-year community-based study. This may be associated with more physically demanding jobs where there is a greater risk of developing osteoarthritis (Anderson and Felson 1998).

Body Mass Index

A higher Body Mass Index (BMI) has been linked to greater deterioration of symptoms of knee pain over a seven-year study period (Peters et al. 2005b) and of risk of severe OA of the hip and knee in men (Järvholm et al. 2005). Järvholm et al. (2005) reported that the relationship between BMI and risk of severe OA existed even in the 'normal' BMI range of 20 to 25kg/m^2. They reported that "*there was almost a doubling of risk of severe knee osteoarthritis with an increase in BMI of 5kg/m^2*" indicating the importance of maintaining a healthy bodyweight to help avoid OA. However, all of the participants in Järvholm et al.'s (2005) study were construction workers who may not be representative of the general population (mainly men, heavy work etc.) and therefore these results may not be generalisable to the whole population.

Treatment Options for Osteoarthritis of the Hip and Knee

In 2003, The European League Against Rheumatism (EULAR) published guidelines on the management of osteoarthritis of the knee (Jordan et al. 2003). They stated that experts recommended that:

> *"The optimal management of knee OA requires a combination of non-pharmacological and pharmacological treatment modalities"* (Jordan et al. 2003:1150)

Suitable treatments for patients with OA of the hip or knee include patient education, simple analgesia such as paracetamol and non-steroidal anti-inflammatory drugs (NSAIDS), exercise, appliances and orthoses (such as walking stick, shoe insoles, and knee braces), and weight reduction (Arthritis Research Campaign 2002;Jordan et al. 2003).

In severe OA of the hip or knee, where other forms of therapy prove ineffective, a joint arthroplasty may be necessary. In the EULAR guidelines for management of osteoarthritis of the knee, Jordan et al. (2003) comment that:

> *"Joint replacement has to be considered in patients with radiographic evidence of knee OA who have refractory pain and disability"* (Jordan et al. 2003:1150)

This recommendation was based on surgeons' opinions as there had been no trials comparing the effectiveness of surgical and non-surgical interventions.

The same guidelines also apply to patients with OA of the hip. EULAR published similar guidelines for management of OA of the hip in 2005 (Zhang et al. 2005).

The next section of the literature review will concentrate on total hip and knee joint replacement.

Total Joint Arthroplasty

Total hip replacement (THR) and total knee replacement (TKR) are carried out to relieve the pain and loss of function associated with severe osteoarthritis. They are increasingly common procedures. In 2005-2006, in NHS hospitals in England, 60,820 THR were carried out and 59,755 TKR completed (Department of Health 2006). The mean waiting list time for THR was 159.7 days compared to 173.5 days for TKR. The length of stay (LOS) following hip replacement was: mean 9.3 days, median 7 days, and knee replacement: mean 8.3 days, median 7 days (Department of Health 2006).

Variability in Length of Stay

It has previously been reported that there is a great deal of variability in LOS following both THR and TKR. Peerbhoy et al. (1999) reported that following THR the mean LOS was 19.4 days and that 90% of patients were discharged by day 27. Similarly, following TKR the mean LOS was 20.1days whilst day 29 was the 90th percentile. Zavadak et al. (1995) reported a range of 8-16 days LOS following THR and a range of 6-23 days post-TKR. Zavadak et al. (1995) also reported a wide variability in time taken to achieve key physiotherapy milestones following surgery. For example, following THR the amount of time taken to achieve independence in sit-to-stand transfer ranged from 2-15 days (mean 4.7 days). Similarly, following TKR the time taken to achieve the same milestone ranged from 2-12 days (mean 5.0 days).

Zavadak et al. (1995) commented that:

> *"A wide variability in patients' functional progress during the acute care admission after elective THA or TKA was demonstrated. The reasons for this variability need to be explored since they may have important implications for planning rehabilitation related to THA, TKA or other orthopedic reconstructive procedures"* (Zavadak et al. 1995:482)

This is of great importance as the demand for THR and TKR will increase with the aging population. Therefore an in depth understanding of factors that influence recovery is necessary to streamline the post-operative process ensuring shorter LOS and thus reducing the waiting list. In addition, if it is understood which factors affect outcome then by adapting the rehabilitation process accordingly it may help to ensure that the outcome following THR and TKR is optimal for all patients. Demographic and medical factors which influence recovery following THR and TKR are discussed later in the chapter.

Variability in Outcome

The measure used to assess the level of success of total joint replacement (TJR) has an impact on how successful the procedure is viewed. Several researchers have assessed the outcome in terms of quality of life. Hopman et al. (1999) state that:

> *"It's particularly important as there is evidence that some patients report little or no benefit from the procedure even though, from the perspective of the medical community, the surgery was successful"* (Hopman et al. 1999:110)

Research assessing the impact of TJR on quality of life (QOL), pain and function conducted by Hopman et al. (1999) and others will be discussed below.

The concept of measuring success of TJR from the patient's perspective (as opposed to clinician measured) is not new. Roush (1985) completed a retrospective survey who had undergone THR/TKR between 1979 and 1982. Patients were 6 to 35 months post-surgery at the time of survey which contained questions on 22 items of activities of daily living relating to personal care, housework and recreational activities. Five percent of the participants reported a loss in function from pre- to post-surgery. The wide variation in time since surgery makes the results of this study difficult to interpret.

Selman (1989) completed a retrospective study of patients who were 12-24 month post-THR. The patients' outcomes were assessed with a modified version of the Arthritis Impact Measurement Scale[2]. Six and a half percent of the 46 participants reported either no change or a loss in pre- to post-operative physiologic function (defined as the physical demonstration of behaviours necessary to participate in activities of daily life). Seventeen percent of the participants reported either no change or a loss in role function which was defined as

[2] A table of references for each of the instruments discussed in this thesis is included on page 407 of the Appendix

characteristic activities of persons within their environment including the ability to perform activities important to social and vocational role.

Johnsson and Thorngren (1989) also completed a retrospective study assessing success of surgery but over a longer time period with participants included in the study being 4 to 14 years post-surgery. Questionnaires were used to assess outcome but the authors are not specific in stating which! They reported that overall 94% of the 505 patients experienced an improvement in hip function, 84% were pain-free in sitting, 65% were pain free on walking, and 63% did not feel restricted by their hip replacement. As with Roush's study, a disadvantage of this study is the great variation (10 years) in the time since the patient received their joint replacement.

The problem with all three of the studies discussed above is that they are retrospective in nature and therefore it is difficult to know the patients' level of impairment prior to TJR. The patient's memory must be relied upon which may be unreliable! Prospectively designed studies are more reliable as they are able to provide an accurate measurement of pre- to post-operative change. More recent studies conducted to assess the outcome of TJR with respect to QOL, pain and function, have employed this design and are discussed below.

Ayers et al. (2004) compared pre-operative and 6-month post-operative function of TJR patients using the Short Form Health Survey Questionnaire-36 (SF-36).[2] Twenty percent of 100 patients completing the post-operative follow-up had no improvement of the Physical Function Scale of the SF-36 6-months post-surgery. Hopman et al. (1999) also employed the SF-36 to assess outcome of THR 6-months post-surgery. Sixty eight patients completed the study. The authors reported that three patient had no change in physical function (as measured with the SF-36) from pre- to post-operatively whilst 10 patients had a decline in the score on physical function. Six patient's level of pain stayed the same from pre- to 6-months post-surgery, whilst 6 patients experienced a decline (worsening) of the scores for pain.

MacWilliam et al. (1996) used the American Medical Group Association THR Consortium approved questionnaire (no reference provided) to assess outcome of THR in 442 patients.

Sixteen percent of patients reported no change in pain or increased pain at 6-months post-surgery. Twenty four percent of patients reported no change in physical function or a decline in physical function at six months post-THR.

Orbell et al. (1998) conducted a study to assess the "health benefits of joint replacement surgery for patients with osteoarthritis". The 107 THR/TKR patients completed interviews pre-operatively and 3- and 9-months post-operatively. Complete data was available for 72 patients. Patients completed 3 different assessments of pain: the McGill Pain Questionnaire (MPQ) which assesses the quality of pain, and two visual analogue scales (VAS), one enquiring about current levels of pain, and the other asking about the worst pain that the patient has ever experienced. Functional activity was assessed by providing the participant with a list of 32 different activities. Each activity was scored by the interviewer on a dichotomous scale of whether or not the participant had completed the activity in the previous month. They were summed to give a total possible score of 32.

Three percent of patients reported a deterioration in pain when the MPQ was used to assess outcome. Thirty one percent of patients experienced no change in resting pain whilst 14% experienced a deterioration in resting pain. Three percent of patients had worse score post-operatively compared with pre-operatively for the VAS assessing the worst pain that the patient had experienced. As the function was measured in an unusual way, it was not possible to provide an overall score in change in function from pre- to post-operatively. However, the data for individual activities was analysed and a statistically significant number of patients (compared with the expected zero) lost the ability to perform various activities such as light cleaning (4%), heavy cleaning (10%), shopping (5%), driving (5%), using the bus (8%), getting in and out of the bath (7%) and picking something up from the floor (4%). It should be noted, however, that in other activities there were substantial increases in the number of patients able to perform the activity (such as walking up and down hills) from pre- to post-operatively. Additionally, the study does not provide any indication of the patients' perspective of their overall change in functioning. However, the study does provide a good insight in to difficulties patients have in completing individual activities post-surgery.

Studies have also focussed on the patients' satisfaction with the outcome of TJR. Johnsson and Thorngren (1989) (see above for details of the study) reported that 97% of the 505 THR patients in their study were satisfied with the outcome. Bayley et al. (1995) asked patients two questions on their satisfaction with outcome. These were: 'how successful was your hip (knee) replacement in allowing you to return to your normal daily activity' and 'how successful was your hip (knee) replacement at relieving pain'. Two hundred and fourteen THR patients took part in the study of which 4 patients (2%) reported that the THR was not at all successful in relation to return to normal activity, whilst 5 (2%) thought that the operation was not all successful in relieving pain. One hundred and twenty eight TKR patients were recruited to the study of which 6 (5%) thought that the operation was not at all successful with relation to improvement in function, whilst all but one patient thought the operation was successful in relieving pain.

Finally, the focus of a study recently completed by Nikolajsen et al. (2006) was on the incidence of chronic hip pain following THR. All patients (1231) who were on the Danish Hip Arthroplasty Register and had their surgery between 1st March and 31st October 2003 were asked to complete a questionnaire. Of these, 1048 were included in the analysis. Hip pain was still present in 294 patients (28%) 12-18 months after surgery, of which 124 patients (11.8%) said the pain was present daily or constantly. Fifty three patients (5%) had moderate to severe pain at rest whilst 11% (115 patients) had moderate to severe pain when walking. Of interest is that 90 patients (8.9%) reported that the pain had a moderate to severe impact on their daily life with difficulties with sitting, walking, working etc. Regression analyses revealed that pain elsewhere in the body was predictive of chronic hip pain. As a result of this the authors state:

> *"(this) raises the question as to whether genetic and psychosocial risk factors are important for the development of chronic pain after surgery"* (Nikolajsen et al. 2006:499)

This section has discussed the variability in success of outcome of TJR. Whilst most patients will experience a significant improvement in pain and function post-TJR, for a small percentage there will be no improvement. Some authors have suggested demographic and medical factors for the lack of improvement (see section below) whilst other have suggested that psychosocial factors may be responsible. Psychosocial factors are the focus of the study presented in thesis and will be discussed further in Chapter 2.

Demographic and Medical Factors Affecting Outcome of Total Joint Replacement

Age

Being more advanced in age is associated with a longer time to achieve functional outcomes post- total joint arthroplasty (TJA). Peerbhoy et al. (1999) reported that following TJA, older individuals were slower to use stairs both assisted and unassisted. More advanced age is also associated with greater length of stay post-THR and post-TKR (Forrest et al. 1998;Peerbhoy et al. 1999;McMurray et al. 2002). Related to this, in a study conducted in America, Epps (2004) demonstrated that older people were more likely to be discharged to another facility rather than directly home than individuals less advanced in age, indicating that older people require further care/rehabilitation. However, it should be noted that ability to complete functional tasks related to movements of the hip or knee (such as climbing stairs) decreases with age independent of any disease or injury to the joint (Brinker et al. 1996;Brinker et al. 1997;Bremmer-Smith et al. 2004). Therefore, the longer time to achieve functional outcomes following surgery in more elderly individuals is related to their general declining ability rather than specifically as a result of their OA. Some caution should be exerted in interpreting the results of the studies by Brinker et al. (1996), Brinker et al. (1997), and Bremmer-Smith et al. (2004) as all three studies samples were skewed containing far more female than male participants.

Gender

Being female has been shown to be associated with slower recovery in the early post-operative outcome following TJA. Thomas et al. (1998) reported that being female was associated with greater pain in the inpatient period following TJA. Epps (2004) reported that a greater percentage of women (compared to men) were discharged to another facility (for further care or rehabilitation) rather than directly home following TJA. However, it should be noted that women have a greater self-reported and objectively-measured disability as a result of their OA pre-operatively (Kennedy et al. 2002) and therefore this greater impairment (compared to men) in the early post-operative period may be associated with this. Alternatively, the worse outcome (as compared to men) for women may be related to their choice of coping strategy usage (Keefe et al. 2000) which shall be discussed in the next chapter.

Co-morbidity and Post-operative Complications

Epps (2004) assessed the impact of number of post-operative complications on LOS following TJA. They do not provide a definitive list of post-operative complications which were recorded and included in the analysis but comment that they ranged from mild such as nausea and urinary retention to severe such as myocardial infarction. They reported that number of post-operative complications was predictive of LOS. It is expected (and logical) that experience of post-operative complications would also slow the achievement of pre-discharge functional milestones, although I have been unable to source any literature demonstrating this.

Pre-existing co-morbidity has been shown to predict functional outcome of THR measured one-year post-operatively (Greenfield et al. 1993), of revision THR measured two-years post-operatively (Davis et al. 2006), and of TKR measured two-years post-operatively (Lingard et al. 2004). However, co-morbid conditions have been shown to be predictive of level of functioning related to the hip and knee joint measured with joint-specific questionnaires in the general population where there was no evidence of injury or disease to the joint (Brinker et al. 1996;Brinker et al. 1997;Bremmer-Smith et al. 2004). Therefore, this finding of pre-operative co-morbid conditions predicting outcome may actually relate to an individuals pre-operative status which has been impaired by a co-morbid condition (see below).

Pre-operative Status

Pre-operative functional status has been shown to predict post-operative status in THR (Fortin et al. 1999;Caracciolo and Giaquinto 2005) and TKR (Fortin et al. 1999;Lingard et al. 2004;Lim et al. 2006). Similarly, pre-operative levels of pain and have been shown to be predictive of medium-term post-operative levels of pain following THR (Holtzman et al. 2002) and TKR (Lingard et al. 2004). This is possibly influenced by or influences age and co-morbidity.

Education Level

Level of education has been shown to predict outcome of TJA. Mahomed et al. (2002) reported that a greater of number of years of schooling was predictive of better outcome 1-year post-TJA as measured with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and SF-36. The authors noted that a higher education level was associated with better expectations of outcome of surgery which in turn were linked with better outcome at 1-year post-surgery (see below). Why more educated patients would expect a better outcome from their surgery, is however, unclear.

Pre-operative Education

Patient education is generally considered to beneficial to the patient with several nursing journal articles providing information to nurses on the best way to deliver information and education to maximise the benefit to patients ((No authors listed) 2000a;(No authors listed) 2000b) .

The positive effects of a pre-operative education program on reducing anxiety and stress, and improving self-esteem pre- and post-operatively are well documented. Gammon and Mullholland (1996) assessed "the effect of preparatory information prior to elective total hip replacement on psychological coping outcomes" in 82 patients undergoing THR. The experimental group received a teaching program comprising "procedural, sensory, and coping information relating to pre-operative and post-operative phases of care". This information was provided verbally and in booklet format. Following surgery (whilst inpatient) patients in the experimental group were visited twice weekly to address any problems they might have. A second training session was provided prior to discharge covering practical issues that would help the patient to cope at home. The control group did not receive any of these interventions. Patient outcomes were assessed on the day prior to discharge. Patients in the control group has significantly higher levels of anxiety and depression (as measured with the Hospital Anxiety and Depression Scale) and significantly lower self-esteem (measured with the self esteem scale), sense of control (measured with the Health Illness (Powerlessness) Scale) and coping. Coping was measured with a simple linear analogue scale from 0 to 10 with 10 indicating "totally able to cope with my new hip replacement" and 0 indicating "totally unable to cope with my new hip replacement".

A similar outcome was reported in a study conducted by Butler et al. (1996). The design of this study was slightly different with half of the patients undergoing surgery within the timeframe of the study being sent an information booklet on THR approximately 4-6 weeks prior to surgery. On admission patients were then recruited to the study allowing a comparison of outcomes between patients who had received the information booklet and patients who had not. Several patients (43) had to be retrospectively excluded from the study as they had previously undergone THR and therefore new what to expect. The patients in the final sample (32 who had the booklet and 48 who did not) were asked to complete the State Trait Anxiety Inventory (STAI) at admission and discharge. Both groups showed significant reductions in the level of anxiety from admission to discharge. The booklet group, however, were significantly less anxious at both time points compared with the no booklet group. The booklet group also required significantly less occupational therapy and physiotherapy although this did not impact on LOS.

Doering et al. (2000) demonstrated that audiovisual presentation of preparatory material is also effective in reducing patients anxiety and stress measured by both questionnaires and physiological markers. The randomised controlled trial (RCT) involved patients undergoing THR; 46 patients were assigned to the experimental group, and 54 to the control. The experimental group received a 12-minute videotape about a 55-year old man with OA undergoing THR. The film, which was strictly from the patient's perspective (i.e. nothing was shown that the patient couldn't see themselves) contained original dialogue and a narrative describing the procedure and the patient's thoughts and feelings (which were obtained by interview). Anxiety measured with the STAI increased in the control group from the pre-operative recording to the measure taken on the morning of surgery. However, anxiety remained virtually unchanged in the experimental group. After surgery, anxiety was shown to drop in both groups but was lower in the group that had received the videotape preparation. Statistically significant differences were found on the recording taken on the morning of surgery and the first two days post-operatively (STAI was recorded everyday until the 5th day post-surgery) between the experimental and control groups. This finding was supported by significantly different levels (lower in the experimental group) of cortisol in overnight 12-hour urine samples both the night prior to surgery (after the intervention) and the first two nights post-operatively. In addition, the control group contained significantly more patients who had a rise in intra-operative systolic blood pressure of greater than 15%. Despite the differences in anxiety and stress between the experimental and control groups, no difference was reported in time taken to achieve key physiotherapy milestones.

So why does preparatory information have psychological benefits to patients? Gammon and Mullholland (1996) discussed this in the paper reported above and states that there are two perspectives offering answers: ideological and practical. There are four theories of an ideological nature reported; these are that of Janis (1958), Johnson (1984), Lazarus (1984) and Bandura (1986). Janis (1958) suggested that patient education enables appraisal of threatening events, reducing anxiety levels and enabling the patient perform physically and psychologically more effectively. Johnson (1984) stated that education focuses the schemata which guide behaviour thus enabling a reduction in the abstract nature of the experience and allowing the development of problem-solving approach towards coping. Similarly, Lazarus (1984) suggested that education provides increased confidence in a person's coping mechanisms. Finally, Bandura (1986) suggested that information improves a person's self-efficacy. From a practical standpoint, Gammon and Mullholland (1996) stated that:

> *"patients who understand more about their condition will also show more compliance with their care needs and medical treatment and work to advance the ultimate goals of their nursing and medical care"* (Gammon and Mullholland 1996: 307)

Despite the apparent psychological benefits of pre-operative education, there is little evidence to suggest that education improves patient function, pain or quality of life. Relating this to the studies above, Butler et al. (1996) were unable to demonstrate any positive effect on length of stay, and Doering et al. (2000) reported that the videotape intervention did not alter the time taken to achieve key physiotherapy milestones.

McDonald et al. (2004) completed a Cochrane review on the effects of a pre-operative education program on outcome of THR and TKR. They searched the Cochrane Library, Medline, Embase, Cinahl, PsycINFO and PEDro. The inclusion criteria were an RCT of pre-operative education (either verbal, written or audiovisual) within 6-weeks of THR or TKR. Seven studies met the criteria. After assessing the studies, the authors concluded that:

> *"There is little evidence to support the use of pre-operative education over and above standard care to improve post-operative outcome in patients undergoing hip or knee replacement surgery, especially with respect to pain, functioning, and length of hospital stay. There is evidence that pre-operative education has a modest beneficial effect on pre-operative anxiety. There may also be beneficial effects when pre-operative education is tailored according to anxiety, or targeted at those most in need of support (e.g. those who are particularly disabled, or have limited social support structures".* (McDonald et al. 2004:1)

For example, Santavirta et al. (1994) were only able to report a limited number of differences between their experimental group (who received a tailored teaching session based on the patient's circumstances covering the surgery and rehabilitation process) and the control group. It was reported that the experimental group were more able to answer the question "when should you inform the healthcare professional you have had THR surgery?" and knew when to inform doctors of possible complications.

Similarly modest results were reported by Gocen et al. (2004) who compared the effectiveness of a pre-operative rehabilitation program involving straight leg raise, stretching of hip flexors and strengthening of upper extremity exercises with waiting list controls in patients awaiting THR. The education program also provided information on movements to be avoided, devices, posture, lifting and carrying, and washing and bathing. Post-operatively patients who had been assigned to the education program achieved transfers earlier. However, there were no longer term effects recorded with scores on the Harris Hip Score for the two groups similar at two-years post-surgery.

Contrastingly, a couple of studies have reported that a pre-operative education program has been able to influence length of stay (LOS). Roach et al. (1995) reported that a pre-operative education program in which patients received a one hour group session followed by individual 45 minute sessions with occupational therapist, physiotherapist, social services and nursing staff, was successful in reducing length of stay from 8.7 days (in the control group) to 8.0 days. However, the study design was fundamentally flawed; all patients receiving THR/TKR were invited to attend the training sessions. The comparison was made between patients who chose to attend and patients who chose not to attend. 463 patients were invited to attend the training, of which 300 attended. Of the 163 who did not attend, 70 had previously undergoing TJR and therefore were aware of the procedures. This left 93 patients in the non-training group. No reasons were obtained for why these 93 patients chose not to attend the training, and no comparisons were made between the two groups in terms of demographics etc. It is therefore possible that the patients who chose not to attend the training session were different either demographically, medically, or psychologically from the patients who attended, and it is these attributes that could have contributed to their worse post-operative performance.

Similarly, Crowe and Henderson (2003) reported that their pre-operative education program, which was tailored toward patients who were not functioning well as a result of joint dysfunction and who had limited social support and/or co-morbidities, was effective in reducing pre-operative anxiety and post-operative LOS. However, the reduced LOS was not a reflection of the time taken to achieve the functional criteria necessary for discharge (getting out of bed independently, able to walk 30 metres and able to climb stairs) but rather a difference in the number of days for a client to make plans for their discharge e.g. arrangement of equipment, meals etc. This therefore merely shows that pre-operative education can be effective in organising a speedy discharge! (but not altering outcomes).

More convincing evidence that pre-operative education may affect outcome has been produced in a few RCTs which have been conducted since McDonald et al. (2004) complete their Cochrane review on the subject. First McGregor et al. (2004) conducted a small-scale RCT (of only 35 THR patients) comparing pre-operative education consisting of classes (and supported by a booklet) describing the pre-operative process, surgery, and post-operative rehabilitation, with waiting list controls. The education group had a significantly shorter LOS (15 days) than the control group (18 days). This difference seems very marked and may be a result of outliers in the control group sample affecting the mean greatly as a result of a small sample size. Additionally, McGregor et al. (2004) reported that the control group required significantly more OT sessions and that the education group reported a greater level of satisfaction both at discharge and at 3-months post-surgery.

Another RCT conducted in the UK by Berge et al. (2004) focussed on moderating levels of pain through a pain management program (PMP) in patients awaiting THR. PMP consisted of 21 ½ hours of education about various topics including arthritis, hip function, joint protection, exercise, pacing, cognitive methods of coping, relaxation, and general health. The patients receiving PMP were compared to waiting list controls. Following the PMP (but prior to surgery), the PMP group had significantly lower levels of pain intensity and pain distress (both measured with a visual analogue scale), and less sleep disturbance than the control group. Post-THR, the PMP group had better scores on the Arthritis Impact Measure Scale physical activity component compared to controls.

Siggeirsdottir et al.(2006) completed a education with a home-based rehabilitation program to the standard clinical procedures following THR. The education group received pre-operative education by an occupational therapist or physiotherapist which provided information on the details of post-operative rehabilitation process and exercises to be performed both pre- and post-surgery. When patients in the education group were deemed ready for discharge, they were discharged home with the support of a nurse, physiotherapist and occupational therapist as required. The control group received the standard care and could be discharged either to home or a rehabilitation facility. LOS was found to be significantly shorter for the education group. Additionally, the education group had significantly better scores on the Oxford Hip Score[3] at 2-. 4-, and 6-month post-surgery. It is difficult to asses, however, the contribution of

[3] A table of references for each of the instruments discussed in this thesis is included on page 407 of Appendix

each of the different components of the intervention (pre-operative education and home-based post-operative rehabilitation) on the outcome.

Finally, Yeh et al. (2005) who were already satisfied that pre-operative education is an important factor for outcome of TJR, completed an RCT comprising two different types of delivery of the pre-operative material. Patients were educated either using a booklet or a multimedia presentation. The authors reported that the group receiving the multimedia presentation had a shorter LOS, greater self-efficacy and a higher functioning post-operatively. However, no details of the instruments used to assess this are provided and therefore it is difficult to make an informed assessment f the reliability of these findings.

To conclude, many researchers have investigated the impact of pre-operative education on outcome of TJR. It is apparent that pre-operative education is successful in reducing anxiety but the effect on outcome with respect to pain and function is less clear. McDonald et al. (2004) failed to find convincing evidence in their Cochrane review. However, since that time, a few RCT have emerged suggesting that pre-operative education may be effective in reducing LOS and improving longer term outcome.

Patient Expectations

Related to level of education and pre-operative education is patient expectation. A systematic review completed by Mondloch et al. (2001) assessed the relationship between patient expectations and health outcomes in a variety of medical disciplines. They were able to locate 16 moderate quality papers which addressed this issue in a range of conditions including myocardial infarction, chronic pain, abortion, alcoholism and hip fracture. Expectations were predictive of some change in health outcome in thirteen of the sixteen studies. The effect varied wildly, but this is to be expected given the inclusion of dramatically different conditions. It has been the aim of very few studies to assess the impact of patient expectations on outcome of THR or TKR. The limited evidence is discussed below.

The aim of the study completed by Mahomed et al. (2002) (discussed in patient education above) was to assess the impact of expectation on outcome of surgery in 103 THR and 89 TKR patients. Outcome was assessed with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and SF-36. Patient expectations were assessed with four questions relating to pain relief, limitations in activities of daily living (both measured with a likert-type scale), and overall success of surgery, and likelihood of joint-related complications measured with a visual analogue scale (VAS). The scores from the VAS were dichotomised into high and low scores. Correlational analysis revealed that patients with expectations of a greater pain relief and greater overall success of the surgery had lower levels of co-morbidity. Multivariate linear regression analysis was used to assess the impact of expectation of outcome after controlling for other variables including co-morbidity. Higher patient expectations were predictive of better outcome as assessed by WOMAC pain, WOMAC physical function and SF-36 physical function. Mahomed et al. (2002) suggest that expectations might be determined by self-efficacy. Alternatively, Venkataramanan et al. (2006) suggests that concerns about surgery (overall concern, pain, complications, recovery and difficulty with everyday activities) may impact on patients expectations.

Whilst Mahomed et al. (2002) are confident that high expectation predict positive outcome, studies assessing the relationship between patient expectation and satisfaction with outcome less clear cut. Mancuso et al. (1997) completed a study assessing the relationship between patient expectation and satisfaction with outcome of THR. The 180 patients completed qualitative interviews with open-ended questions assessing their expectations of THR surgery. Forty five different expectations were listed. These were grouped into five categories: pain, improvement in walking, psychological benefit, improvement in essential activities (an activity required to complete daily function such as get dressed), and improvement in non-essential activities e.g. dancing, golf etc. It was found that patients who had expectations of improvement in non-essential activities were less satisfied than patients who did not expect an improvement in this area. Whilst this is an interesting finding, caution must be exercised in interpreting the results as the qualitative interview was conducted two to three years post-surgery and therefore patients' recall of their expectations may not be accurate.

Eisler et al. (2002) assessed the impact of patient expectation on satisfaction in patients undergoing revision THR. Their findings were similar to Mancuso et al.'s (1997); dissatisfaction may be caused by unrealistic expectations. However, they state:

> *"Preoperative intervention by the surgeon with the aim of giving revision patients more realistic expectation may be double-edged because positive and sometimes high expectations have be shown to be beneficial to recovery after surgery".* (Eisler et al. 2002:460)

To summarise, in order to fully understand the relationship between patient expectation and outcome and satisfaction further research is needed. It appears however, that positive but realistic expectations have a beneficial effect on outcome and satisfaction with outcome.

Summary of Chapter

This chapter has reported the incidence of hip and knee OA in the general population. It has been demonstrated that several demographic factors affect the prevalence of OA of the hip and knee. Advancing age is a strong predictor of OA. Being of female gender is associated with both a greater prevalence of hip and knee OA and of severity of symptoms/disability. It is appears that both hip and knee OA are commonest in White populations, although further work in the UK is necessary to clarify this. Body Mass Index is associated with the prevalence of hip and knee OA, with a rise of 5kg/m^2 having a great impact on the incidence of severe OA. Finally, social class and education were shown to have an impact on the prevalence of OA, with OA being more prevalent in lower social classes.

Several treatment options for OA are available; TJA may be a requirement for individuals experiencing severe pain and disability. TJA is a relatively common procedure; its incidence is set to increase with the age population. Currently, there is a great deal of variability in the early post-operative outcome and the longer outcome of TJA in terms of pain, function and quality of life. There is a need to explore the factors contributing to this variability in order to make each patient's outcome as optimal as possible. Several medical and demographic factors are known to impact outcome. These include age, gender, co-morbidity and post-operative complications, pre-operative functional status, pre-operative patient education, education level and patient expectations.

Despite the variability in part being explained by these demographic and medical factors, from the research in health psychology, it is likely that psychological variables may also affect outcome. These will be discussed in the next chapter.

Chapter 2: The Impact of Psychological Variables on Pain and Function in Osteoarthritis and on Recovery from Rehabilitation

This chapter provides background information on the existing literature relating the association of psychological variables to pain and disability in chronic disease and the effect of psychological variables on rehabilitation. Details of the search strategy used in collating the literature for this review can be found on page 22 of the methodology chapter. Where possible, in order to relate to the subject of the thesis, this chapter has focussed using arthritis as the chronic disease and rehabilitation involving orthopaedics or arthritis. However, research into the impact of psychological factors in orthopaedics is still in its infancy and many of the constructs have not been investigated. Therefore, for some of the psychological constructs used, wider examples in the health psychology area have been provided.

The effects of many different psychological variables have been studied in research involving health psychology and pain. These include global personality traits, locus of control, control efficacy, coping strategies, positive and negative effect, optimism and pessimism and motivation. From the existing literature, it is likely that all of these variables may have an effect on chronic disease status and on rehabilitation. However, it is not possible to study all these factors simultaneously.

My research has focussed on broad personality, locus of control and coping strategies and therefore these will be focus of this literature review. My research focussed on these as there is existing evidence on the importance of locus of control orientation and coping strategy usage in pain and function in osteoarthritis (Keefe et al. 1987a;Keefe et al. 1990a;Keefe et al. 1990b;Keefe et al. 1991;Keefe et al. 2000;Kendell et al. 2001;Cross et al. 2006)

Broad Personality

Over the last few years there has been a general consensus that personality can be accurately described using a five factor model (Goldberg 1990). There is some disagreement as to the exact model with respect to the names of the five domains. McCrae and Costa (1985) proposed a five factor model which contains the domains neuroticism, extraversion, openness to experience, agreeableness and conscientiousness.

McCrae and John (1992) provided definitions of the five factors: neuroticism is characterised by feeling of anxiousness, self-pity, tension, instability and worry. Extraverted individuals are active, assertive, energetic, enthusiastic, outgoing and talkative. Individuals scoring highly on openness to experience tend to be artistic, curious, imaginative, insightful, original, and have wide-spanning interests. Individuals scoring highly on agreeableness are appreciative, forgiving, generous, kind, sympathetic and trusting. Finally, adjectives describing conscientiousness include efficient, organized, planful, reliable, responsible and thorough. This model of personality is used in the studies reported in thesis, measured using the NEO-Five Factor Inventory (NEO-FFI) (Costa and McCrae 1992).

This five factor model of personality has been recommended for research relating psychological variables to parameters of health. Marshall et al. (1994)[4] completed a study assessing the relationship between the NEO-FFI and various variables commonly measured in health psychology. They found moderately strong relationships between the individual psychological constructs and the broad personality domains and reported that:

> "*Our research suggests that broad personality domains, as exemplified by the five factor model, provide an adequate and initial organizing framework for research aimed at understanding the linkage between personality and health*" (Marshall et al. 1994:282).

Several investigators have researched the relationship between personality, health-protective behaviours, and behaviours which are detrimental to health. The results whilst very interesting

[4] The setting, number of participants and study type all have an influence on the robustness of the data. Appendix pages 412-461 summarise this information along with a summary of strengths and weaknesses for each of the studies included in the literature review. The implications of including studies with varying settings, small sample size etc. is discussed further in the literature searching strategy and methods section in Chapter 3 – Methodology.

(discussed below) should be viewed with some caution as a lot of the work has been conducted in samples distinctively different from an elderly clinical population. For example, Marshall et al.'s (1994) sample was composed of male military recruits. Similarly, Booth-Kewley and Vickers (1994) used Navy Personnel for the focus of their study. University students were used by Lemos-Giráldez and Fidalgo (1997) and Vollrath et al. (1999). Whilst global personality has been shown to be stable over time, there may be other psychological factors which are markedly different in these populations to the subjects of my PhD studies.

There is general agreement that agreeableness and conscientiousness are associated positively with healthy-behaviours and negatively with behaviours which can be detrimental to health. Booth-Kewley and Vickers (1994) reported that higher scores on both agreeableness and conscientiousness were related to more wellness behaviours such as exercising and maintaining a healthy diet, to more accident control behaviours and to less traffic risk taking. Lemos-Giráldez and Fidalgo (1997) agreed reporting that agreeableness and conscientiousness are associated with healthy behaviours and attitudes relating to smoking, drinking, exercise and health diet. In addition, Vollrath et al. (1999) reported that individuals scoring highly on either of these personality domains, had a low perceived susceptibility to illnesses resulting from these unhealthy behaviours (such as alcohol dependency and lung cancer) as they do not engage in unhealthy activities such as smoking and drinking .

There is also a general agreement that openness to experience is associated with unhealthy or risky behaviours such as substance taking (Booth-Kewley and Vickers 1994), risky sexual behaviours (Vollrath et al. 1999), and to smoking, drinking, and to having a poor diet (Lemos-Giráldez and Fidalgo-Aliste 1997).

There is less agreement, however, on the impact of neuroticism and extraversion on health behaviours. Booth-Kewley and Vickers (1994) reported that high levels of neuroticism were associated with fewer wellness behaviours, less accident control and more traffic risk taking. Similarly, Lemos-Giráldez and Fidalgo (1997) found that high levels of neuroticism were associated with smoking, drinking, unhealthy diet and poor exercise regimen. In contrast, however, Vollrath et al. (1999) reported that neuroticism was not linked to any of the health risk-taking parameters measured (which assessed smoking, drinking and risky sexual behaviour) but was linked to susceptibility of diseases related to these behaviours (such as alcohol dependency, and sexually transmitted diseases). The authors postulated that this was indicative of a neurotic individual's tendency to worry about their future health and perceive a worse possible outcome in spite of the fact that their health behaviours are no worse than other individuals.

Previous studies have also investigated the relationship between personality and perceived status. Jerram and Coleman (1999) investigated the relationship between personality and reporting of health problems in elderly individuals attending their general practitioner. Neuroticism was associated with greater reporting of medical problems, worse general health perceptions, poorer mental health and greater physical role limitation. Extraversion was linked to more vitality and more positive health behaviours. In addition, in women, extraversion was associated with better general health perceptions and better physical functioning. The effects of the other three personality domains are varied by gender. In women, openness to experience was related to better health perceptions, better physical functioning and less physical role limitation, less pain and more vitality. Contrastingly in men, openness to experience was only related to vitality, with a greater score on openness to experience being associated with a lower level of vitality. In women, high agreeableness was linked to better health perceptions, better physical functioning, better mental health, and more vitality. No relationship was found between agreeableness and any of the outcome measures in men. Finally, conscientiousness was related to better general health perceptions in men and to reporting of more lumps and growths in women.

Duberstein et al. (2003) completed a robust study assessing the relationship between personality and perceived health status in primary care patients. In agreement with Jerram and Coleman (1999), Duberstein et al. (2003) reported that high neuroticism was associated with worse perceived health. They also found that high levels of openness to experience were associated with better functional status. This is in agreement with Jerram and Coleman's (1999) findings relating to women but not men.

Whilst it has been suggested that five factor model (as measured using NEO-FFI) is suitable to use as a framework for health and personality research, it has also been suggested that there is value in considering individual psychological traits. Marshall et al. (1994) stated that:

> *"There is limited utility of a system that does not recognise narrow as well as a broad level of analysis......... Broad and narrow personality dimensions provide complementary frames of reference, neither of which is necessarily more meaningful than the other"* (Marshall et al. 1994:283)

As such, the narrow psychological constructs that are used in my research shall now be discussed starting with locus of control.

Locus of Control

Locus of control (LOC) is a measure of whom the patient perceives that the responsibility for their health/disease lies with. Generally speaking, LOC is categorised into internal (oneself) and external (others or the environment). There are various instruments available to measure LOC; some perceive LOC as multidimensional (where internal and external are independent of one another) whilst some believe it to be unidimensional with internal and external polar opposites on the same scale. Instruments relevant to this area of study are the Multidimensional Health Locus of Control Scale (MHLC) and the Recovery Locus of Control Scale (RLOC). The MHLC (Wallston et al. 1978), as the name suggests, is multidimensional; it measures LOC on three scales which are internal, external chance (covering concepts such as fate and luck) and external powerful others. More recently, a form which can be made condition-specific has also been developed from the instrument (Wallston et al. 1994). The RLOC scale (Partridge and Johnston 1989) is a LOC scale designed to assess LOC in recovery/rehabilitation and therefore is relevant to this area of research. It measures LOC on a single dimension with internal and external being at opposite ends of the scale.

LOC orientation has previously been linked to pain and function in chronic disease and success of recovery/rehabilitation. Cross et al. (2006) recently reported that, in patients with osteoarthritis, scoring highly on the chance scale of MHLC was associated with greater pain and worse function. Härkäpää et al. (1991) examined the effect of LOC on success of a treatment regimen for chronic back pain. They reported that a greater internality was associated with a greater decrease in disability and a greater frequency of exercise completion. In addition, a high externality was associated with a low frequency of exercise completion.

In the study in which the RLOC was developed, Partridge and Johnston (1989) reported that, in patients undergoing rehabilitation following either stroke or fracture of the wrist, a greater internality was associated with a quicker recovery. Using the RLOC as a measure of LOC, Shaw et al. (2003) found that in patients recovering from surgery for fractured neck of femur, a greater internality was associated with less disability at 30-days post-surgery. However, it is difficult to draw conclusions from this study as LOC was also measured 30-days post-surgery and success of rehabilitation so far may have influenced the individual's LOC beliefs. Kendell et al. (2001) also employed the RLOC in their study examining the influence of psychological factors on the achievement of key physiotherapy milestones in the early recovery period following TKR. They found that a greater internality was associated with a shorter time (in days) to achieve straight leg raise. However, caution should be used when interpreting the results of this study due to the small sample size and large number of variables entered into the regression analysis.

LOC has also been shown to have an impact on post-operative pain. Johnson et al. (1989) completed a study examining the effect of LOC on efficacy on patient controlled analgesia in individuals following gynaecological surgery. They found that externality was associated with higher levels of pain and less satisfaction with the patient-controlled analgesia. Contrastingly, internality was associated with less pain and more satisfaction.

Therefore, from the literature available it appears that a high external LOC (including chance) is generally associated with a worse outcome and a higher internal LOC orientation with a better outcome. External LOC beliefs may affect pain, function and recovery through feelings of helplessness to control the situation or through coping strategy usage. Crisson and Keefe (1998) reported that, in chronic pain patients, a chance LOC orientation was associated with feelings of helplessness in dealing with their chronic pain problem. Härkäpää et al. (1996) reported that scoring highly on chance locus of control (measured with MHLC) was linked to a tendency to catastrophize (see below). The positive effects of internality may also be mediated through coping strategy usage. Härkäpää et al. (1996) reported that a high score on the internal scale of MHLC was associated with use of coping self statements (see below). Literature relating to coping strategies shall now be discussed.

Coping Strategies

Coping is of great interest to researchers looking at adaptation to chronic diseases and rehabilitation as it an area which has the potential for the development of interventions that can change the way we behave. A body of evidence suggests that the type of coping strategy employed can either have positive or detrimental effects on pain and disability in chronic diseases such as OA and RA, and can affect the success of a rehabilitation programme.

There are various measures of coping strategies available. One on the most popular, which is used in my studies (and therefore this review will focus on), is the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983). The CSQ measures seven different coping strategies which are diverting attention, reinterpreting pain sensations, coping self statements, ignoring sensations, praying/hoping, catastrophizing, and increasing behavioural activities. A definition and example of an item measuring each of these can be found in the psychological definitions on page 404 of the Appendix. In addition, two items of the CSQ are devoted to measuring pain control efficacy which will be discussed in the section below.

Coping strategy usage has been shown to have an impact on pain and disability in a variety of conditions. Rosenstiel and Keefe (1983) studied the effects of coping strategy usage in patients with chronic back pain. The completed CSQ was subjected to factor analysis from which three factors were created. These were 'cognitive control and suppression', 'helplessness', and 'diverting attention and praying/hoping'. Patients scoring highly on the 'cognitive control and suppression' factor, which was characterised by high scores on reinterpreting pain sensations, coping self statements, and ignoring sensations, reported a greater functional impairment. 'Helplessness' was characterised by high scores on catastrophizing and low scores on the items relating to pain control efficacy. High scores on 'helplessness' were linked to anxiety and depression. Finally, high scores on the 'diverting attention and praying/hoping factor' (which was characterised by high scores on both) was associated with greater pain and functional impairment.

Snow-Turek et al. (1996) examined the effect of coping strategy on status in chronic pain patients. They divided the CSQ into active and passive components. The active component consisted of diverting attention, reinterpreting pain sensations, coping self statements, ignoring sensations and increasing behavioural activities. The passive component consisted of catastrophizing and praying/hoping. They reported that passive coping was related to higher levels of psychological distress and depression whilst active coping with higher activity levels and lower psychological distress.

Hill et al. (1995) examined the effects of coping on pain and disability in patients with phantom limb pain. The regression analysis was undertaken using both factors of the CSQ (created through factor analysis) and using the individual coping strategies as independent variables. The factor analysis created three factors. The first was 'coping attempts' which contained ignoring sensations, coping self statements, reinterpreting pain sensations and diverting attention. The second factor, 'helplessness', contained catastrophizing, praying/hoping and increasing behavioural activities. The third factor, 'self-efficacy', was characterised by high scores on the coping efficacy items. A high score on the 'helplessness' factor was associated with greater pain, physical and psychosocial dysfunction. Regression analyses where the coping strategies were entered separately as independent variables revealed that catastrophizing was associated with pain and greater physical and psychosocial dysfunction. In addition, praying/hoping was predictive of pain and physical dysfunction whilst reinterpreting pain sensations was a significant predictor in the model for psychosocial disability.

In agreement with these findings, Rapp et al. (2000) reported that low levels of catastrophizing and praying, high levels of ignoring sensations and reinterpreting pain sensations, and a high pain control efficacy were associated with less disability and better function in elderly individuals with knee pain.

Turner et al. (2002) assessed the relationship between coping strategies and pain and disability in individuals with spinal cord injury. All coping strategies measured by the CSQ were recorded and input into the regression analysis but only catastrophizing was found to be a predictor of these outcomes. Similarly, in Kendell et al's (2001) examining the relationship between psychological variables and achievement of key physiotherapy milestones following TKR all CSQ scales were measured and input into the analysis. Again only catastrophizing was found to be a predictor; it was associated with a longer time to achieve 90° flexion of knee.

A growing body of literature (see above) has shown catastrophizing to be the most important of the coping strategies in predicting pain and disability. Investigators have begun to research this strategy independently (of the other coping strategies measured with the CSQ) using either the catastrophizing scale from the CSQ or the Pain Catastrophizing Scale (Sullivan et al. 1995). This research has created a large body of evidence linking catastrophizing to pain and disability in chronic pain conditions in adults (Severeijns et al. 2001;Buer and Linton 2002;Sullivan et al. 2005;Peters et al. 2005a) and in children (Vervoot et al. 2006), in phantom limb pain (Whyte and Carroll 2004), in soft tissue injury (Sullivan et al. 1998), and in rheumatoid arthritis (Keefe et al. 1989).

To summarise, a great deal of research has been conducted assessing the impact of coping strategies on pain and disability in chronic conditions, and in a rehabilitation setting. Much of the research has highlighted catastrophizing to be an important predictor of pain and disability. In addition, research using the CSQ has also highlighted the importance of pain control efficacy in pain and disability; this shall now be discussed.

Pain Control Efficacy

Pain control efficacy is assessed on the CSQ with two items; the first item assesses perceived control over pain and the second item assesses perceived ability to decrease the pain. Pain control efficacy has been consistently linked to pain and disability in chronic pain conditions (Tan et al. 2002) and in arthritis. Keefe et al. (1987a) assessed the impact of coping strategies on disability assessed in a behavioural analysis in patients with osteoarthritis of the knee. Factor analysis of the CSQ revealed three factors; one of which was 'pain control efficacy and rational thinking'. This factor was characterised by low levels of catastrophizing and high scores on the items relating to perceived control of pain. Patients scoring high on this factor were less disabled than those scoring low on this factor. In a related study, Keefe et al. (1987b) found that, again in patients with osteoarthritis of the knee, a high score on the pain control and rational thinking factor was associated with lower levels of self-reported disability and pain. Finally, in patients with rheumatoid arthritis following TKR, high scores on the pain control and rational thinking factor was associated with lower levels of pain and disability one-year post-surgery. Both coping strategies (Haythornthwaite et al. 1998) and locus of control (Crisson and Keefe 1998) are known to impact on pain control efficacy.

Summary

The chapter has introduced the effects of personality, locus of control, coping strategies, and pain control efficacy on pain and disability in chronic conditions and their effects on success of rehabilitation. Unfortunately, much of the work completed in this area has been of a low standard with problems with sample sizes, sampling techniques or unusual choices of outcome measures (see Appendix page 412). In addition, a lot of the research is on the periphery to the desired area of study; there is very little research on the relationship between personality variables and outcome of joint replacement surgery. However, from the results collated, it appears that neuroticism exerts a negative effect on these whilst the other four broad personality domains have positive effects. Internal locus of control is associated with lower levels of pain and disability and greater activity. External control (both chance and powerful others) is associated with greater pain and disability in chronic conditions and less success in rehabilitation. Research involving coping strategies has identified catastrophizing as a key coping strategy in predicting pain and disability in chronic conditions. A higher pain control efficacy has been associated with less pain and disability in chronic conditions and post-surgery. Coping strategies and locus of control are known to impact on pain control efficacy and it is possibly through this that they exert their actions. Due to the general lack of previous studies in the area of the relationship between personality and outcome of joint replacement (and the general poor quality of those studies that have been done) it was decided to conduct an exploratory study investigating the impact of several personality factors on outcome. No specific hypotheses were set due to the lack of clear data on expected outcome. This (and the consequences of this) will be discussed further in the methodology chapter (Chapter 3) and during the general discussion towards the end of the thesis.

Chapter 3: Methodology and Data Handling

This chapter reports the following:

- Literature searching strategy and methods
- Rationale for the study.
- Aims of the study.
- The protocol used in the study:
    - Sample size.
    - Inclusion and exclusion criteria.
    - Instruments and measurements:
        - Psychological questionnaires.
            - Choice of psychological instruments to measure global personality
            - NEO-FFI
            - Choice of instruments to measure locus of control
            - MHLC
            - Choice of instruments to measures coping strategies CSQ
        - Instruments measuring outcome:
            - Summary of instruments available to measure generic, condition-specific and site-specific quality of life
            - Measurements used in hip study:
                - Oxford Hip Score
                - Self-report Harris Hip Score
            - Measures used in knee study:
                - Oxford Knee Score
                - Knee Society Knee Score
            - Measures of pain
        - Demographic questionnaires.
        - Medical measures.

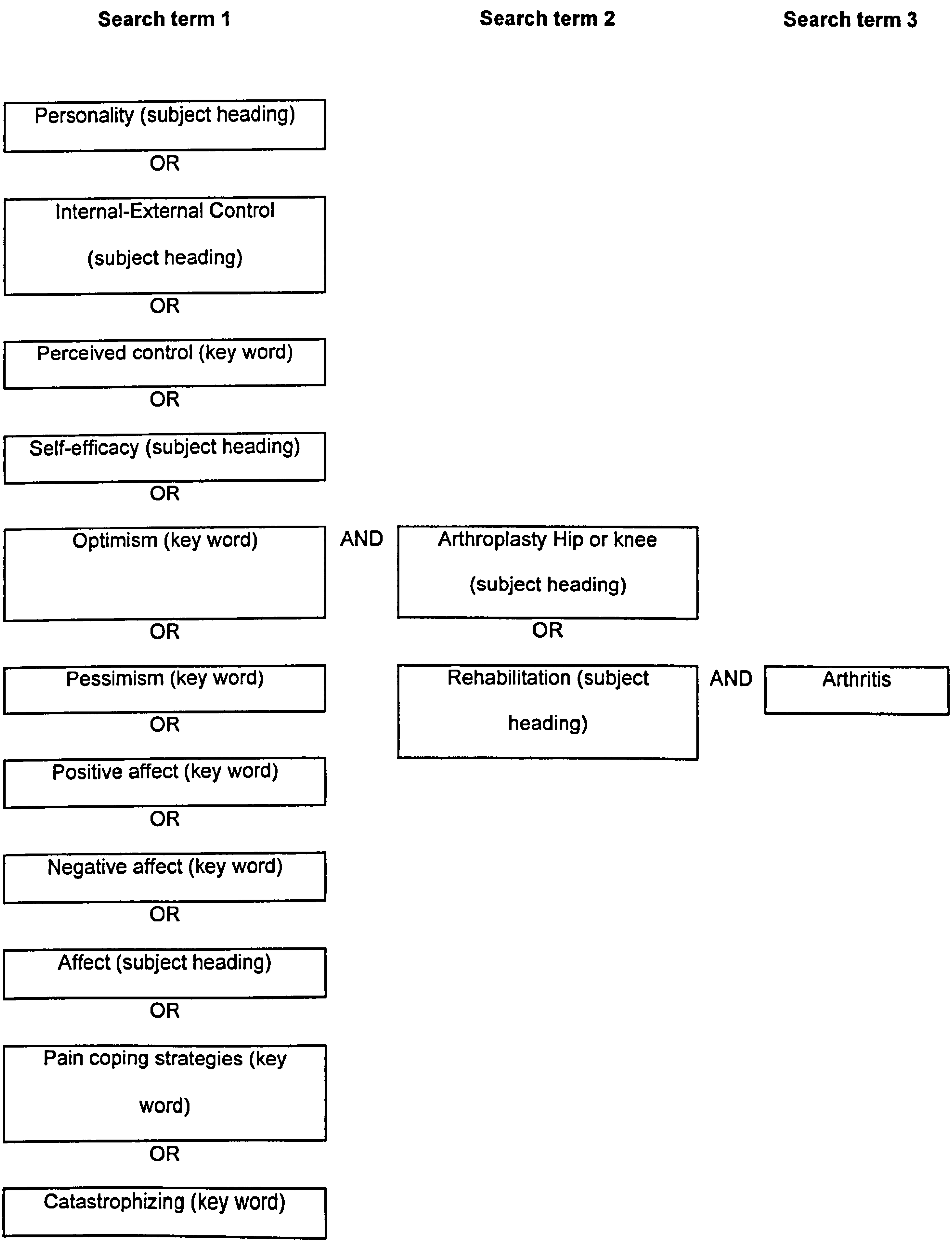
        - Physiotherapy key milestones.

- Ethics procedures:
    - Ethics approval
    - Adaptations to protocol:
        - Inclusion of patients experiencing post-operative complications.
        - Alteration of the inclusion criteria.
        - Inclusion of Claremont Hospital and Thornbury Hospital patients.
        - Inclusion of envelope B.
        - Adaptation of the protocol to include knee patients.
    - Ensuring ethical study procedures:
        - Informed consent
        - Confidentiality
        - Anonymising data.
- Data Analysis:
    - Assessment of distribution of data.
    - Variability of CSQ over time.
    - Correlational analysis assessing the relationship between the psychological variables.
    - Descriptive statistics of patient demographics.
    - Regression analyses

Literature searching strategy and methods

This section details the how the literature search was conducted, the search terms used, databases searched etc. The literature review was originally conducted between June and November 2003. (The literature was updated during 2006-2007 when the thesis was written.) From general background reading at the start of the PhD (when deciding which direction to take the research) several psychological factors which affect (or perception) of health and rehabilitation were identified. These included global personality, locus of control and pain coping strategies; which are the focus of this thesis. Additional psychological factors identified were: optimism and pessimism, positive and negative affect, self-efficacy, perceived control. The search strategy was originally specific with the aim of focusing the search on factors which affect outcome of total joint arthroplasty or in a rehabilitation setting with patients with osteoarthritis. The search was conducted using Medline via Ovid Online, psycINFO via WebSPIRS, and CINAHL. Appropriate subject headings were identified in Medline and the search strategy outlined in figure 3.1 was completed. As Medline is primarily a medical database, it was not possible to identify appropriate subject headings for all of the psychological variables of interest, and therefore free word searches were used for these.

Figure 3.1 – Original search strategy for identifying relevant literature through Medline via Ovid Online



The search strategy described in figure 3.1 yielded only a small number of results, few of which were relevant. This was due largely to the problem of subject heading mapping of the psychological variables in a medical literature database. A similar problem was experienced when using a similar search strategy in psycINFO (not shown). Whilst it was easy to map the psychological factors to an appropriate subject heading it was less easy to do so with the orthopaedic/rehabilitation outcome measures. For example, there was not a suitable subject heading for hip arthroplasty. After trawling though the literature produced by these search strategies, it was decided to take an alternative approach using free word searches.

There is a risk using free word searches that important references would be missed. In order to minimise this possibility, a list of synonyms was drawn up for each of the search terms and used in Medline, psycINFO and CINAHL. Taking this approach, still only a few articles were found in the desired area (the effect of personality on recovery following total joint replacement) so a decision was made to widen the search to include arthritis (not linked to rehabilitation as in the above search strategy), general health and health perceptions, and surgery in general. However, conducting the search with this strategy led to a large amount of irrelevant literature. Therefore, in order to minimise this, the search terms of the psychological aspects were reassessed and replaced with terms which specifically related to the constructs being studied and the methods of measuring them. For example, in this study, global personality is measured with NEO-Five Factor Inventory (NEO-FFI) and measures personality on five scales: neuroticism, extraversion, openness to experience, conscientiousness and agreeableness. When searching, each of these terms were entered into the search engines. A similar strategy was used for the other psychological constructs studied.

In addition to the literature searching completed with online databases (as described above), recent issues of a variety of psychological journals such as the European Journal of Psychology and Psychology and Health were hand-searched. Additionally, reference lists from the articles obtained were examined to source other papers.

Due to the limited literature in the area of research, it was important not to exclude any papers. Therefore the only criteria for inclusion of a paper were its availability and being published in the English language. Where possible, examples closer to the area of study were used in the literature review. Geographical area and time were not used as exclusion criteria. In addition, due to the limited literature available, studies which had a poor methodology were also included in the literature. The lax inclusion criteria for the literature may have some impact on the applicability and quality of the literature (see footnote page 2).

In general, one should only consider studies of the highest standard in generating support for a theory. Ideally papers with a poor methodology, small sample size etc. should not be considered to generate evidence, however, as already stated it was necessary to include these. This has an impact on the robustness of the data.

Papers have also been included in the literature for a wide variety of geographical settings. Different countries and cultures have a different approach to healthcare. For example, rehabilitation varies markedly with different cultures (Adebajo and Alegbeleye 2007). In addition, normal ranges of psychological variables vary with different cultures (McCrae and Terracciano 2006). Therefore, including articles from wide ranging geographical areas may have some impact on the applicability of the evidence. However, it is considered better to have some weak evidence than no evidence at all! In order to allow the reader to consider the applicability of each reference in the literature review, a table is included in the Appendix on page 412 which details the origin, setting, sample size and study type of each study.

Rationale for Study

The literature review provides examples in chronic disease of psychological variables predicting pain and function and how personality and other psychological variables can affect outcome of rehabilitation. Extrapolating the knowledge gained from other areas of rehabilitation and health psychology research, it is reasonable to assume that psychological variables may also affect the functional outcome of orthopaedic surgery. Research into the effects of psychological variables on success of recovery following TJA is still in its infancy. The small amount of research which has been conducted has focussed on individual personality constructs (e.g. locus of control) or coping processes. There is a dearth of research in this area in general and also that which focuses on high-order wide-based personality traits such as that measured with the NEO-FFI.

Aims of the Study

The main aims of the study were as follows:

1. To explore the relationship between personality, locus of control, the coping strategies used and the patient's activity limitation/participation restriction prior to total hip replacement (THR) and total knee replacement (TKR).
2. To explore the relationship between impairment, activity limitation and participation restriction prior to THR/TKR.
3. To explore the relationship between personality, locus of control, coping strategies and achievement of key physiotherapy milestones following THR/TKR.
4. To explore the relationship between personality, locus of control, coping strategies and the patient's subjective perceptions of their pain and activities limitation/participation restriction three-months post-THR/TKR.
5. To explore the relationship between impairment, activity limitation and participation restriction three-month post-THR/TKR.

In order to ensure the robustness of the findings above, an investigation of the instruments used to assess psychological factors was also planned:

1. To examine the reliability of the Coping Strategies Questionnaire (CSQ) over time in patients with OA of the hip.
2. To carry out an exploratory factor analysis (in fact a principal components analysis was later deemed more suitable for the task) to look for redundancy between the constructs. This analysis will explore whether it is possible to reduce the number of factors fitted into the main analysis. In addition, if two or more constructs were actually deemed to

be measuring the same factor, then if the study were to be repeated, a more condensed version of the questionnaire would need to be completed.

The main study aims were kept broad and no specific hypotheses were made due to lack of previous research on the area being studied. This design allows the investigation to identify possible psychological factors which affect outcome. Subsequent work carried out in this area could be more specific with tight hypotheses as to the expected outcome.

Protocol

The original protocol was designed only to include THR patients; TKR patients were added to the study as a later amendment. Therefore, this section describes the final methodology used in the hip study. The majority of the protocol is the same for the knee study, however, there are additional considerations for the knee study, which are also discussed in this section.

Study Design

This study was designed as a single-centred correlational study of 100 patients undergoing primary unilateral total hip replacement (THR) (or total knee replacement (TKR) in the knee study) as a result of osteoarthritis (OA). This is an appropriate design for an initial investigation to assess relationships between various factors.

An alternative approach would have been to employ a qualitative design to expand knowledge about this area. This was a consideration as qualitative research is often used initially to gain information about an area in which very little is known. Qualitative interviews could have been used to elucidate which psychological factors felt may contribute to their recovery following total joint replacement. Had this method of research been employed, then the response provided by the interviewees may itself have been biased by psychological factors! Research in other areas of health psychology has already provided a 'short-list' of factors which may affect outcome and therefore it was felt more appropriate to conduct an exploratory study of psychological factors using the correlation design. Regression analysis was used to assess the relationships between the dependent and independent variables. This was felt an appropriate technique as several other studies investigating the relationship between psychological variables and general health or function or pain have used this technique (see page 412 of Appendix).

Setting

The research was conducted involving patients who were under the care of the Lower Limb Arthroplasty Unit (LLAU) at the Northern General Hospital (NGH). The LLAU, consisting of four consultants and an associate specialist, specialises in total hip and knee arthroplasty surgery. This research setting was selected for the study primarily due to the large numbers of arthroplasty surgery that is conducted annually in the unit and so providing a large sample patient population for study recruitment. Patients under the care of the LLAU would receive their surgery at the Northern General Hospital (NGH), or at either Claremont or Thornbury Hospitals (private hospitals) under a waiting list initiative or patient choice.

Participants

Sampling

A convenience sampling strategy of consecutive consenting patients was used to recruit patients to the study. As all eligible patients were invited to participate in the study, it was felt that this sample of patients would be representative of patients attending for total joint arthroplasty in Sheffield (Lunsford and Lunsford 1995). However, a concern on consecutive sampling techniques is that the sample may not be representative of the wider joint-arthroplasty population; this is discussed further in Chapter 14.

Sampling Size

As this is a relatively new area of research, there is little to inform a suitable sample size for the study. A sample size of 100 was created after considering the following:

i. Kwaakel et al. (1996) advocates a method of calculating sample sizes which states that a study should contain 10 participants for each variable being investigated.

ii. Cohen (1992) calculated the number of participants required for small, medium and large effects sizes (r = .10, .30 and .50 respectively) where power is = .80 and α = .05 for various statistical tests. For multiple regression with 8 independent variables a medium effect (one that is visible to the naked eye) would be shown with 107 participants and a large effect revealed with 50 participants. (We are not interested in the small effects as part of the rationale for the study was to generate knowledge for the future development of interventions tailored to different personality types. If the effect were only small, then an intervention would be unlikely to have any clinical benefit).

iii. The number of patients that could be recruited and retained on the study during the finite research period based on the number of patients undergoing unilateral THR per year within the LLAU.

Inclusion Criteria

All patients who were listed to attend orthopaedic pre-operative admission assessment clinic at NGH during the research period who were under the care of one of the five clinicians in the LLAU and who were attending for assessment prior to undergoing unilateral THR (or TKR in the knee study) as a result of OA were eligible to take part in the study.

The recruitment phase of the hip study ran from May 2004 until August 2005 (and the recruitment phase of the knee study ran from October 2004 until December 2005). The weeks that the researcher was on annual leave, no patients were recruited. This was not expected to introduce bias into the study findings. If the researcher was unexpectedly unable to attend (i.e.

due to illness), then if possible the consultant or orthopaedic research nurse linked with the LLAU took informed consent from patients willing to take part in the study.

Exclusion Criteria

Patients were excluded from the study if they did not have a reasonable ability to understand written English. This was necessary for the completion of questionnaires which were all self-administered.

Patients were excluded from the study if they had a condition or past medical history (stroke, dementia, learning difficulty) which may affect their ability to comprehend the information in the study. Again, this was necessary for the completion of the questionnaires. In the manual for the NEO-Five Factor Inventory, Costa and McCrae (1992) state that patients with dementia should not be asked to complete the questionnaires. Patients who had experienced a previous transient ischaemic attack (TIA) were not excluded from taking part in the study as TIAs are not thought to have any lasting impact on the patient's cognitive ability.

Patients were excluded from the study if they had a pre-existing condition which would prevent the normal usage of a Zimmer frame or crutches such as rheumatoid arthritis, osteoarthritis or injury of an upper limb joint.

Patients were excluded from the study if they had a medical aetiology that may have adversely affected the rehabilitation process, such as multiple sclerosis or stroke. This included patients with OA of another lower limb joint for which surgery was planned (e.g. if the patient was listed for staged bilateral THR or a unilateral THR followed by a unilateral TKR). Patients were not excluded from the study if they had OA of another lower limb joint but for which not surgery was planned, as in the study population many patients (especially in older age groups) have multiple joint involvement and would not be practical to exclude this population.

Instruments and measurements

Baseline Recordings

The following information was recorded at orthopaedic pre-admission assessment clinic or from the self-administered questionnaire pack. The instruments will be discussed in more detail in the instruments section below:

- Range of Motion of hip joint (ROM) (or knee joint for knee study).
- Demographic information.
- Multi-dimensional Health Locus of Control Questionnaire (MHLC).
- Coping Strategies Questionnaire (CSQ).
- NEO- Five Factor Inventory (NEO-FFI).
- Self-Report Harris Hip Score (HHS) (The Knee Society Knee Score for the knee study).
- Oxford Hip Score (OHS) (The Oxford Knee Score was used in the knee study).

Utilising Hospital Medical Records

The following information was recorded from the patients' hospital records (paper and electronic databases):

- Date of surgery.
- Hospital which patient had surgery.
- Co-morbidities which may affect outcome of rehabilitation (see Appendix pages 501: hip 514: knee). This information was recorded from the clerking notes taken by the nurse and junior doctor at the orthopaedic pre-admission assessment clinic. A list of co-morbidities which may affect the outcome of a total joint replacement was developed in consultation with orthopaedic physiotherapists and clinicians in the LLAU about their clinical experiences. The co-morbidities which were deemed to possibly affect the outcome of TJA were chronic obstructive pulmonary disease, shortness of breath on exertion, asthma, previous pulmonary embolism, previous myocardial infarction, previous deep vein thrombosis, angina, and previous coronary artery bypass graft. For the purpose of analysis they were divided into the broad categories of cardiology,

respiratory, and cardiology & respiratory. It was felt unnecessary to include a neurological category and rheumatological category as these patients were excluded at the recruitment point.[5]

- Referral to physician prior to surgery to check for suitability of surgery. In instances where the surgeon felt that the risk of surgery may have been increased by the patient's past medical history (co-morbidities), patients were suspended on the waiting list and referred to a physician to check that they were in the best possible shape before undergoing their surgery. This information was recorded on the medical information sheet (Appendix pages 501: hip and page 514: knee) as it was felt that this would provide an additional measure as to the severity of the co-morbidities. This information was taken from the notes recorded in the patients' notes from pre-admission assessment clinic, orthopaedic outpatient clinic and from correspondence between the surgeon and the medic.
- Previous joint arthroplasties (Appendix pages 502: hip and 515: knee). It was deemed important to record this information as it was felt that this factor may influence the outcome of the surgery (at the key milestones stage). There is some evidence that educating the patients about the surgery and rehabilitation has a positive effect on success of the surgery (Roach et al. 1995;Tappen et al. 2003) (See chapter 1) and there can be no better education than previously experiencing the procedure oneself.
- Post-operative complications (Appendix pages 501: hip and 515: knee). Post-operative complications such as pulmonary embolism, deep vein thrombosis are known to adversely affect early inpatient outcome (Epps 2004) and therefore were recorded as a confounding variable. The information was recorded from a combination of physiotherapy notes, the variance sheet in the orthopaedic unit primary/bilateral total

---

[5] This novel approach to recording co-morbidity was deemed fit for the purpose of the study. Previous studies have used medication usage as a proxy for co-morbidities. However, this method was not used in the current study as it is not necessarily a reliable method for recording co-morbidities. Medication usage is subject to both client and clinician preferences. The clinician may be aware of a condition but choose not to treat it with medication or choose an alternative medication to another clinician. Schneeweiss and Maclure (2000) state that:

"Prescription drugs as proxies for diagnoses can face reduced validity because they often have mixed indications, and because of a tendency to avoid providing additional drugs to patients who are already taking several and to reduce preventative medication in sicker patients." (Schneewiess and Maclure 2000:897)

The client may be aware of a condition they have but choose not to be treated for that condition (for example, if they deem the side effects of the medication to be more severe than the effect of the treatment). Therefore, it was felt that using medication as a proxy for co-morbidity in this patient group would be unable reliable and it would be more acceptable to rely upon the clerking taken at pre-admission assessment clinic.

hip replacement collaborative care pathway booklet, and from notes from post-operative orthopaedic outpatient clinic appointments.

- Physiotherapy key milestones (see below for further details).

Outcome Measures

Physiotherapy Outcome Measures

Time taken (in days) to achieve the following key physiotherapy milestones was recorded:

- Achievement of Straight leg raise (SLR) (knee study only)
- Achievement of 90° bend (knee study only)
- Independently bed transfer (movement from supine to standing independently).
- Independently chair transfer (from sitting to standing position).
- Independent with Zimmer frame. (This milestone was not recorded in all patients as some patients progressed straight to crutches rather than first utilising the frame and in other cases the patient began to learn to use the crutches before independent with frame. In these instances time to taken to be independent with crutches is recorded as a conservative measure for the purpose of the analyses.)
- Independent with crutches. (This milestone was not recorded in all patients. Some patients deviated from the normal care pathway and were discharged home using a Zimmer frame. This was usually in cases where the patient did not feel confident enough to use crutches or where the physiotherapist felt that the patient would be unsafe using crutches unsupervised but where the patient was competent in all other aspects of their care. In these instances number of days until deemed ready for discharge by physiotherapy team is recorded as a conservative measure of this for the purpose of analysis.)
- Number of days until deemed ready for discharge by the physiotherapy team. (This milestone was recorded as the patient maybe fit from a physiotherapy perspective for discharge some time before they can be discharged from the ward. This is because

patients may be waiting for transport, social services to deliver equipment to the house etc before the discharge can occur.)

- Post-surgical length of stay.

In each case the day of surgery was considered as day 0. Independence is defined for the purpose of the study as successful completion of the task without physical aid from another person. Emotional support was permitted as long as the physiotherapist felt confident that the task could be performed adequately if the patient were alone. In some cases the notes record a task being completed "on day x with minimal assistance". In these instances, if the exact day that independence is achieved is not recorded, then independence on that task is assumed to have occurred the following day (day x + 1).

Three-Month Post-operative Outcome Measures

- Range of motion.
- Oxford Hip Score (Oxford Knee Score in knee study).
- Harris Hip Score (Knee Society Knee Score in knee study).

Instruments

This section introduces each of the instruments used in this study. The psychological instruments will be discussed first including a discussion of the important considerations of selecting appropriate measures followed by a rationale of why each of the instruments was selected as some brief detail about each of the instruments. This will be a followed by a similar discussion for the outcome measures, before detailing the demographic questionnaire.

Psychological Instruments

The psychological instruments used in this study were:

- NEO Five Factor Inventory (NEO-FFI).
- Multidimensional Health Locus of Control Questionnaire (MHLC).
- Coping Strategies Questionnaire (CSQ).

The relationships between the traits and strategies measured on these instruments are explored in Appendix 6 (page 566).

Choice of psychological Instruments

The above instruments were selected after considering the other instruments available which measure these traits. This section details the rationale for choosing each instrument for each of the constructs measured.

Choice of Psychological Instrument to Measure Global Personality

Several instruments are available to measure global personality including the NEO Five Factor Inventory (Costa and McCrae 1992), NEO Personality Inventory – Revised (Costa and McCrae 1992), Goldberg's measure of the 'big five' – the International Personality Item Pool (Goldberg 1999), Eysenck's Personality Inventory (Eysenck et al. 1985), Cloninger's Tridimensional Personality Inventory (Cloninger et al. 1993), and the Myer-Briggs Type Indicator. Each of the above instruments was considered as for inclusion in the study as the measure of global personality; the details of each are summarised in table 3.1

Table 3.1: Comparison of the instruments considered for measuring personality in the study

Instrument	Construct measured	Number of items	Applicability
Cloninger's Tridimensional Personality Inventory (TPQ)(Cloninger 1987)	Four dimensions measured: • Harm avoidance • Novelty Seeking • Reward Dependence • Persistence	100	Designed to assess both normal and abnormal personality, the TPQ has been used for extensively in health research. However, most research has focussed on drug and alcohol addiction.
Eysenck's Personality Inventory (EPQ) (Eysenck et al. 1985)	Three constructs measured: • Extraversion/Introversion • Neuroticism/Stability • Psychoticism/Socialisation	100	The Extraversion/Introversion and Neuroticism/Stability scales are still used in health psychology research. However, the current consensus is of a five factor model which this questionnaire does not support.

Table 3.1 Continued: Comparison of the instruments considered for measuring personality in the study

Instrument	Construct measured	Number of items	Applicability
International Personality Item Pool (IPIP) (Goldberg 1990)	Measures the 'big five': • Surgency • Agreeableness • Conscientiousness • Emotional Stability • Intellect	300	Little relevant research has been conducted using the IPIP
Myer-Briggs Type Indicator (MBTI) (Myers and McCaulley 1985)	Four dichotomies measured: • Introversion/Extraversion • Sensing/Intuition • Thinking/Feeling • Judging/Perceiving	88	The MBTI is well-known as it is commonly used in employment tests, career counselling etc. However, little relevant research has been conducted with the MBTI in health psychology.

Table 3.1 Continued: Comparison of the instruments considered for measuring personality in the study

Instrument	Construct measured	Number of items	Applicability
NEO Five Factor Inventory (NEO-FFI) (Costa and McCrae 1992)	Measures the 'big five': • Neuroticism • Extraversion • Openness to Experience • Agreeableness • Conscientiousness	60	Both the NEO-FFI and NEO PI-R have been fairly extensively used in health psychology research. Marshall et al. (1994) suggested that the five factor model, measured with either the NEO-FFI or the NEO PI-R, could be used an initial organisational framework for research aimed at understanding the link between personality and health.
NEO Personality Inventory – Revised (NEO PI-R) (Costa and McCrae 1992)		240	

The current consensus among trait theorists is that personality can be measured with five constructs (Goldberg 1990). These have been coined 'the big five'. Eysenck's Personality Questionnaire and the Cloninger's Tridimensional Personality Questionnaire, whilst popular choices in health psychology, do not adhere to this structure and therefore were not further considered for inclusion in the study. The three instruments considered for inclusion which measured 'the big five' were Goldberg's International Personality Item Pool (IPIP), and the two instruments developed by Costa and McCrae; the NEO-Five Factor Inventory (NEO-FFI), and the NEO-Personality Inventory Revised (NEO PI-R). Goldberg's instrument in lengthy, being 300 items in length, and little relevant research had been conducted using this instrument. Therefore the choice came down to either the NEO-FFI or the NEO PI-R. Both have been used fairly extensively in health psychology research and Marshall et al. (1994) advocates their use in understanding the links between personality and health. The NEO PI-R is a lengthy instrument comprising 240 items; this was deemed too taxing for participants as they would also be asked to complete a number of other questionnaires. Additionally, the NEO PI-R breaks each of the dimensions down into facets. For example, the neuroticism dimension includes the facets of anxiety, hostility and depression; this was deemed in too greater depth for an exploratory study. Therefore, it was decided to use the NEO-FFI, which is much shorter containing only 60 items but still with a reasonable degree of reliability and validity. Further details of the NEO-FFI can be found in the section below.

NEO Five Factor Inventory

The NEO Five Factory Inventory (NEO-FFI) (Costa and McCrae 1992) measures 'the big five': neuroticism, extraversion, openness to experience, agreeableness and conscientiousness. Definitions of each of these traits are stated on Appendix page 403. McCrae and Costa's five factor model of personality has been used in a variety of different health research settings (Booth-Kewley and Vickers 1994;Lemos-Giráldez and Fidalgo-Aliste 1997;Jerram and Coleman 1999;Vollrath et al. 1999;Goodwin and Engstrom 2002;Duberstein et al. 2003;Goodwin et al. 2006). The NEO-FFI has a lower reliability than the full NEO PI-R but is still of an acceptable level. Internal consistency has been reported as 0.86 (neuroticism), 0.77 (extraversion), 0.73

(openness to experience), 0.68 (agreeableness) and 0.81 (conscientiousness). (Costa and McCrae 1992).

Form S of the NEO-FFI is a 60-item self-report questionnaire which is appropriate for use by male or female adults (a copy of the questionnaire can be found in the Appendix 5 page 548 and the scoring system of page 553). Twelve items assess each of the domains measured. Each item contains a statement such as *'I usually prefer doing things alone'* which respondents must select how much they agree with the statement from a choice of strongly disagree, disagree, neutral, agree, and strongly agree. For each domain, the score from the 12-items is added up; the minimum score is 0 and the maximum is 48.

Choice of Psychological Instruments to Measure Locus of Control

Several instruments are available to measure locus of control (LOC) including the classic Locus of Control Scale developed by Rotter (1966). However, when deciding which instrument to use as a measure of locus of control for the study, only instruments which focused on health locus of control were considered. A review by Furnham and Steele (1993) suggested appropriate instruments to consider. These included the Health Locus of Control Questionnaire (HLC) (Wallston et al. 1976) and the Multi-dimensional Health Locus of Control Questionnaire (MHLC) (Wallston et al. 1978). A more recent version of the MHLC has been published which can be made condition-specific (Wallston et al. 1994). In addition, the Recovery Locus of Control Questionnaire (Partridge and Johnston 1989) is specific for patients in rehabilitation. Each of these instruments were considered for inclusion as the instrument to measure health locus of control in the study. Their characteristics are summarised in Table 3.2 below.

Table 3.2 Characteristics of different instruments measuring health locus of control

Instrument	Multi-dimensional?	Number of Items	Condition-Specific?	Applicability to area of research?
Health Locus of Control Questionnaire		11		✓
Multi-dimensional Health Locus of Control Questionnaire	✓	18		✓
Multi-dimensional Health Locus of Control Questionnaire Form C	✓	18	✓	✓
Recovery Locus of Control Questionnaire		9	✓	✓

All four of the instruments considered have been used in relevant research in the field of health psychology. In addition all of the instruments were fairly short in length and therefore the burden on the participant in completing the instrument was not considered.

One important factor to consider when selecting the instrument was whether they considered LOC to be unidimensional or multidimensional. The original LOC scale developed by Rotter was unidimensional with internal LOC and external LOC considered as polar opposites. This theory was challenged shortly after by Leverson (1972) who suggested that LOC should be considered multidimensional and that external and internal beliefs should be separated. In addition, Leverson (1972) suggested that a third dimension, chance, should be added. Logically, it is possible that when a patient is considering who is responsible for the health, the beliefs that the individual themselves, external sources such as doctors and nurses, and chance or fate, can all play a part. Therefore instruments which consider LOC to be multidimensional are favoured.

Another important factor to consider is whether the instrument is condition-specific i.e. does the instrument probe the respondents feelings on LOC with relation to their situation with respect to their health. Only the Recovery Locus of Control Questionnaire which was designed for use in patients in a rehabilitation setting was condition-specific. However, the Multi-dimensional Health Locus of Control Questionnaire allows adaptation to make the instrument condition-specific.

As the Multi-dimensional Health Locus of Control Questionnaire Form C met all of the criteria of being applicable to the area of research, condition-specific, multi-dimensional, and short in length, it was chosen for inclusion in the study as the most appropriate measure for LOC. Further details of the instrument can be found in the section below.

Multidimensional Health Locus of Control Questionnaire

The Multidimensional Health Locus of Control Questionnaire (MHLC) measures locus of control, or who the respondent believes is responsible for control of their health. It measures three different domains of locus of control which are internal (the individual), chance, and external (e.g. doctors and others).

Much research has been conducted assessing the effect of locus of control in a health care setting (Partridge and Johnston 1989;Härkäpää et al. 1991;Härkäpää et al. 1996;Kendell et al. 2001;Shaw et al. 2003) and of the instruments available this was deemed most appropriate to measure LOC for the study (see above section).

This study used form C of the MHLC (Wallston et al. 1994) which can be adapted appropriately to be condition-specific. Form C has been shown to be reliable with internal consistencies of between .70 and .87 for the 4 scales. (Wallston et al. 1994). The altered version used in the study can be found in Appendix page 522 (and page 534 for knee version) and the scoring system is located on page 551. The questionnaire contains 18 statements which the respondent answers with a choice of strongly disagree, moderately disagree, slightly disagree, slightly agree, moderately agree, and strongly agree (1 = strongly disagree, 6 = strongly agree). The lack of neutral or "don't know" option forces a response. Six items on the questionnaire measure internality, and a further six items measure chance externality. The powerful others externality section is further subdivided into doctors and others; each of which are measured by three items.

Choice of Psychological Instruments to Measure Coping Strategies

There are several instruments available to measure coping strategies including the field standard, the Ways of Coping Questionnaire[6], the Coping Strategy Indicator, and the Coping Measures Questionnaire. These instruments, however, focus on coping strategies to cope with everyday stressors and not specifically in pain. It is already well documented that pain coping strategies affect pain and function in osteoarthritis and therefore it was felt important to focus on instruments designed specifically to assess coping strategy usage in pain. Previous research has found the coping strategy, catastrophizing, to be important in pain and disability (Keefe et al. 1989;Sullivan et al. 1998;Severeijns et al. 2001;Buer and Linton 2002;Whyte and Carroll 2004;Sullivan et al. 2005;Peters et al. 2005a;Vervoot et al. 2006) and therefore it was considered whether a specific instrument should be used to assess this such as the Pain Catastrophizing Scale developed by Sullivan et al. (1995). However, it was decided that as this is an exploratory to study, to include an instrument which measures several coping strategies. If the results were to show catastrophizing to be an important work, then future work could focus more closely on this coping strategy using a dedicated scale. The two scales which were consider for the study were the Coping Strategies Questionnaire (CSQ) developed by Rosenstiel and Keefe (1983) and the Chronic Pain Coping Inventory (CPCI) (Jensen et al. 1995). The CSQ measures 7 coping strategies; these are diverting attention, reinterpreting pain sensations, coping self statements, ignoring sensations, praying hoping, catastrophizing, and increasing behavioural activities. In addition, two items measure pain control efficacy. The CPCI contains 65-items measuring 11 different coping strategies: guarding, resting, asking for assistance, relaxation, task persistence, exercise/stretch, seeking social support, coping self-statements, opioid medication use, non-steroidal medication use, and sedative-hypnotic medication use. Whilst some of the scales measure psychological coping such as coping self-statements, guarding (which is a sign of catastrophizing), some of the other scales focus more

[6] A table of references for each of the instruments discussed in this thesis is included on Page 407 of Appendix

on the treatment aspects of coping with the pain (such as the categories concerning medication use). These were not of interest, as the study being developed was to assess psychological factors which affected outcome after joint-replacement. Therefore, it was decided to use the CSQ to measure pain coping strategies in the study. Further information about the CSQ is found in the section below.

Coping Strategies Questionnaire

The Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) measures different coping strategies employed in coping with pain. A great deal of research has been conducted assessing the impact of coping strategies on pain and function in chronic diseases (Keefe et al. 1987b;Keefe et al. 1991;Keefe et al. 1997a;Haythornthwaite et al. 1998;Rapp et al. 2000). Much of this research has focused on the maladaptive coping strategy catastrophizing (Keefe et al. 1989;Sullivan et al. 1998;Sinclair 2001;Sullivan et al. 2001;Severeijns et al. 2001).

The CSQ has been shown to possess acceptable levels of internal consistency (Rosenstiel and Keefe 1983). There has been some question as to the reliability of it over time. Main and Waddell (1991) reported high levels of reliability over a 3-day period but the reliability was found to be substantially lower over a longer period of 6-months (Keefe et al. 1990a;Keefe et al. 1990b). An assessment of reliability over time has been conducted in this study and has been included in the Appendix on page 563.

The CSQ contains 50-items (including 4 filler items) which measure seven different coping strategies and include an assessment of efficacy in controlling or decreasing pain. Each item contains a statement of a coping strategy used when in pain. For example *"when I feel pain I rely on my faith in God"*. Participants are asked to respond on a 7-point Likert-type scale with 0 representing '*never do that*', 3 representing '*sometimes do that*' and 6 representing '*always do that*'. The seven coping strategies measured are diverting attention, reinterpreting pain sensations, coping self statements, ignoring sensations, praying/hoping, catastrophizing and increasing behavioural activities (definitions of these have been provided on page 403 of the Appendix). For each of the coping strategies measured, the minimum score is 0 and the maximum score is 36. In addition, one item measures efficacy in controlling pain with the question: *'Based on all the things you do to cope, or deal with your pain, on an average day, how much control do you feel you have over it?'* and one item assesses efficacy in decreasing pain with the question: *'Based on all the things you do to cope, or deal with your pain, on an average day, how much are you able to decrease it?'*. Each item is answered a 7 point Likert-type scale with 0 representing no control, 3 representing some control, and 6 representing complete control. A copy of the CSQ is located in the Appendix 5 on page 544 and the scoring system on page 552.

Orthopaedic Instruments – Hip Study

Choice of Orthopaedic Measures and Instruments to Measure Impairment

A variety of different measures could have been used to assess impairment. These include a rating of severity of radiographic changes in the joint, Charnley grade and range of motion. The choice of method to assess impairment was largely influenced by the practicalities of conducting the study. The study was entirely unfunded and therefore I was reliant on the surgeons' and nurses' goodwill in completing a measure of impairment. The Charnley hip assessment is time consuming. Assessing radiographical severity of the joint requires a high level of expertise and would be time consuming for the surgeon to complete for study patients. Additionally, previous research has shown a limited relationship between impairment, as measured with x-severity, and other outcome measures used when assessing osteoarthritis of the hip and knee (Dieppe 1989;Dieppe et al. 1997) Range of motion (assessed using the ROM component of the Harris Hip Score) was being used as a measure of impairment on another study running in the department (The Stem Design Study) and therefore there were nurses and surgeons available to make this assessment for patients.

Choice of Self-Report Outcome Measures

There are many scales available to measure outcome in hip replacement patients. Bowling (1997;2001) provides information on many of the generic and condition-specific quality of life instruments that can be used to assess outcome in rheumatological conditions. In addition, site-specific instruments such as the Oxford Hip Score (OHS) are available and are commonly used in this area of research. Tables 3.3 (generic), 3.4 (disease-specific) and 3.5 (site-specific) provide brief descriptions of the common outcome measures and their psychometric properties.

Table 3.3: Details of generic measures considered for measurement of outcome in the hip study

Instrument	Items	Details of measurement	Psychometric Issues
Sickness Impact Profile (SIP) (Bergner et al. 1981)	136	12 domains measured: work, recreation, emotion, affect, home life, sleep, rest, eating, ambulation, mobility, communication & social interaction.	**Validity:** Bowling (1997) summarised the findings of studies assessing the clinical validity of SIP and stated that correlations ranged 0.40 – 0.60. **Reliability:** Assessed by de Bruin et al. (1992):Test-retest reliability: 0.75-0.85, Internal consistency: 0.91-0.95, Inter-rater reliability: 0.87-0.92. **Sensitivity:** De Bruin et al. (1992) stated that the SIP may be insensitive to small positive changes (improvement)
Nottingham Health Profile (NHP) (part 1)[7] (Hunt et al. 1986)	38	6 domains measured: mobility, pain, energy, sleep, emotional recreations and social isolation.	**Validity:** Satisfactory face, content and criterion validity (Hunt et al. 1986) **Reliability**: Test-re-test: 0.71-0.88 (Hunt et al. 1986) **Sensitivity**: sensitive to change (Jenkinson et al. 1988;O'Brien et al. 1988;Caine et al. 1991). However, Jenkinson et al (1988) concluded that *"the domains of measurement of pain, as measured by the instrument, are found to be confounded"*. (Jenkinson et al. 1988:1411)

[7] Part 1 of the NHP contains the domains listed in the table above. Part II looks at the impact of health on seven areas of life. These are: work, looking after the home, social life, home life, sex life, interests, hobbies and holidays. Bowling (1997) states that: *"Part II is not always a useful addition. For some groups several items do not apply e.g. the elderly, the unemployed, the disabled, those on low incomes. The authors have recently carried out developmental work on Part II and recommended that Part II should no longer be used"*. Therefore, only Part I of the NHP is discussed in the table above.

Table 3.3 continued: Details of generic measures considered for measurement of outcome in the hip study

Instrument	Items	Details of measurement	Psychometric Issues
SF-36 (Ware et al. 1993)	36	8 domains measured: Physical functioning, social functioning, role limitation due to physical problems, role limitation due to emotional problems, mental health, energy/vitality, pain and general health perceptions.	**Validity:** Ware et al. (1993) reported a good correlation between the physical functioning subscales of SIP, AIMS & NHP (0.52-0.85). Others are concerned that the instrument does not possess face validity. Bowling (1997) cites a study conducted by Hills and Harries (1994) who were assessing outcomes in the community-dwelling adults over the age of 65. The participants reported during interviews that the SF-36 did not reflect their values. Bowling (1997) goes on to state: *"These findings support the arguments of Hunt and McKenna (1993) who argue that the development and testing of the SF-36 has relied too heavily on psychometric techniques at the expense of serious consultation of lay people for their views about the instruments"(Bowling 1997:59)* **Reliability**: Internal co-efficiency correlations were reported to be between 0.60-0.81 for the 8 scales (Brazier et al. 1992) **Sensitivity**: Brazier et al. (1999) reported that three of SF-36 scales (physical functioning, pain and vitality) were sensitive to change in patients pre- to post-TKR. However, they found the WOMAC was more sensitive in detecting change in TKR.

Table 3.4: Details of condition-specific measures considered for measurement of outcome in the hip study

Instrument	Items	Details of measurement	Psychometric Issues
Arthritis Impact Measurement Scale (AIMS) (Meenan et al. 1980)	45	Measures 9 domains: mobility, physical activity, ADL, dexterity, household activities, pain, social activities, depression and anxiety. These have been grouped into 3 scales: pain, physical disability, and psychological status.	**Validity:** Assessed by Meenan et al. (1980) by correlating scores from the subscales with the American Rheumatism Association functional status and disease were reported to be satisfactory. **Reliability**: Assessed by Meenan et al. (1980) . Test-retest reliability: 0.60-0.90. 0.87 (across all scales). **Sensitivity**: Assessed by Meenan et al. (1984) and concluded that the instrument was sensitive enough to detect clinically meaningful improvements.
Arthritis Impact Measurement Scale (2) (AIMS2) (Meenan and Mason 1990)	78	Measures 12 domains: mobility level, walking and bending, hand and finger function, arm function, self-care tasks, social activity, social support, pain from arthritis, work, level of tension and mood.	With respect to the psychometric issues relating to AIMS2, Bowling (2001) states: *"While the scaling properties, validity and reliability of AIMS-2 have been reported to be satisfactory with initial tests, most information on the psychometric properties of AIMS comes from the extensive work carried out on AIMS-1 (Meenan and Mason, 1990). Given that items have been revised, deleted and some new items have been added, and given that most responses are now scaled, it is uncertain to what extent the results from AIMS-1 apply to AIMS-2".* (Bowling 2001:234) **Reliability**: Assessed by Meenan et al. (1992): Internal consistency: 0.72-0.96, Test re-test reliability: 0.78-0.84.

Table 3.4 Continued: Details of condition-specific measures considered for measurement of outcome in the hip study

Instrument	Items	Details of measurement	Psychometric Issues
Western Ontario and McMaster Universities Arthritis Index (WOMAC) (Bellamy et al. 1988)	24	Contains 3 subscales: pain, stiffness, and physical function.	McConnell et al. (2001) reviewed the psychometric properties of the WOMAC. These are their findings: **Validity:** McConnell et al. (2001) comment that: *"...the WOMAC has convergent construct validity with numerous impairment (e.g. range of motion, radiology Kellegren rating) and disability (e.g. Short Form-36 physical function, Nottingham Health Profile function scale) measures; that is, there is moderate or strong correlations between the measures"* **Reliability**: 5 studies had assessed test re-test reliability. These ranged from 0.65-0.90 for pain, 0.43-0.76 for stiffness, and 0.68-0.93 for physical function. Bellamy et al. (1988) reported the internal consistency to be 0.86 for pain, 0.90 for stiffness, and 0.95 for physical function. **Sensitivity:** THR and TKR had large effect sizes for the WOMAC.(McConnell et al. 2001)

Table 3.5: Details of site-specific measures considered for measurement of outcome in the hip study

Instrument	Items	Details of measurement	Psychometric Issues
Harris Hip Score (Harris 1969)		Surgeon assessed measure of ROM, pain and function.	**Validity**: Söderman et al. (2001) reported moderate correlations between domains of HHS with domains of the WOMAC, SF-36, NHP: Pain 0.36-0.42, Function: 0.42-0.50. Kalairajah et al. (2005) reported a good correlation between HHS and OHS. **Reliability:** Söderman and Malchau (2001) reported a test re-test reliability of 0.94 and good internal consistency for the HHS. **Sensitivity:** Ritter et al. (1990) reported that the HHS was more sensitive to pain than the Charnley but may not be sensitive enough and does not affect overall score.
Self-Report Harris Hip Score (Mahomed et al. 2001)	7	7 items assess pain, walking aid, limp, distance able to walk, climbing stairs, donning shoes & socks, and sitting.	**Validity:** Mahomed et al. (2001) reported good correlations between the self-report version of HHS and the surgeon-assessed HHS (0.99) and the self-report HHS with components of WOMAC (0.90-0.96) and SF-36 (0.71-0.97). **Reliability**: not tested.

Table 3.5 Continued: Details of site-specific measures considered for measurement of outcome in the hip study

Instrument	Items	Details of measurement	Psychometric Issues
Oxford Hip Score (OHS) (Dawson et al. 1996a)	12	12 items assessing pain, activities limitation and participation restriction.	**Validity:** Dawson et al. (1996a) reported moderate correlations between the OHS and components of the Charnley Hip Score (0.28-0.58), SF-36 (0.25-0.71), and AIMS (0.03-0.66). **Reliability:** Internal consistency was measured by Fitzpatrick et al. (2000) in a study of 7151 THR patients. Reported to be between 0.86-0.92. Dawson et al. (1996) reported good test re-test reliability. **Sensitivity**: Fitzpatrick et al (2000) reported that the instrument was sensitive to change from pre- to post-operatively.

Tables 3.3-3.5 summarise the psychometric properties of several the outcome measures suitable for assessing outcome in THR as a result of OA. Brazier et al. (1999) compared the WOMAC, Health Assessment Questionnaire (HAQ), SF-36, and EuroQol for suitability as outcome measures in rheumatology patients and patients undergoing TKR. The validity, reliability, ease of use and acceptability to patients, and responsiveness were assessed. All four measures were found to be satisfactory in terms of ease of use, acceptability, validity and reliability. However, they differed in terms of their responsiveness. In the TKR group, WOMAC was found to be the most responsive to change whereas in the rheumatology group the SF-36 was the most responsive instrument. These findings are in line Bachmeier et al. (2001) who reported that in 86 THR and 108 TKR patients, the WOMAC was more responsive than the SF-36 especially early on in the recovery period. In contrast to Brazier et al.'s (1999) findings in the rheumatology group, Salaffi et al. (2005) reported that the WOMAC was more responsive to change than the SF-36 in patients with OA of the hip or knee (who were not undergoing TJR). Therefore, from the generic and site-specific instruments available, it appears that the WOMAC is the most appropriate instrument to assess outcome in TJR.

However, there are also site-specific instruments available to assess the outcome of THR. The measures discussed are the HHS and the OHS. Although the HHS is commonly used, the psychometric properties suggest that the instrument is not very desirable. The self-report HHS seems to fair slightly better but there is only preliminary work by Mahomed et al. (2001). The psychometric properties of the OHS are more promising. The advantage of a site-specific instrument to assess outcome of THR is explained by Dawson et al. (1996b):

> *"A hip specific instrument (Oxford Hip Score) is likely to be more able to distinguish between symptoms and functional impairment produced by the index joint, as compared with other joints and conditions than either a disease-specific instrument (AIMS) or a generic health status (SF-36)."* (Dawson et al. 1996b: 224)

In Dawson et al.'s (1996b) study, responsiveness of the OHS, AIMS and SF-36 was assessed in patients who had undergone THR and had no other lower limb problems compared with patients who had undergone THR and had other lower limb symptoms. Although no difference existed between the two groups in terms of success of outcome of THR, both the SF-36 and

AIMS detected a difference suggesting that they were influenced by co-morbid conditions. The OHS, however did not detect a difference between the two patient groups. As some of the patients undergoing THR in my study are likely to have some degree of symptoms/problems in other areas of their lower limbs, it is important to select an outcome measure which can be specific to the joint and not affected by other co-morbidities or conditions.

Finally, Garbuz et al. (2006) compared the WOMAC and OHS in 402 THR patients one-year post-surgery. They reported that both instruments had problems with floor and ceiling effects indicating that neither instrument is ideal. However, the OHS was found to be marginally more responsive than the WOMAC.

From the discussion above it appear that the OHS and the WOMAC are the most appropriate outcome measures to assess improvement following THR. However, the hip study was originally going to be linked to another study being conducted within the same department and with the same patient population (the Stem Design Study) to allow sharing of resources (please see ethics section of methodology on page 79). As such it was necessary for my study to contain the same outcome measures (OHS, HHS) as the Stem Design Study. Therefore, whilst it is acknowledged that the WOMAC may have been a more appropriate choice (see section above) of outcome measure, it was not feasible to do this due to burden on the patient. In the ethical amendments section further into this chapter it is noted that due to slow recruitment to the Stem Design Study as a result of tight inclusion criteria, an amendment to ethics was sought to allow the two studies to run separately. At this point it was considered whether the outcome measures should be changed as the WOMAC was preferable to HHS. However, the ethics committee approving the study provided guidance that it would not be appropriate to use different outcome measures to the Stem Design Study as many of the patients would be participants in both studies and adding different outcome measures would increase the burden on the patient. Therefore the orthopaedic instruments used in the hip study were:

- Oxford Hip Score.
- Self-Report Harris Hip Score.
- Range of Motion section from Harris Hip Score.

Each of these shall now be discussed in more detail below.

Oxford Hip Score

Oxford Hip Score (OHS) (Dawson et al. 1996a) is a self-report measure assessing pain and function relating to the hip. The questionnaire contains twelve items which are scored from one to five. The total score ranges from 12-60 with twelve indicating the best possible function and pain-free whilst sixty indicates the greatest pain and disability. The OHS has been shown to possess good validity and reliability (Dawson et al. 1996a;Fitzpatrick et al. 2000), is sensitive to change (Dawson et al. 1996a) and is easy to complete by respondents (Fitzpatrick et al. 2000). In addition, the OHS has been shown to be less susceptible to 'noise' of co-morbidities than the Arthritis Impact Measurement Scale (AIMS) and the SF-36 when comparing function post-THR(Dawson et al. 1996b). A copy of the OHS is found in Appendix 5 on page 524 and the scoring system on page 555.

Self-report Harris Hip Score

The Harris Hip Score (Harris 1969) has been used in numerous studies due to its suitability for use in follow-up after THR (Söderman et al. 2001). It has been shown to have an acceptable validity and reliability (Söderman and Malchau 2001). However the Harris Hip Score was not suitable for use in this study where a self-report measure was required. The Self-report Harris Hip Score was developed by Mahomed et al. (2001) and was based on the Harris Hip Score. The Self-report Harris Hip Score (HHS) contains seven items; one which relates to pain, the other six relate to function. It is scored from 0 to 70 with 70 indicating the best possible function. Mahomed et al (2001) reported high levels of concordance between self-report and surgeon assessed questions and suggested that the self-report version is suitable for use in place of the traditional surgeon-assessed instrument. A copy of the HHS can be found in Appendix 5 on page 529 and the scoring system on page 556.

Hip Range of Motion

Range of motion (ROM) was required for the study as an objective assessment of impairment. It was assessed using the range of motion section of the Harris Hip Score (Harris 1969). A copy of the proforma used to measure this and of the scoring system can be found in the Appendix on pages 499 and 560. The score is weighted placing greater emphasis on flexion than the other movements. The total possible score is 100.5 (in the original score this was divided by 20). Kirmit et al. (2005) reported that there is a high inter-rater reliability for this instrument. In addition to using this weighted scoring system in recording ROM, all-round ROM was also calculated by summing the number of degrees achieved for each of the following movements: flexion, internal rotation in extension, external rotation in extension, abduction and adduction.

Other factors considered

Many studies assessing the outcome of joint replacement record various pieces of information about the procedure itself such as type and amount of anaesthetic, prosthesis type, approach etc. The aim of the studies detailed in this PhD thesis was to investigate the impact of psychosocial factors on outcome. Including details of anaesthetic, surgical approach etc. was deemed too clinical. Studies assessing prosthesis traditionally look at survivorship, rate of loosening etc. Whilst these are important issues, the length that a prosthesis survives in situ is not necessarily related to patient-focussed outcomes such as level of pain, participation in activities etc.

Orthopaedic Instruments – Knee Study

As the knee study commenced after the hip study, the instruments chosen as outcome measures were guided by those which were being used in the hip study as it was important to have measures in the two studies which were comparable. Tables 3.3 and 3.4 contain generic and condition-specific instruments which are suitable to measure outcome of TKR. Although it has been shown that a generic instrument such as the SF-36 or a condition-specific instrument such as the WOMAC would be a good choice of instrument to measure outcome of TKR (Brazier et al. 1999;Bachmeier et al. 2001;Marx et al. 2005;Salaffi et al. 2005) as only site-specific instruments were used in the hip study (as a result of the reasons discussed above) it was decided to take the same approach in the knee study. A large number of instruments suitable for assessing outcome of TKR have been identified. Garratt et al. (2004) provide a review of the 16 different knee instruments identified which are suitable for completion by the patient (not all of these are aimed at TKR). Kreibich et al. (1996) and Bach et al. (2002) discuss instruments which may involve surgeon-assessment of the patient. Table 3.6 contains information on the psychometric properties of some site-specific instruments which are suitable for the assessment of outcome of TKR. Not all of the available instruments are discussed; the reader should refer to the above articles for a more in-depth review. Below this there is a discussion of the most appropriate instruments to use in the knee study.

Table 3.6: Details of site-specific measures considered for measurement of outcome in the knee study

Instrument	Number of items	Details of measurement	Psychometric Issues
Knee Injury Osteoarthritis Outcome Scale (KOOS)(Roos et al. 1998b)	42	Measures five domains: pain, symptoms, activities of daily living, sport and recreation, and knee-related quality of life.	**Validity**: Roos et al. (1998b) reported that the measure had adequate construct validity when compared with the SF-36. **Reliability**: Internal consistency is good (0.71-0.95) (Roos et al. 1998a) as is test re-test reliability (0.75-0.93) (Roos et al. 1998b). **Sensitivity:** responsiveness has been assessed in ACL reconstruction patients. The instrument showed a better sensitivity than the SF-36 or WOMAC (Roos et al. 1998b).
Knee Society Knee Score (KSKS) (Insall et al. 1989)	8 patient completion	8 questions for patient completion regarding pain and function. A separate clinical component assessing impairment (ROM, stability of joint and deformity).	**Validity:** Lingard et al. (2001) reported that the KSKS had adequate construct validity when compared with the SF-36 and WOMAC. **Reliability:** Questionable intra-observer reliability was reported by Liow et al. (2000). **Sensitivity:** Kreibich et al. (1996) reported that the KSKS was more responsive to change than the SF-36.

Table 3.6 Continued: Details of site-specific measures considered for measurement of outcome in the knee study

Instrument	Number of items	Details of measurement	Psychometric Issues
Oxford Knee Score (OKS) (Dawson et al. 1998)	12	12 items assessing pain, activities limitation and participation restriction.	**Validity:** Dawson et al. (1998) reported moderate correlations between the OKS and the KSKS function component (-0.54), SF-36 physical component (0.69) and the HAQ disability component (0.61). In developing the questionnaires, interviews were conducted with patients to ensure face validity. **Reliability**: Dawson et al (1998) reported internal consistency pre-operative (0.87) and post-operatively (0.93) and test re-test reliability (0.92). **Sensitivity**: Effect size from pre- to post-operatively was greater than that recorded for the SF-36 (Dawson et al. 1998).

As stated above, some of the generic and condition-specific measures would have been appropriate to assess outcome in TKR in the knee study. However, in selecting outcome measures for use in the knee study, two factors were considered. First, it was desired that the outcome measures used in the knee study be similar to those employed in the hip study to enable a comparison of results. Second, the study required an instrument which contained an objective assessment of impairment to enable investigation into the relationship between impairment and activities limitation prior to and following TKR. Table 3.6 demonstrates that the OKS has good psychometric properties. In addition, the instrument produced by the same group for study of outcome of hip replacement (OHS) was employed in the hip study and therefore it was desirable to use this method. Table 3.6 indicates that the psychometric properties of the KSKS are questionable. However, as it was a requirement of the study that the an instrument contain a measure of impairment; it was decided to use the KSKS. With retrospect it may have been more appropriate to use the clinical component of the KSKS alongside an alternative instrument such as the WOMAC.

Therefore, the instruments used in the knee study were:

- Oxford Knee Score.
- Knee Society Knee Score which contains a clinical component assessing ROM and a self-report component assessing pain, limitations of activities and participation restriction.

Each of these shall now be discussed below in more detail.

Oxford Knee Score

The Oxford Knee Score (OKS) (Dawson et al. 1998) is a twelve-item questionnaire relating to pain and function of the knee. This instrument is scored in the same way as the OHS discussed above on page 68. The OKS has been shown to have high levels of validity and reliability (Davies 2002;Garratt et al. 2004) and to be responsive to change (Garratt et al. 2004). A copy of the OKS is on page 524 of Appendix 5 and the scoring system is located on page 555.

American Knee Society Knee Score

The American Knee Society Knee Score (Insall et al. 1989) was developed as two separate components to objectively assess the knee joint and to provide a measure of functional ability. The reasoning for this was to objectively assess the knee even when there is a decline in functional ability due to increasing age.

The updated scoring system was used. The updated scoring system of the KSKS has never published in a journal but available online at http://www.kneesociety.org/index.asp/fuseaction/site.outcomes. A copy of the questionnaire used, the ROM section and the scoring system is contained in the Appendix on pages 512, 541, 557, and 559. The KSKS is divided into two components; a clinical component and a functional component. The clinical component assesses pain, ROM, stability of the joint and deformity. For the purpose of this study, the pain component was scored separately.

Measurement of pain

Pain was measured in the hip and knee studies using components of the joint-specific questionnaires. This approach was taken to ensure that the pain relates directly to the joint. Visual analogue scales (VAS) and numeric rating scales (NRS) have been commonly used to rate pain. However, despite their common usage there are several disadvantages to these scales namely their questionable psychometric properties, the fact that pain is multidimensional but the scales are uni-dimensional and the variability in interpretation by the patient (Williams et al. 2000). Williams et al. (2000) conducted a qualitative study with 78 chronic pain patients. They reported that patients interpreted the scales very different with one person's 8 meaning "average everyday pain" whilst to another it meant "barely tolerable". They also noted that:

> *"patients made increasingly small distinction towards the upper endpoint giving the impression not of a uniformly linear scale, but of one which at its upper end is approximated by a logarithmic scaling."*(Williams et al. 2000:462).

As the points on the VAS (and NRS) have subjective meaning to each patient and as the scale is unlikely to be linear, this makes statistical analysis using the results of this tool difficult and therefore was deemed inappropriate for use in my studies. As pain was only one component of the study, another dedicated measure such as the McGill Pain Questionnaire (Melzack 1975) was deemed to in depth for the purpose of the study and would have added a greater burden on the participants.

Demographic Questionnaire

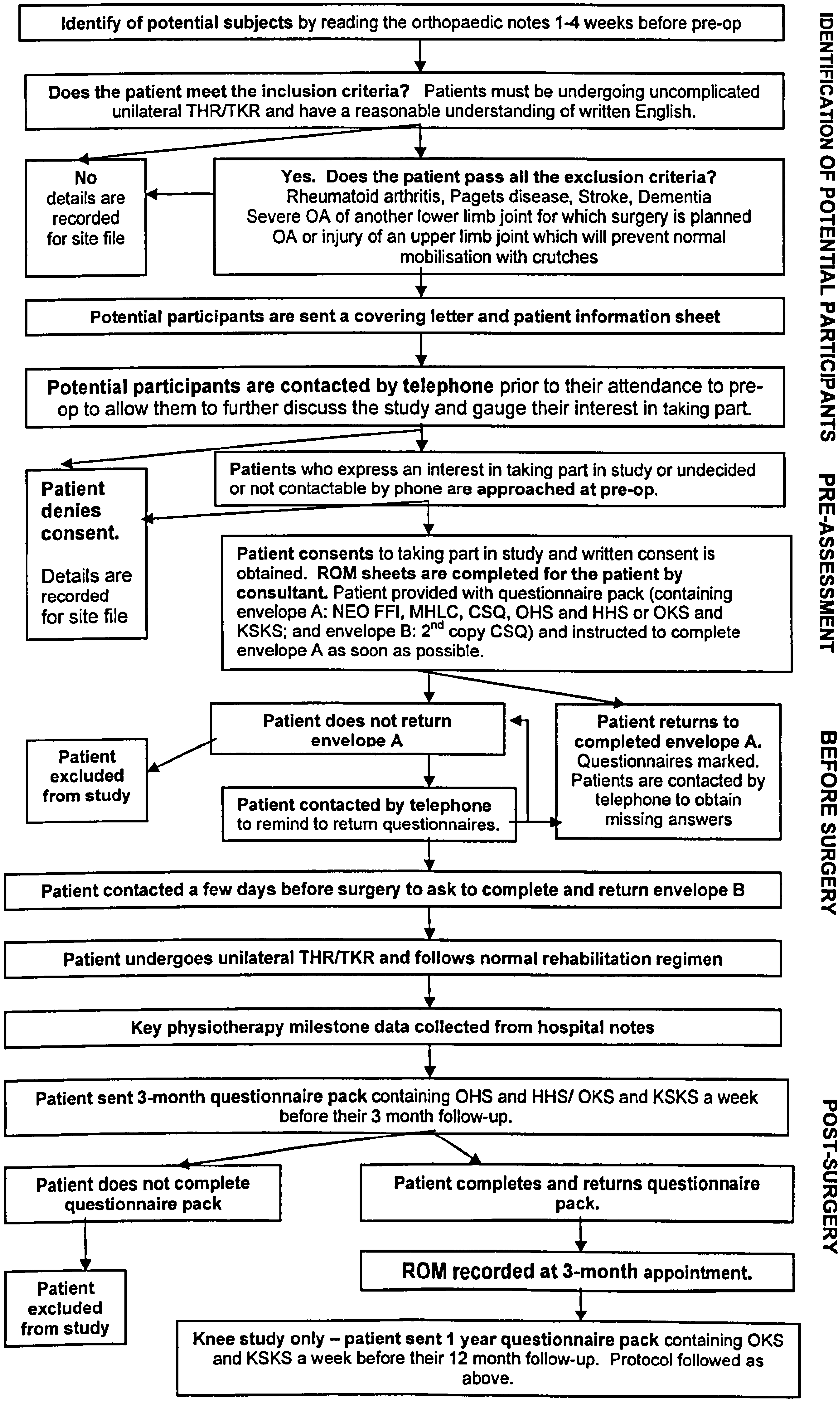
A demographic questionnaire was produced to ascertain information regarding age, gender, education, social class and living arrangements. Copies of the demographic questionnaires for the hip and knee studies can be found on pages 520 and 532 of the Appendix. Social Class was recorded from patients' responses to the question relating to occupation (or previous occupation if retired) and was based on the Registrar General's classification. The classifications were made independently by two researchers and any discrepancies discussed (before agreeing a final classification).

It is known that the demographic variables of gender (Keefe et al. 2000;Kennedy et al. 2002) and social class (Peters et al. 2005b) affect pain and function in osteoarthritis, whilst age (Forrest et al. 1998;Peerbhoy et al. 1999) and education (Mahomed et al. 2002) have been shown to affect recovery from THR/TKR and therefore it was important to have measures of these demographic variables.

Procedure

The procedure is summarised in the flow chart in Figure 3.2. Patients eligible to take part in the study were identified by reading the patients' notes one to four weeks prior to their attendance to orthopaedic pre-admission assessment clinic. Suitable patients were sent a covering letter (see Appendix pages 492: hip and 505: knee) and patient information sheet (see Appendix pages 493: hip and 506: knee) detailing the study. The covering letter indicated that patients would be contacted by telephone prior to their attendance to orthopaedic pre-admission assessment clinic by the researcher. (In order to check that the wording of the letter and of the phone call were appropriate for an elderly person, trial runs were carried out using the researchers grandparents and grandparents-in-law who had personal knowledge of joint replacements but no previous knowledge of the study). This phone call, which followed a standard script (see Appendix pages 497 (hip) and 510 (knee) for details), allowed the study to be discussed in more detail and provided the patient with an opportunity to ask any questions that they may have had about the study. If patients were unable to be contacted by telephone prior to their attendance to clinic (e.g. due to not having a household phone, deafness, patient out at work or on holiday etc.) then the researcher would approach the patient in clinic. At pre-admission assessment clinic patients were approached to further discuss whether they would like to be involved in the study. Patients who were willing to take part were asked to complete a consent form (see Appendix pages 498 (hip) and 511 (knee)) and then were provided with the self-administered questionnaire pack. The clinician recorded the patients ROM on the hip evaluation sheet (see Appendix page 499) (or knee evaluation sheet (see Appendix page 512)). The questionnaire pack consisted of envelope A which contained all the self-report instruments and envelope B which contained a second copy of the CSQ. Patients were asked to complete envelope A and return as soon possible. The researcher checked the questionnaire for any missing answers. In the event that a question had not been answered, the researcher contacted the patient by telephone (where possible) in order to obtain the missing data. The patients were asked not to complete envelope B until contacted by the researcher. The researcher contacted the patient approximately three days prior to their operation to ask the patients to complete envelope B (this provided the researcher with the CSQ recorded at two different time points and so enabled the analysis of the reliability of the CSQ over time). If the surgery date was approaching and the patient had not returned envelope A then the patient was contacted to request that they do this. In this instance the patient was not required to complete envelope B. Patients were also exempt from completing envelope B if there was only a short time period (within a week) between the researcher receiving the patients completed envelope A and the patient's date of surgery. Following surgery key physiotherapy milestones were recorded from the patient's physiotherapy notes. Medical information, past joint arthroplasty surgery, post-operative complications and length of stay were recorded from the patient's medical records. Patients were sent HHS and OHS (or OKS and KSKS in knee study) to fill out 3-months post-operatively. Where possible, ROM was recorded at the patient's 3-month post-operative outpatient clinic appointment by the Arthroplasty Nurse Specialist.

Figure 3.2: Flow chart of procedures in study



Ethics and Governance

Ethical Approval

Ethical approval for the study was obtained from the North Sheffield Ethics Committee and research governance procedures of the Northern General Hospital were followed. Copies of the documentation are located in Appendix 2.

Development of the Study Protocol

The original study protocol was approved by the North Sheffield Ethics Committee. There have been many changes to the protocol each of which has been approved by the local ethics committee. This section details each of the changes made and explanation as to why it was deemed necessary for these changes to be made. Documentation summated to and received from the North Sheffield Ethics Committee is located in Appendix 2.

Inclusion of Patients Experiencing Post-operative Complications

It was the intention of the research team that patients experiencing serious post-operative complications, such as pulmonary embolism and deep vein thrombosis, would be excluded from the study (and analysis). This decision had been made based on experience that post-operative complications were linked with a delayed in-patient outcome (Epps 2004). As the key milestones involve the measurement of time taken to achieve various tasks, the contraction of a post-operative complication was obviously going to alter this. As such, the exclusion criteria of the original protocol (see Appendix 2) included patients experiencing post-operative complications. However, the ethics committee felt that patients who did experience post-operative complications should not be excluded from the study and instead the researcher should also examine whether personality and the other psychological variables relate to the likelihood of a post-operative complication. Amendment number 1 (see Appendix 2) therefore also details this change. This issue will not be examined in thesis and analysis of the physiotherapy data was conducted excluding patients who experienced post-operative complications as their inclusion skewed the results. However, patients who had experienced post-operative complications were included in the three-month analyses.

Alteration of the Inclusion Criteria

It was the original intention of the research team that this study would link in with another study (the Stem Design Study) being conducted with the LLAU which would enable the sharing of resources and data. The Stem Design Study had begun a few months previous to the anticipated start date of this study. Due to the nature of the Stem Design Study, it had quite tight inclusion/exclusion criteria, and as a result the recruitment had been slow. It was felt that as these criteria were unnecessary for my study and it would be better for my study to run independently of the Stem Design Study (the exception has been when patients have been recruited to both studies in which case the Orthopaedic Research Sister was responsible for recording the 3-month post-operative ROM). As a result an amendment was sent to the ethics committee with the altered inclusion/exclusion criteria (see Appendix 2).

Inclusion of Claremont Hospital and Thornbury Hospital Patients

Just as the recruitment of patients was due to begin, the hospital implemented a 'waiting-list initiative' which allowed some patients to have their surgery at one of two alternative hospitals within Sheffield (Thornbury which is a private hospital, and Claremont Hospital which is a not-for-profit hospital) but still under the care of the same surgeon and still funded by the NHS. The hospital planned that patients would all still attend orthopaedic pre-admission assessment clinic at NGH but then patients would be selected later to have their surgery at one of the other hospitals. This plan posed a problem to the planned protocol for the study as the study only had ethics and research governance considerations to be carried out at NGH. As patients were not pre-selected to attend an alternative hospital if the study had proceeded as planned then many patients may be have been recruited and then have had to be excluded if they had their surgery and rehabilitation at Claremont or Thornbury. In order to prevent this, a further amendment (see Appendix21) was sought from ethics and research governance procedures completed with Claremont and Thornbury Hospitals was completed before recruitment began.

This amendment, which allowed the researcher to study patients who received their care at Claremont on Thornbury but still funded by the NHS, also covered a later waiting list initiative which came about once the government introduced the concept of patient choice. Patient choice is initiative to provide the patient with more choice about when, where and how they receive their treatment (ref: http://www.dh.gov.uk/PolicyAndGuidance/PatientChoice/fs/en). Based on this new government policy a new company was formed by several of the orthopaedic surgeons working at the NGH (including those within the LLAU) who began to offer selected patients who would have received the treatment at the NGH the choice to have their surgery at one of the private hospitals instead but still under the management of NGH.

The decision to include patients from these two waiting list initiatives may have implications for the results and analysis of the study. It was deemed necessary in the first instance to include patients as they were being selected for surgery at Claremont and Thornbury after the time slot for recruitment of patients and not including this subgroup of patients would have meant excluding many patients retrospectively.

In the second instance it was deemed necessary to include patients in the study who accepted patient choice at one of the private hospitals as the patients were being 'cherry-picked' so that younger, fitter patients who had less chance of post-operative complications were selected to receive their surgery at one of the private hospitals. Excluding this group of patients would have skewed the results of the whole study as the study population would have consisted of the sicker patients who are less likely to do well in the rehabilitation setting. There is a tendency for this to occur even with the inclusion of these patients, as other patient choice initiatives in the area have access to the waiting list information for total joint replacement patients at the NGH. These other local patient choice initiatives have been known to invite any patient to have their surgery in their hospital and if they later they discover that they have a medical condition which is associated with an adverse recovery, send the patient back for treatment at NGH!

However, inclusion of this set of patients also introduces some potential problems into the study. Some difference between the hospitals and how this may impact on either the rehabilitation or analysis will now be discussed.

The majority of orthopaedic surgical patients at NGH share a bay within a ward with five other patients who have had similar operations. It may be that the patients help each other along with their rehabilitation process either consciously by encouraging the patient on to complete a task (such as using the Zimmer frame to get to the toilet independent of any help) or subconsciously as a patient who is day one post-surgery may be sharing a ward with patients who are day three or four post-surgery and so looks at the improvement in these patients ability for inspiration. All patients receiving treatment at Thornbury have individual rooms. The physiotherapist who was the contact point for this study believes that patients attending Thornbury who have previously received treatment on the NHS can find this experience very isolating and this may be detrimental to their rehabilitation. At Claremont, all wards are arranged into individual rooms with the exception of one bay which is shared by four ladies. The physiotherapist at Claremont who was the contact point for the study feels, through past experience, that the ladies on the shared bay do better than the patients in individual rooms as they are able to provide each other with mutual support. She said that "The new ones coming into the ward can see how the ones who have been there for a couple of day have progressed and this provides them with motivation to rehabilitate"

The patients, irrespective of which hospital they have their surgery, are supposed to follow the same post-operative care pathway, as this is set by the surgeon not by the hospital. However, the physiotherapy service provided at Claremont and Thornbury differs from that of the NGH. The main difference is that patients in the private hospitals receive a more intensive physiotherapy treatment (with more physiotherapy sessions per day) than patients at the NGH receive. Patients at NGH routinely receive one physiotherapy session per day. Sometimes, if deemed necessary, and if time and resources permit, then a patient may be seen twice a day. At Claremont and Thornbury patients are seen routinely twice a day. If it is deemed necessary then both would attempt to see the patient for a third time in the day. This fact could potentially mean that with extra effort patients would reach their key milestones earlier than if they were receiving their treatment in NGH. It is difficult to do a direct comparison of time taken to achieve key milestones in the three hospitals as patients receiving patient choice tend to be younger, still working, and have less co-morbidities all of which are associated with a more successful rehabilitation. The impact of including patients receiving care at the private hospitals is discussed further in Chapters 8, 12 and 13.

Inclusion of Envelope B

The original plan was to provide patients with a single questionnaire pack and request that they did not complete it until contacted by the researcher. The researcher rang the patients a few days before their surgery to request that they complete and return their questionnaire. The rationale for this is that there have been various studies suggesting that reliability of the CSQ varies over time (Keefe et al. 1990a;Keefe et al. 1990b). As one of the study aims was to determine the effect of the coping strategies on the success of surgery, it was desirable for this questionnaire to be completed as close to the surgery as possible. However, on implementing this protocol, it soon became apparent that this method was not going to suitable. The first 30 patients were recruited under this protocol and only 50% of the questionnaire packs were returned. Subjects felt that they did not wish to have the extra task of completing a large questionnaire when they had just found out their surgery date was imminent and when they were trying to get their lives into order before being admitted into hospital. An amendment to the protocol (see Appendix 1) and patient information sheet was made introducing the concept of envelope B. Patients were asked to complete the majority of the questionnaires as soon as possible after their pre-admission assessment clinic visit and were left with only a separate copy of the CSQ to complete a few days prior to their surgery. This new strategy would also enable the exploration of the reliability over time of the CSQ.

Adaptation of the Protocol to Include Knee Patients

Early on in the recruitment phase to the hip study, various health care professionals commented that they wished that the study was also being completed with total knee replacement (TKR) patients. Some physiotherapists felt that the effects of personality on rehabilitation would be more apparent in TKR patients as the rehabilitation process is more reliant on the patient actively participating in rehabilitation from an early stage post-surgery.

In the rehabilitation process following TKR, the patient is expected to actively exercise in between physiotherapy sessions to strengthen their muscles and increase their range of motion (ROM). This is very important as ROM needs to be restored before scar tissue forms around the joint preventing further gains in movement. This will influence the long term function of the knee. The physiotherapy team believe that personality and other psychological factors (such as locus of control) exert a large influence over which patients are likely to partake in their exercises in between the physiotherapy sessions. Therefore, personality will affect long term outcome.

An amendment (see Appendix 1) was sought from ethics for the inclusion of knee patients in the study. The psychological instruments used remained unchanged. The Oxford Knee Score (OKS) was used in place of the OHS. The Knee Society Knee Score (KSKS) was used in place of the HHS. The knee evaluation sheet (see Appendix page 512) was used to evaluate the ROM of the joint.

As the rehabilitation process is more complex, additional physiotherapy key milestones were also recorded. The additional key milestones are time taken to achieve straight leg raise, and time taken to achieve 90° bend of knee. As stated above, the latter of these two milestones is deemed of great importance to the overall long term outcome of the knee replacement.

As the recovery period after TKR is longer than that after THR, it was also felt that a 1-year follow-up (using the OKS and KSKS) should be included in the knee study. As there is thought to be little improvement in ROM of the knee joint after 3-months it was deemed unnecessary to record ROM at the 1-year point).

In addition, it has been noted that body mass index (BMI) affects the success of TKR and so this was also recorded. Due to the more complex nature of TKR, it was felt that the patients living arrangements (i.e. whether or not they have some to care for them when they go home) may have a greater impact on the patient's discharge date. In order to assess this, an amendment was made to the demographics questionnaire (see Appendix page 532 for details).

Ensuring Ethical Study Procedures

In order to ensure that the study was run ethically, the following steps were taken.

Informed Consent

All patients eligible to participate in the study were provided with a copy of the patient information sheet and supplementary covering letter. Patients were provided with an opportunity to ask questions about the study. The patient was given at least 48 hours to consider their participation in the research thereby adhering to the rules of good research practice. Patients willing to participate in the study were asked to complete a consent from which confirmed that they had read and understood the information sheet and had been given an opportunity to ask questions.

Confidentiality

All data collected was treated with the strictest confidentiality. Each patient was given a unique identifier with which all their documentation was marked. Only the researcher had access to these numbers.

Anonymising Data

All data was anonymised with any unique identifying information removed before analysis.

Data Analysis

Data was recorded in Microsoft Access and SPSS version 13. All data was checked when originally entered into the databases, and a random sample was re-checked.

Assessment of Distribution of Data

Prior to completing any analyses the data were examined, and z-scores calculated (see Appendix pages 628 (hip) and 638 (knee)) to asses the normality of data. Z-scores of greater than 3 indicated a dataset for which there was an unacceptable level of skew or kurtosis. Log transformation or square root transformation were carried out on these datasets and the z-scores recalculated on the transformed data to check that the transformation had successfully normalised the data (see Appendix page 635 (hip) and 638 (knee) for details of transformations).

The following analyses were conducted using the transformed data in both hip and knee studies and shall be discussed in more detail below:

- Assessment of reliability over time of the Coping Strategies Questionnaire.
- Correlational analyses of the relationships between psychological variables.
- Descriptive statistics of demographics.
- Correlational analyses exploring the relationship between ROM, function and pain pre- and post-operatively.
- Multiple regression analyses exploring the relationship between demographic, medical, and psychological variables with pain and function pre-operatively and three-months post-operatively.
- Multiple regression analyses exploring the relationship between demographic, medical and psychological variables with outcome measured using achievement of key physiotherapy milestones.

Variability of CSQ over Time

Using the transformed data, Pearson correlations were conducted on the data from the two time points to assess the reliability of the questionnaire over time. This analysis is discussed in the Appendix page 563.

Correlational Analyses Assessing the Relationship between Psychological Variables

Using the transformed data, correlation matrices for the psychological variables were created for each study. On analyses of these it was decided not to continue with principal component analysis. This is discussed further in the Appendix page 566.

Descriptive Statistics of Patient Demographics

Descriptive statistics of patient demographics were produced for each study. This was completed in order to assess whether the sample was representative of the total joint arthroplasty population.

Regression Analyses

In the regression analyses conducted at each time point in the studies, the following techniques were employed. Pearson correlations were carried out on the transformed data as an initial assessment of which factors should be included in the regression analysis. Any independent variable which had a significant relationship ($p < .05$) was included in the regression analysis. A forward stepwise regression was used for each of the dependent variables using the independent variable identified in the above step.

Chapter 4: The relationship between Impairment, Activity Limitation, and Participation Restriction

Introduction

The World Health Organisation's International Classification of Functioning, Disability and Health (ICF) (World Health Organisation 2001:283) states that disability emerges from an interaction between health conditions and contextual factors. Disability encompasses three components these are: impairment defined as a physiological or psychological problem within the body, activity limitation and participation restriction.[8] Previous studies (Williams and Bury 1989;Cowley et al. 1991;Creamer et al. 2000) have shown that only a limited relationship exists between impairment and activity limitation and participant restriction.

One of the aims of the study was to assess the relationship between impairment, activity limitation and participation restriction in patients with osteoarthritis prior to, and following TJA. Range of motion of the joint (ROM) and pain provide measures of impairment (Stucki and Ewert 2005). Pollard et al. (2006) completed a study to define which components of the ICF framework osteoarthritis outcome instruments measure. They reported that of the 13 instruments studied, including OHS, HHS, OKS and KSKS, that only the KSKS (see abbreviations on page 402 of Appendix for acronyms) contained items which were uniquely measuring impairment or activity limitation. All of the other instruments contained items which were measuring a combination of impairment, activity limitation and participation restriction. Therefore, it was no deemed possible to measure the impact of impairment on activity limitation and participation restriction separately but in combination.

---

[8] Several researchers have previously considered impairment as an objective measure of disability whilst activities limitation and participation restriction were considered more as subjective measures of disability. This is largely due the method in which the measurement is collected. Impairment is often assessed by clinician or physician whereas activities limitation and participation restriction are usually self-report by the patient/participant. Whilst behind the times, this is still acceptable terminology in some areas of research including orthopaedics. As such, the abstract presented at the British Orthopaedic Association Annual Conference 2006 (in Appendix on page 648) contains the terms objective and subjective disability in order to be accessible to the target audience.

The findings of previous research assessing the relationship between ROM activity limitation/participation restriction has been mixed. Johnston and Smidt (1970) and McGrory et al. (1996) demonstrated that a certain level of ROM of the hip joint is required to complete certain activities such as putting on socks, sitting down, and picking items up from the floor. In contrast, other researchers (Kantz et al. 1992;Witvrouw et al. 2002;Miner et al. 2003) have demonstrated a limited relationship between ROM in the knee and activity limitation/participation restriction. Contrastingly, strong relationships have been reported pain (also defined as an impairment by WHO) and activity limitation/participation restriction (Creamer et al. 2000;Rietman et al. 2004).

The aim, therefore, of this section of the study was to assess the impact of two different impairments experienced in OA (ROM and pain) on the impact of activity limitation and participation restriction. It should be noted that there is some dispute as to whether pain should be considered as an impairment; this is discussed later in the chapter on page 105.

Methods

Hip study

In order to assess the relationship between pain (impairment) and activity limitation/participation restriction, the questionnaires (which contain questions relating to both pain and activity limitation/participation restriction) were split into components. Question 1 of the HHS (see Appendix page 529) makes up the HHS pain component whilst the HHS activity limitation/participation restriction component is composed of questions 2 to 7.

The OHS (see Appendix page 524) was also split into questions which relate to pain (questions 1, 10 and 12) and questions which relate activity limitation and participation restriction (2, 3, 4, 5, 7, and 9). Questions 6, 8 and 11 fall in between the two constructs as they enquire as to the patients' activity limitation and participation restriction experienced as a result of pain (impairment) (or vice versa) and so are included in both groups in turn. In the results tables below OHS pain component type 1 refers to the sums of the scores of questions 1, 6, 8, 10, 11, and 12 whilst OHS pain component type 2 refers to the sums of the scores of questions 1, 10 and 12. OHS functional component type 1 refers to the sums of the score from questions 2, 3, 4, 5, 7, and 9 whilst OHS functional component type 2 refers to the sums of scores from questions 2, 3,4 ,5,6, 7, 8, 9 and 11. Two alternative components were created for the OHS as many of the questions mix the constructs pain and activity limitation/participation restriction and therefore separating them out into separate components posed some difficulty.

Three different range of motion scores were used in the analysis:

- Flexion only (recorded in degrees).
- Using the range of motion section from the Harris Hip Score. The score considers flexion, abduction, external rotation in extension, and adduction and is weighted so that more points are given for flexion than other movements.
- All round range of motion (recorded in degrees) calculated by summing the degrees recorded for flexion, abduction, adduction, external rotation in extension, and internal rotation in extension.

Calculations of z-scores for skewness and kurtosis (see Appendix page628) revealed that not all of the variables were normally distributed. The data was, therefore transformed (see page 635 in Appendix) and then Pearson correlations calculated.

Knee Study

As in the hip study, in order to assess the relationship between ROM and function, the questionnaires were split into components. The instruments came be found in the Appendix on pages 536 and 541.

The Clinical component of the Knee Society Knee Score (KSKS) was used to measure range of motion (ROM). In addition to the assessment of ROM, the Clinical component of the KSKS also contains items relating to pain. These components were separated. The functional component contains questions relating to activity limitation and participation restriction and therefore the scoring of this instrument did not need to be altered for the purpose of analysis.

Two alternative components were created for the OKS. As many of the questions contained a mix of impairment (pain) and activity limitation and participation restriction, separating them out into different components posed some difficulty. The OKS was also split into questions which relate to pain (questions 1 and 8) and questions which relate activity limitation/participation restriction (2, 3, 6, 7, 10, 11 and 12). Questions 4, 5 and 9 fall in between the two constructs as they enquire as to the patients' activity limitation and participation restriction experienced as a result of pain (impairment) (or vice versa) and so are included in both groups in turn. In the analysis below OKS pain component type 1 refers to the sums of the scores of questions 1, 4, 5, 8, and 9 whilst OHS pain component type 2 refers to the sums of the scores of questions 1 and 8. OKS functional component type 1 refers to the sums of the score from questions 2, 3, 6, 7, 10, 11 and 12 whilst OKS functional component type 2 refers to the sums of scores from questions 2, 3,4 ,5, 6, 7, 9, 10, 11 and 12.

Two different range of motion scores were used in the analysis:

- Flexion only (recorded in degrees).
- Using the clinical component of the KSKS with scores relating to pain excluded. The score considers flexion, medio-lateral stability, antero-posterior stability, alignment, flexion contracture and extension lag.

Calculations of z-scores for skewness and kurtosis (see Appendix page 638) revealed that not all of the variables were normally distributed. The data were transformed (see Appendix page 645) and Pearson's correlation coefficients calculated.

Results

The results of the analyses conducted in the hip study will be presented first followed by the findings of the knee study.

Hip Study

Pre-operative findings

Table 4.1 summarises the relationship found pre-operatively between ROM and activity limitation/participation restriction. Table 4.2 contains the Pearson correlations between pre-operative pain and activity limitation/participation restriction.

Table 4.1: Correlations between the 3 scores for range of motion and the components of joint-specific questionnaires

	HHS	HHS F	HHS S	OHS	OHS F1	OHS F2	OHS S
ROM	.11	.20*	.23*	-.16	-.25*	-.22*	-.31**
All round ROM	.10	.19	.21*	-.11	-.24**	-.18	-.29**
Flexion	.12	.17	.18	-.16	-.21*	-.20	-.28**

Note: * $p \leq .05$, ** $p \leq .01$, n = 97

Abbreviations: HHS – Harris Hip Score; HHS F – HHS functional component; HHS S – HHS Socks question; OHS – Oxford Hip Score, OHS F1 – OHS functional component type 1; OHS F2 - OHS functional component type 2; OHS S – OHS socks question.

Only weak correlations were recorded between ROM and activity limitation/participation restriction as measured by the joint-specific questionnaire. None of the correlations with either of the complete questionnaires (HHS and OHS) were statistically significant. Statistically significant correlations were recorded between the ROM and the components of the joint-specific questionnaires measuring activity limitation/participation restriction. The strongest correlations were found between the ROM components and the answer to the OHS socks question.

Table 4.2: Correlations between the 3 pain scores and the components of joint-specific questionnaires

	HHS	HHS F	HHS S	OHS	OHS F1	OHS F2	OHS S
HHS pain				-.69***	-.55***	-.66***	-.32***
OHS pain 1	-.75***	-.66***	-.32***				
OHS pain 2	-.59***	-.49***	-.21*				

Note: ** p ≤.05, ***p ≤ .001, n = 105. Abbreviations as noted in Table 4.2.

Correlations are negative as a higher score on OHS indicates a greater degree of activity limitation and participation restriction whilst a higher score on HHS indicates a better ability to complete activities and no participation restriction.

The correlations recorded between pain and the components of the joint-specific questionnaires were much stronger than those recorded between ROM and the components representing activity limitation/participation restriction. It is expected that a strong relationship would be found between a pain component of one joint-specific questionnaire and the other complete joint specific questionnaire (e.g. HHS pain component vs. OHS, OHS pain component type 1 or 2 vs. HHS) as the complete questionnaire contains questions relating to pain and therefore the same construct (in the different questionnaires) is being correlated However, of interest are the correlations between the pain component of one questionnaire and the component of the other questionnaire measuring activities limitation/participation restriction. Here there is no overlap of constructs but the correlations remain strong suggesting that pain relates to function.

Post-operative findings

Table 4.3 contains the correlations found between ROM and the components of the joint-specific questionnaires measuring activity limitation/participation restriction. Table 4.4 summarises the post-operative correlations between pain and the components of the joint-specific questionnaires.

Table 4.3: Correlations between the 3 scores for range of motion and the components of joint-specific questionnaires

	HHS	HHS F	HHS S	OHS	OHS F1	OHS F2	OHS S
ROM	.38**	.32*	.27*	-.32**	-.32**	-.33**	-.23
All round ROM	.32**	.27*	.20	-.34**	-.33*	-.34*	-.26*
Flexion	.32**	.24*	.20	-.24	-.22	-.24	-.13

Note: * $p \leq .01$, ** $p \leq .05$, $n = 66$.

Abbreviations: HHS – Harris Hip Score; HHS F – HHS functional component; HHS S – HHS Socks question; OHS – Oxford Hip Score, OHS F1 – OHS functional component type 1; OHS F2 - OHS functional component type 2; OHS S – OHS socks question.

Table 4.4: Correlations between pain and the components of joint-specific questionnaires

	HHS	HHS F	HHS S	OHS	OHS F1	OHS F2	OHS S
HHS pain				-.72***	-.58***	-.67***	-.45***
OHS pain 1	-.80***	-.68***	-.50***				
OHS pain 2	-.73***	-.58***	-.48***				

Note: ***$p \leq .001$, $n = 88$. Abbreviations as noted Table 4.3.

The post-operative results are in agreement with those found pre-operatively; range of motion is only weakly related to subjective functioning, whilst pain correlates much better to subjective functioning.

The correlations between ROM and the components of the outcome measures are of a slightly greater magnitude post-operatively compared to pre-operatively; this is likely to be a result a greater inter-rater error pre-operatively as a greater number of individuals were responsible for recording these measurements pre-operatively (the 5 clinicians and if occasionally unavailable their registrars) compared with post-operatively (recordings where either made by the arthroplasty nurse specialist or the orthopaedic research nurse). However, there may be another explanation for this difference as inter-rater reliability in measuring ROM has been reported as good in other studies. Kirmit et al. (2005) reported a good inter-rater reliability for the Harris Hip Score (for which ROM component was taken) when measured using a goniometer and Holm et al. (2000) reported a good concordance between visual estimates of ROM and when measured using a goniometer.

Knee Study

Pre-operative findings

Table 4.5 summarises the relationship found between ROM and the components of the joint-specific questionnaires measuring activity limitation and participation restriction. The Pearson correlations found between pain and the components of the joint specific questionnaires are summarised in Table 4.6.

Table 4.5: Correlations between the range of motion scores and components of joint-specific questionnaires

	KSKS Function	OKS	OKS Function 1	OKS Function 2
Clinical KSKS	.20	-.25*	-.25*	-.26*
Flexion range	.23	-.26*	-.23	-.28*

Note: * $p < .05$.

In agreement with the findings of the hip study, only weak correlations were found between ROM (measured either with the clinical component of the KSKS or as number degrees of flexion) and the components of the joint-specific questionnaires measuring activity limitation/participation restriction.

Table 4.6: Correlations between the pain components and components of joint-specific questionnaires

	KSKS Function	OKS	OKS Function 1	OKS Function 2
KSKS pain	.62***	-.79***	-.70***	-.75***
OKS pain 1	-.66***			
OKS pain 2	-.43***			

Note: * p < .05.

Correlations between the KSKS function and pain components have been included as they are considered as separate components of the scoring system. Correlations between the components of the OKS are not included as it is designed as a single instrument which has been split into components here for the purpose of analysis. Correlations between the KSKS and OKS are negative as a higher score on OKS indicates more activity limitation and participation restriction whilst in the KSKS a lower score is indicative of these.

Table 4.6 reveals the much stronger correlations were found between pain and the components of the joint specific questionnaires. This finding is in agreement with the results of the hip study.

Post-operative results

The relationship between range of motion (ROM) and scores on the components of the joint-specific questionnaire is summarised in Table 4.7. The relationship existing between pain and activity limitation/participation restriction as measured by the components of the joint-specific questionnaires is summarised lower down in the extended results section in Table 4.10.

Table 4.7: Correlations between the 2 scores for range of motion and the components of joint-specific questionnaires

	KSKS Function	OKS	OKS Function 1	OKS Function 2
Clinical KSKS	.24	-.50**	-.50**	-.51**
Flexion range	.23	-.54**	-.54**	-.56**

Note: ** p < .01, n = 31.

The correlations of the ROM scores with the KSKS functional component are of a similar magnitude to those recorded pre-operatively and are not significant. The correlations recorded between the ROM scores and the OKS components are of a greater magnitude than those recorded pre-operatively and achieve a greater significance level.

There are two possible explanations for the greater strength of post-operative correlations between ROM and OKS components, and flexion range and OKS component; they are inter-rater reliability and change in range of motion from pre- to post-operatively.

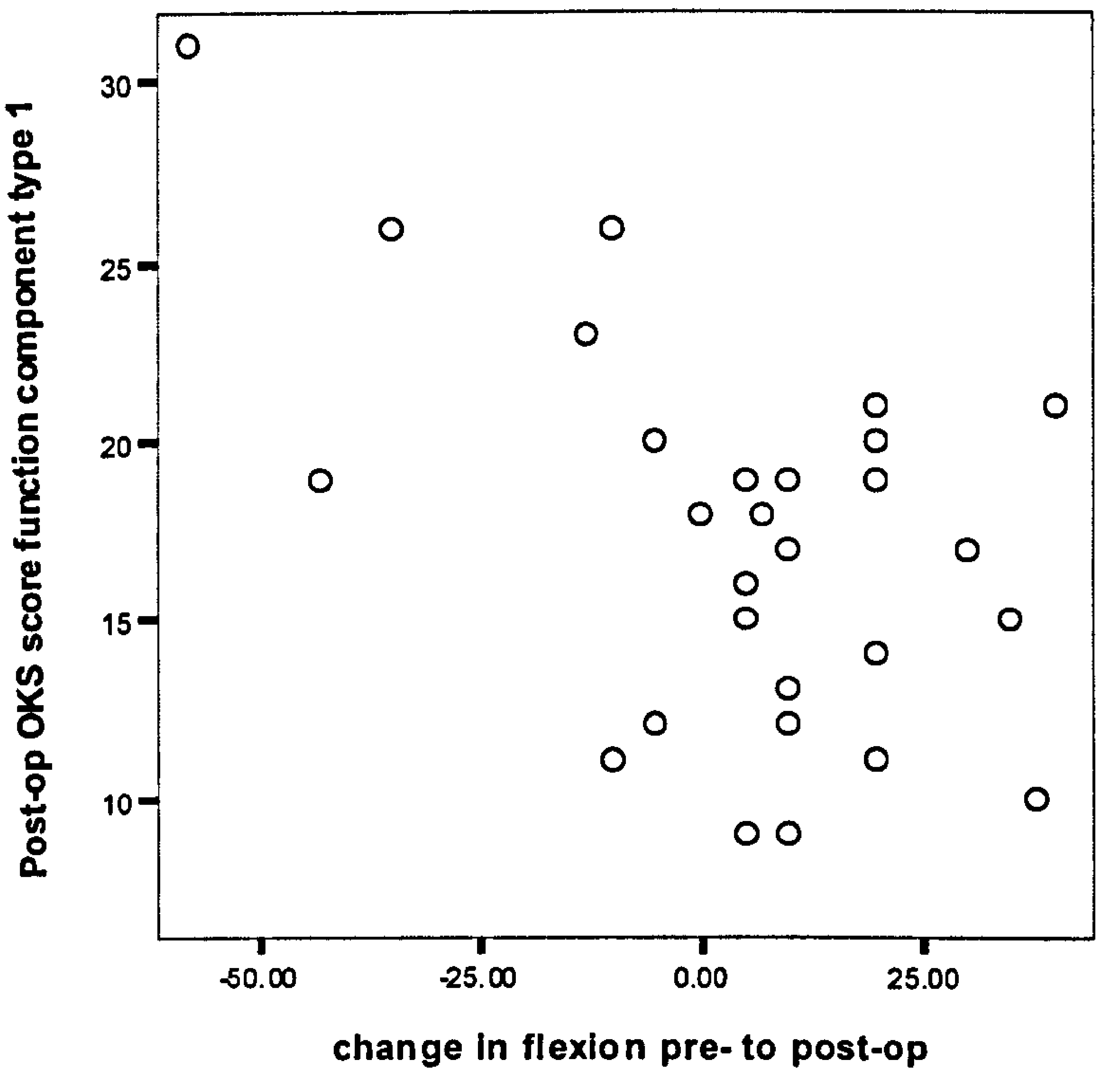
Inter-rater Reliability

Pre-operatively there were five clinicians responsible for recording ROM compared to two individuals post-operatively. However, if this is solely responsible for the dramatic change, then ROM would be an inaccurate method of assessing success of surgery anyway due to the variability of recordings.

Change in Range of Motion from Pre- to Post-Operatively

The apparent stronger relationship post-operatively between ROM and function may relate to change in ROM from pre- to post- operatively rather than absolute ROM. Change in flexion from pre- to post-op was calculated and this variable plotted against the score for OKS functional component type 1 (see Graph 4.1).

Graph 4.1: Scatter plot of relationship between change in flexion (measured in degrees) pre- to post-operatively with OKS functional component type 1



From Graph 4.1 it is apparent that patients who had lost flexion pre- to post- operatively tended to score higher on OKS functional component type 1 indicating a worse function. Contrastingly, patients whose level of flexion had remained stable or had increased pre- to post-operatively had a much wider range of scores for OKS functional component type 1 (thus a less obvious relationship between the two variables). This suggests that change in flexion may be a factor in determining activity limitation and participation restriction at three-months post-operatively. In support of this, Pearson correlations between change in flexion and the functional components (see Table 4.8) were of a similar magnitude to those recorded between flexion (and the clinical knee score) and function in Table 4.6.

Table 4.8: Correlations between the change in range of motion pre- to post-operatively and the components of joint-specific questionnaires

	KSKS Function	OKS	OKS Function 1	OKS Function 2
Change in Clinical KSKS	.13	-.49**	-.48**	-.50**
Change in Flexion range	.03	-.56***	-.50**	-.57***

Note: ** $p \leq .01$, *** $p \leq .001$, n = 31.

Unfortunately, nine patients suffered a loss in ROM from pre- to post-operatively (range: 5-58°). Excluding these patients from the correlational analysis of absolute post-operative ROM and function yielded results similar to those seen pre-operatively (see Table 4.9).

Table 4.9: Correlations between the 2 scores for range of motion and the components of joint-specific questionnaires where patients who suffered a deterioration in range of motion pre- to post-operatively are excluded

	KSKS Function	OKS	OKS Function 1	OKS Function 2
Clinical KSKS	.29	-.19	-.23	-.19
Flexion range	.26	-.34	-.41	-.37

Note: n = 22.

The findings of this correlational analysis are in line with those recorded pre-operatively (see Table 4.6). They are still of a slightly greater magnitude but the correlations are non-significant.

Table 4.10 summarises the correlations found between the post-operative scores on pain and components of the joint-specific questionnaires measuring activity limitation and participation restriction. In the results above, it has been discussed that the stronger relationship recorded post-operatively between ROM and the OKS function components may have been a result of the inclusion of patients who had experienced a deterioration in ROM from to pre- to post-operatively. The correlations were repeated excluding these patients. In order to allow for comparison, the correlation between pain and the components of the joint-specific questionnaires have also been repeated excluding these patients. These are summarised in Table 4.11.

Table 4.10: Correlations between the pain components and the function components of joint-specific questionnaires

	KSKS Function	**OKS**	**OKS Function 1**	**OKS Function 2**
KSKS pain	.56***	-.87***	-.83***	-.86***
OKS pain 1	-.63***			
OKS pain 2	-.52***			

Note: *** $p < .001$, $n = 57$.

The correlations between pain and the functional components are of a slightly greater magnitude than those recorded pre-operatively. Of particular interest is the strong correlation between the KSKS pain component (which considers pain on rest, when walking and on stairs) with OKS functional component type 1 (which considers functional ability in walking, ascending stairs, washing, kneeling, using public transport, and shopping).

Table 4.11: Correlations between the scores on the three pain components and the components of joint-specific questionnaires where patients who suffered a deterioration in range of motion pre- to post-operatively are excluded

	KSKS Function	OKS	OKS Function 1	OKS Function 2
KSKS pain	.59***	-.83***	-.77***	-.82***
OKS pain 1	-.65***			
OKS pain 2	-.53***			

Note: *** p < .001, n = 48.

Taking all of the above findings into consideration, it appears that where a patients' ROM is comparable, or better than, those recorded pre-operatively, then the weak relationship between objective and subjective function persists. However, this finding does not stand true in cases where there has been a deterioration in ROM from pre- to post- operatively are included in the analysis. Patients experiencing a deterioration in ROM (and who tended to have lower absolute post-operative ROM) tended to have a worse function. Inclusion of these patients in the data caused a stronger correlation to be recorded than otherwise would have been seen. It is postulated that this is as a result of change in ROM rather than absolute ROM, as if it were a result of absolute ROM then we would except the relationship to be seen in the pre-operative correlations (where there is a greater range in flexion).

Discussion

In the pre-operative hip and knee studies, only a limited relationship was recorded between impairment as measured by ROM and activity limitation and participation restriction as measured with the components of the joint-specific questionnaires. Post-operatively, the same weak correlations were replicated in the hip study. In the knee study, contrary to expectations, a stronger magnitude of correlations was recorded between ROM and the components of the joint-specific questionnaires. Further analysis revealed that this relationship was only found in patients who had experienced a decrease in ROM from pre- to post-operatively, suggesting that where there has been a deterioration in ROM there is also a severe impairment in function. When these patients were excluded from the analyses, the strength of the correlation diminished indicating a weak relationship between impairment measured with ROM and activity limitation and participation restricted measured with components of the joint-specific questionnaires.

The findings of the two studies are in agreement that only a weak relationship exists between impairment measured with ROM and activity limitation/participation restriction in TJA. The agreement between the two studies is logical; if objectively restriction in movement is only weakly related to function/disability in one joint (presumably as other factors such psychological factors mediate the relationship) then it would be expected that the same be true of the other joint. However, previous literature has only provided evidence for a weak relationship between ROM and function in the knee (Kantz et al. 1992;Witvrouw et al. 2002;Miner et al. 2003) but not in the hip where a strong relationship has been reported between ROM and activity limitation/participation restriction.

Johnston and Smidt (1970) used healthy subject to measures the levels of ROM normally used to complete simple activities of daily living such as tying shoe laces, or standing from a chair. In a second phase of the study they correlated impairment in ROM of the hip with observed difficulty in completing these tasks in patients with abnormal hip movement. However, the results of this study may be biased as the same investigator was responsible for recording ROM and assessing difficulty in completing activities.

More recently, McGrory et al. (1996) reported that one-year post-THR that there was a moderate correlation between ROM and patients' answers on functional components of the HHS and WOMAC function. They were so convinced by the strength of their results that they even suggested that a patient's ROM could be estimated (for example by phone) by asking appropriate questions which were known to relate to ROM. The correlation between the HHS socks question and the weighted HHS ROM component was .53. A correlation of .63 was recorded when the item related to ability to don socks was correlated with the all-round measurement of ROM. These correlations are of a much greater magnitude of those found in my hip study. Differences between these finding may relate to the different time points at which the recordings were made (1 year post-operatively in the McGrory et al. study compared with pre-operatively and 3-months post-operatively in my hip study) or as a result of differences in the way the measurements were recorded.

In the same study, however, McGrory et al. (1996) reported that there was no relationship between ROM (measured by any method) and overall scores on the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Function component. However, correlations were noted between ROM and some of the individual items on the WOMAC function score including ability to get on/off toilet, ability to pick things up off the floor, ability to get in and out of a car and ability to put on socks. These correlations, however, were much weaker and more in line with the magnitude of the correlations found in my study, for example, a correlation of .34 was reported between ROM and the socks question of the WOMAC function. This is comparable to the correlation of .26 reported between ROM and OHS socks question at 3-months post-operatively in the hip study.

In contrast to these findings, several researchers have reported the existence of only a weak relationship between ROM and activity limitation and participation restriction as measured with OA-specific questionnaires(Kantz et al. 1992;Witvrouw et al. 2002;Miner et al. 2003).

Witrvrouw et al. (2002) assessed the relationship between abnormal knee movement (impairment) measured using the DynaPort Knee Test, and activity restriction/participation limitation measured using the WOMAC function scale, in total knee replacement patients. The DynaPort Knee Test assesses the quality of movement in the knees using sensors which are attached to the patient's leg and knee whilst they complete a series of movements including walking, ascending and descending stairs, and moving from sitting to standing etc. Correlations of .34 and .22 were found between the DynaPort Knee Test and WOMAC function and stiffness subscales. A subsequent regression analysis failed to identify the objective measure as a predictor of function. Witrouw et al. (2002) suggest that there may be a weak relationship between subjective pain and function (recorded with WOMAC) and objective measures of ROM as

> *"These functional self-reported scales are sensitive to psychological and non-disease factors such as fatigue and depression."* (They believe that) "*This can be considered as a merit of these scales such factors contribute significantly to the patient's actual pain and dysfunction*". (Witvrouw et al. 2002:349)

Miner et al. (2003) reported that post-TKR only weak relationships were found between ROM of scores on the function component of the WOMAC. Similarly, Kantz et al. (1992), that again following TKR, objective measures of impairment (ROM and x-ray) were only weakly related to activity limitation and participation restriction measured using the SF-36 and the KSKS. Other research has also shown a limited relationship between impairment and activity limitation and participation restriction in TJA and wider area of orthopaedics. Both Botha-Scheepers et al. (2006) and Creamer et al. (2000) demonstrated a limited relationship between impairment measured using the Kellgren-Lawrence score for assessing radiographs, and activity limitation and participation restriction assessed using the WOMAC function scales. Both authors point to the importance of psychological factors in modifying activities limitation in OA, with Botha-Scheepers et al. (2006) concluding:

> "*...our study shows the importance of modifying psychological factors, with respect to limitation in activates in patients with OA and the complexity of interactions between different aspects within the ICF framework*" (Botha-Scheepers et al. 2006:1109)

Kocher et al. (2004) assessed the relationship between objective assessment of ligament stability and symptoms and function following anterior cruciate ligament reconstruction. Three objective assessments which are used to assess ligament stability following anterior cruciate ligament surgery (instrumented knee laxity, Lachman examination, and pivot-shift examination) were used in the study. Subjective symptoms included pain, swelling, partial or full giving way, locking, crepitus, stiffness and limping. Self-report of activities included satisfaction with outcome, walking, squatting, ascending and descending stairs, running, jumping, twisting, activity limitation and activities of daily living. Two of the measures (instrumented knee laxity and Lachman examination) were not significantly related to activities limitation or participation restriction. The third measure was found to be related to some but not all of the variables.

Finally, Dagfinrud et al. (2005) reported that impairment in ankylosing spondylitis measured using blood samples and anthropometric measures was only partially able to explain limitations in activity and restriction of participation measured using the Canadian Occupational Therapy Performance Measure.

The findings of a weak relationship between impairment and activities limitation and participation restriction have been found in many other areas of health research. A limited between impairment and limitation in activities and restriction in participation in chronic heart failure (Cowley et al. 1991;Grigioni et al. 2003), various respiratory conditions including asthma (Rosenzweig et al. 2004) and COPD (Williams and Bury 1989;Ortega et al. 1994;Tsukini et al. 1996), in cancer (Rietman et al. 2004;Hayes et al. 2005;Thorsen et al. 2006), multiple sclerosis (Goverover et al. 2006), and in shoulder pain with hemiplegia following stroke (Chae et al. 2007).

In contrast to the limited relationship found between objectively measured impairments (such as ROM, radiographical changes etc.) and activity limitation/participation restriction, a strong relationship was found between pain (also classified as an impairment by WHO) and limitations in activities and restriction of participation. This finding is in line with a wealth of literature.

Chui et al. (2005) found moderate to strong correlations between neck pain and disability. Leveille et al. (2001) reported a correlation at baseline between severity of musculoskeletal pain in elderly women and difficulty in completing activities of daily living, walking ability and lifting ability. Furthermore, in the patients who had not yet developed a difficulty in completing activities of daily living, severe pain at baseline predicted the development of disability (measured using the above criteria) over the course of the three year study which was independent of demographic variables.

Creamer et al. (2000) completed a study assessing the 'factors associated with functional impairment in symptomatic knee osteoarthritis'. In a regression analysis, pain severity was found to account for a large proportion of patient's limitation in activity and participation restriction as measured by WOMAC.

Similarly, Rietman et al. (2004) reported that in patients who had previously undergone surgery for breast cancer, pain showed a strong relationship to shoulder disability measured with the Shoulder Disability Questionnaire, and health-related quality of life. Pain has also been shown to impact quality of life in patients with shoulder pain as a result of hemiplegia post-stroke (Chae et al. 2007).

There are clearly strong differences in the strength of the relationship between impairment and activity limitation/participation restriction depending on what type of impairment is measured. Objectively measured impairments such as range of motion, radiographical changes, results of blood tests etc. have shown a limited relationship with limitation in activity and participation restriction. Pain (which is also classified by WHO as an impairment), on the other hand, has been shown to have a strong relationship with activity limitation and restriction in participation in a variety of different conditions. Pain is considered as an impairment as it is considered as a problem with a body function which is defined as physiological functions of the body systems (including psychological functions) (World Health Organisation 2001). However, it is well known that pain is a subjective experience individual to each patient (Resnik et al. 2001;Ong and Seymour 2004;Chapman 2005). Chapman et al. (2005) eloquently describe the subjective nature of pain stating:

> *"Pain....is subjective and private. In order to assess pain, one must rely on first-person reports from patients. Although we all know what pain feels like, we will never be able to experience someone else's pain. We can no more experience another person's pain than we can experience their joy, their love of Mozart, their aversion to anchovies, or their suffering. This aspect of pain, perhaps more than any other, interferes with its incorporation into modern medicine"* (Chapman 2005:283)

Pain is also known to affected by a variety of psychological factors such as coping strategies (Keefe et al. 1990b), self-efficacy (Lefebvre et al. 1999), helplessness (Skevington 1983) and global personality factors such as neuroticism (Affleck et al. 1992;Goubert et al. 2004). Many of these factors may also influence self-reports of activity limitation and participation restriction.

For example Creamer et al. (2000) noted the influence of anxiety on helplessness on scores on WOMAC, whilst Botha-Scheepers et al. (2006) reported that mental health and illness perceptions affected self-reported limitation in activities and participation restriction again measured with the WOMAC. As the psychological factors are responsible for modulating patients' perceptions of pain and self-report of limitation of activities and restriction of participation (measured with a variety of joint-specific and condition-questionnaires) it is to be expected that there is a strong relationship between pain and these factors. It is also highlights the importance of this area of research as the greater we know about the psychological factors which affect pain and function, the more likely that it is that we will be able to develop interventions to target these.

Summary of Chapter

This chapter has reported and discussed:

- The weak relationship recorded between ROM and components of joint-specific questionnaires measuring activities limitation and participation in both hip and knee patients pre-operatively.
- The weak relationship between ROM and components of the joint-specific questionnaires post-total hip replacement.
- That the strength of the relationship between ROM and the components of the joint-specific questionnaires post-total knee replacement seems to be influenced by whether a patient has experienced a decrease in ROM from pre- to post-surgery.
- The strong relationship between pain and components of the joint-specific questionnaires measuring activities limitation and participation in both hip and knee patients pre- and post-operatively.
- These findings have been related to the ICF framework in the context of orthopaedic research and in wider health research.

Chapter 5: Hip Study: Baseline Findings

Introduction:

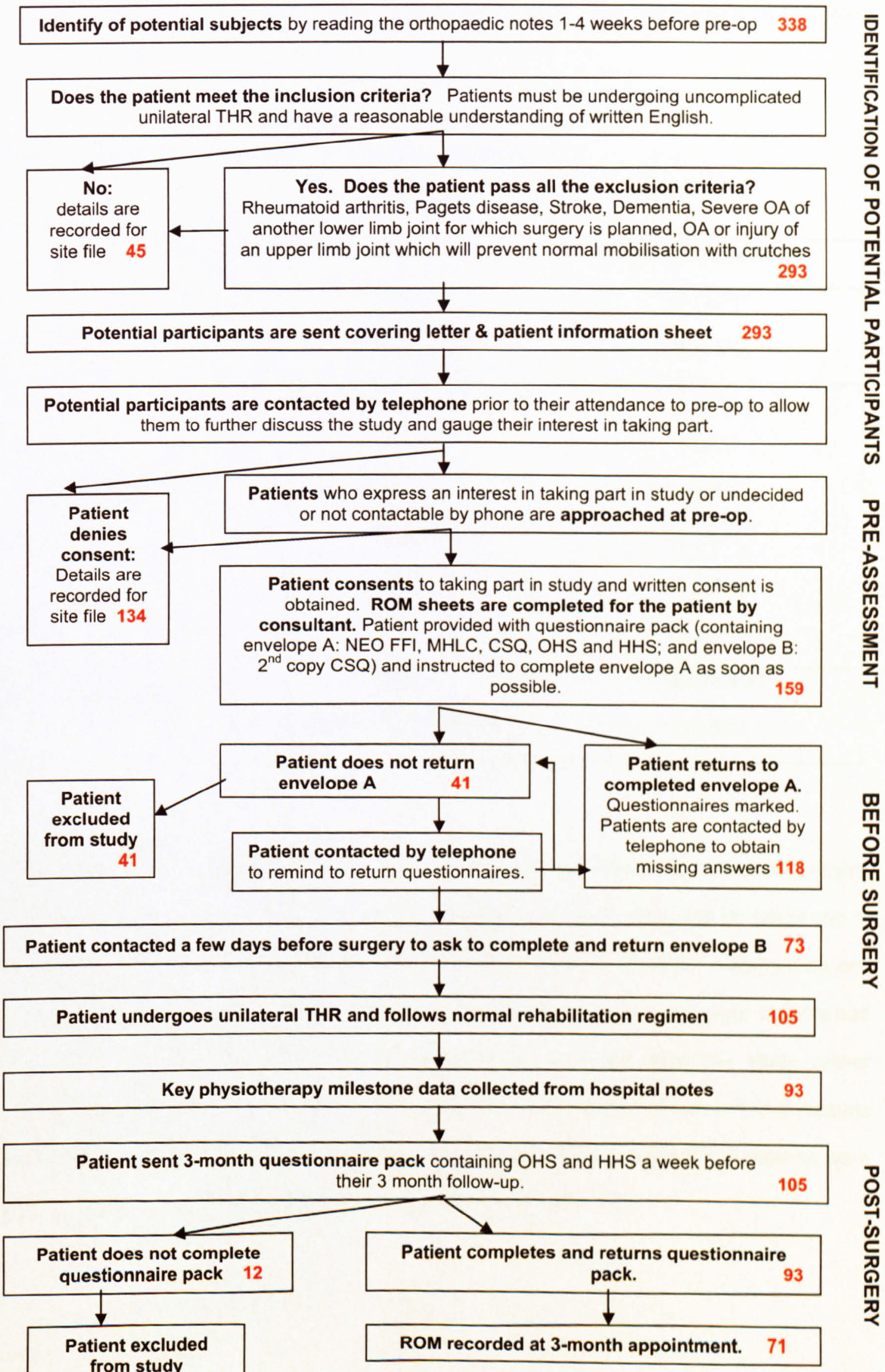
This chapter will report the:

- Recruitment and Retention of Study Participants
- Demographics of participants in the hip study.
- The relationship between psychological factors and pre-operative recordings of activity limitation and participation restriction as measured with the joint-specific questionnaires.
- The relationship between psychological factors and pain with pre-operative recordings of activity limitation and participation restriction as measured with the joint-specific questionnaires.

Recruitment and Retention of Participants

Figure 5.1 summarises the recruitment and retention of participants to the hip study. The numbers of participants at each stage are in red.

Figure 5.1: Flow chart of patient recruitment and retention to hip study (shown in red)



Demographics

One hundred and fifty nine patients were recruited to the study. The demography of this group of patients is summarised in the Table 5.1.

Table 5.1: Demography of subjects consented to study

Demographic Factor		**Number of Subjects**
Gender	Male	67 (42%)
	Female	92 (58%)
Age category	30-39	2 (1%)
	40-49	8 (5%)
	50-59	27 (17%)
	60-69	60 (38%)
	70-79	42 (26%)
	80-89	20 (13%)
Ethnicity	White	158 (99.4%)
	Black or Black British	1 (0.6%)

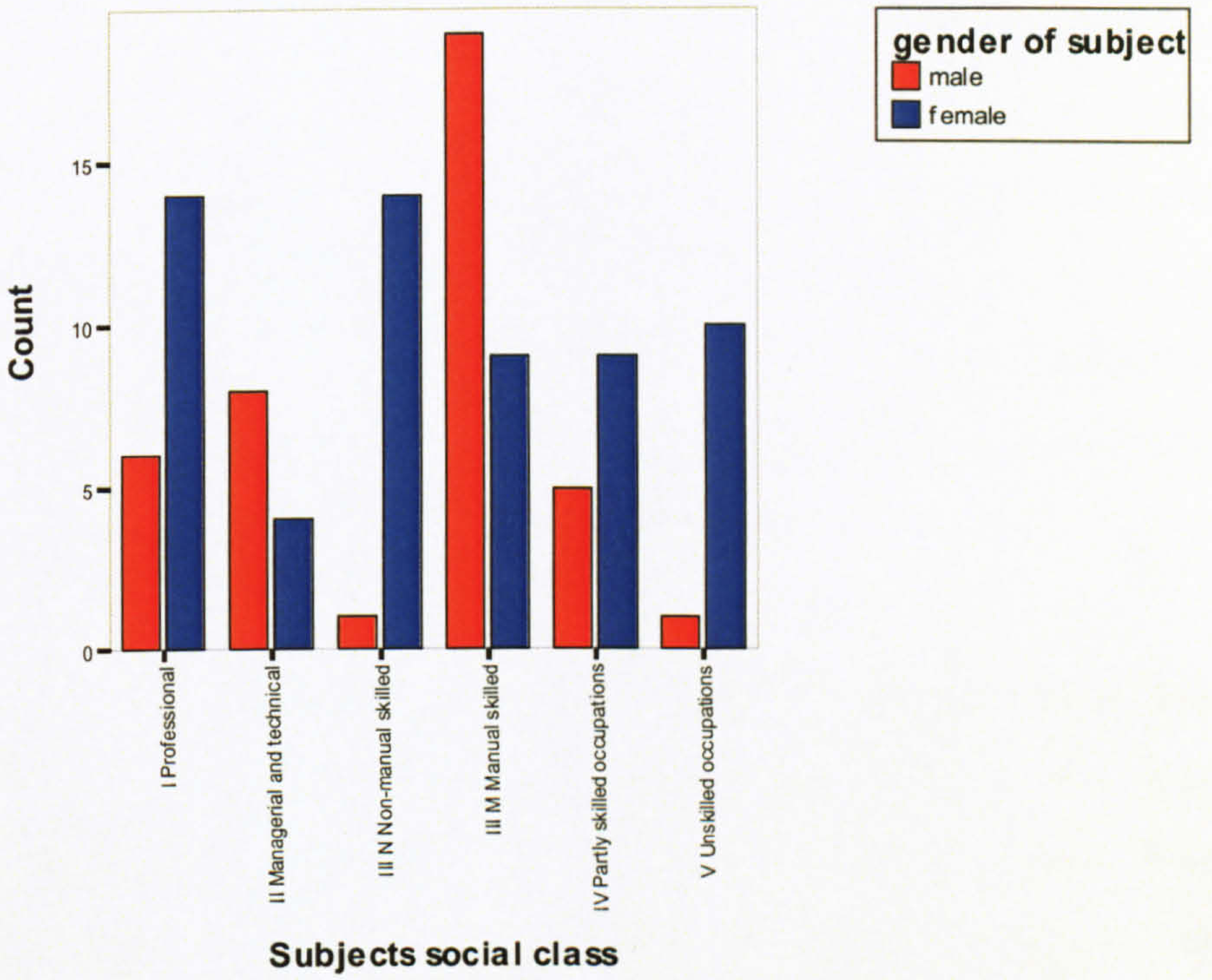
Of the 159 patients consented to the study, 118 returned questionnaires. Several patients returned incomplete questionnaires. In these instances they were contacted by telephone in order to obtain missing answers. In four cases it was not possible to obtain missing data and therefore these patients were excluded from the study. Of the 114 remaining, eight patients had their surgery cancelled and further nine patients were excluded from the study (either retrospectively and excluded for reasons that were missed at the time of consent or if patients did not have their surgery within the timeframe of the study). Thus, a total of 105 patients were in study population. The demography is summarised in the Table 5.2.

Table 5.2: Demography of subjects who returned completed questionnaires and had their surgery within the timeframe of the study

Demographic Factor		Number of Subjects
Gender	Male	42 (40%)
	Female	63 (60%)
Age category	30-39	1 (1%)
	40-49	3 (2.9%)
	50-59	20 (19%)
	60-69	44 (41.9%)
	70-79	25 (23.8%)
	80-89	12 (11.4%)
Ethnicity	White	104 (99%)
	Black or Black British	1 (1%)
Employment status of subject	Employed	19 (18.1%)
	Unemployed	7 (6.7%)
	Retired	79 (75.2%)
Highest education level achieved	No further education	49 (46.7%)
	Other	32 (30.5%)
	'A' level	9 (8.6%)
	Degree	10 (9.5%)
	Post-graduate	5 (4.8%)
Social class	I Professional	20 (19%)
	II Managerial and technical	12 (11.4%)
	III N Non-manual skilled	15 (14.3%)
	III M Manual skilled	28 (26.7%)
	IV Partially skilled occupations	14 (13.3%)
	V Unskilled occupations	11 (10.5%)
	Missing	5 (4.8%)

The social class classification is based on an individual's employment or previous employment for retired participants. It was not possible to classify participants who had never worked. These are summarised in Table 5.2 as missing. These individuals will be excluded from regression analyses involving social class as the independent variable.

Figure 5.2: Gender difference in social class groupings



Discussion

The reason for recording of demographic variables in this study was twofold: first, it will enable the assessment of whether the results are applicable to the wider population of total hip replacement patients. Second, some demographic variables are associated with different outcomes in the replacement, and so these will be entered into the multiple regression analysis. The discussion here deals with the first of these reasons.

The gender split of patients in the study is similar to the age-standardized rates per 100,000 population of primary hip replacements for the Trent region reported by Dixon et al. (2006). They report 65.5 males per 100,000 population and 83.6 females per 100,000 population underwent total hip replacements in the year 2000. This equates to 44% of total hip replacements being carried out on male patients and 56% female patients.

The distribution of subjects across different age categories is a little different to what would be expected compared with the information published on the age categories of patients undergoing total prosthetic replacement of hip joint (W37-W39) from the Hospital Episode Statistics for NHS hospitals in England for the year 2004-05 (Department of Health 2005). They report that 16% of the patients are aged 15 to 59, 48% are aged 60-74, and 35% fall into the over 75 category. Comparatively, for the study patients who returned completed questionnaires and had their surgery within the timeframe of the study the data were as follows: 22% of patients fall into the age category of 15-59, 57% into the 60-74 age category, and 21% in the over 75s. Analysis of the percentage of patients recruited by age category compared with the number of potential patients revealed that the more elderly patients were less likely to consent to the study. Only 40% of the potential subjects in the 80-89 category consented compared with 57% in the 50-59 category.

The ethnic origin of the patients recruited to the study also deserves comment. All but one of the patients recruited to the study were White. This reflects the very low number of patients of an ethnic minority attending for THR at the Northern General hospital. There were only three potential patients of an ethnic minority (all Black or Black British) who met the inclusion criteria for the study. It is known that osteoarthritis of the hip is more common in White than other ethnic backgrounds (Dawson et al. 1994;Arthritis Research Campaign 2002). Much of the research regarding the lower incidence of osteoarthritis in different ethnic groups has been conducted in America and therefore it is unknown whether these differences apply to the United Kingdom. As there are no definite figures available on the percentage incidence of osteoarthritis in different ethnic minorities, it is difficult to predict what proportion of patients consented to the study should be of an ethnic minority. 8.8% of people residing in the Sheffield area are of an ethnic minority (Sheffield City Council Corporate Policy Unit 2003). Based on these figures it may be expected that the number of participants in the study who are of an ethnic background would be higher. A possible explanation for this comes from Dunlop et al.

(2003) who found that after accounting for demographics, health needs, and economic variables, ethnic minority patients with osteoarthritis of the hip or knee were significantly less likely to undergo a joint replacement compared with white people. Ibrahim et al. (2002) suggest that Black patients may be less willing to undergo joint replacement surgery as they are less familiar (do not have relatives who have undergone the same procedure etc) with joint replacement surgery and have more concerns about the surgery than White patients. This is discussed further in Chapter 9.

Comparison of social class groupings of the cohort of patients with people residing in the Sheffield area poses some difficulty as the social class was recorded in the study using the old social class classification based on the Registrar General's classifications. From 2001 the government replaced these were the National Statistics Socio-Economic Classification (NS-SEC) and statistics of social class from 2001 census were recorded in this form. This classification was not used in the study as it was deemed too detailed for use in the multiple regression analysis. Therefore, in order to compare the social class of participants on the study with that of the general public, the 2000 statistics produced for the office for National statistics (Office for National Statistics 2000) have been used. These statistics only cover those of working-age. The percentages falling into each category are comparable except that the percentage of patients falling into the professional category is double that quoted in the national average in 2000 and the number patients falling into the managerial and technical category is less than would be expected.

On first comparing the education levels of patients retained in the study with the qualification levels for people residing in Sheffield published by the National statistics office (Office for National Statistics 2001) it appears that the number achieving the highest education level is lower than would be expected. However, on viewing another table published by the National Statistics Office (Office for National Statistics 2005) which is categorised as qualifications by age, gender and ethnicity, it is apparent that people in the older age groups are generally less well-qualified than those in younger age groups, and therefore the education level of the patient cohort is comparable with that of the population for the area. The percentages and trends when split by gender are comparable except for a higher percentage of participants falling within the professional category compared with that of the population of the United Kingdom.

Baseline psychological characteristics

Tables 5.3 – 5.7 summarise the scores for each of psychological constructs studies.

Table 5.3: Summary of scores on the Multidimensional Health Locus of Questionnaire

Component	N	Range	Mean (+ SD)	Median	Mode
Internal subscale	104	11 – 36	24 ± 6	25	27
Chance Subscale	104	6 – 34	16 ± 7	16	17
Doctors Subscale	104	3 – 18	14 ± 3	14	15
Others Subscale	104	3 – 18	12 ± 4	12	12, 13

Note: the possible range of scores for Internal and chance subscales is 6 – 36, possible range of scores for doctors and others subscales is 3– 18.

The means and standard deviations for the MHLC scales were compared with the means and standard deviations on subscales of form C for different diagnostic groups published by Wallston et al. (1994). The four patient groups were rheumatoid arthritis, chronic pain, diabetes and cancer. Patients with osteoarthritis were considered to be comparable to either patients with rheumatoid arthritis or chronic pain, and therefore the means and standard deviations of the patient dataset was compared with these. The means of the chance scale and the doctors scale were comparable with the rheumatoid arthritis dataset. Both the means for the internal scale and the others subscale were found to be higher than the means reported for either the chronic pain or rheumatoid arthritis group.

Table 5.4: Summary of scores on the NEO-Five Factor Inventory

Factor	N	Range	Mean (+ SD)	Median	Mode
Neuroticism	105	0 – 43	18 ± 8	17	13, 14
Extraversion	105	8 – 46	27 ± 6	26	26
Openness to Experience	105	10 – 45	25 ± 7	25	26
Agreeableness	105	20 – 44	34 ± 5	34	32
Conscientiousness	105	22 - 47	36 ± 5	36	36

Note: the possible range of scores for all factors is 0 – 48.

The scores on the NEO-FFI approximated to normal distributions. The mean scores were similar the US norms reported by Costa and McCrae (1992). Jerram and Coleman (1999) reported that the their sample of English community-dwelling pensioners had lower scores for openness and agreeableness. The level of openness to experience was marginally lower (2 points) than the US norms but, contrastingly, the level of agreeableness was marginally higher (2 points) than those reported in the US normative data.

It is possible to categorise patients as very low, low, average, high or very high for each of the five factors in the NEO-FFI using the scoring form. Table 4.5 contains the number and percentage of patients scoring in each category on each factor.

Table 5.5: Number and percentage of patients scoring in each category of each factor of the NEO-FFI

Factor	Very low	Low	Average	High	Very High
Neuroticism	8 (7.6%)	36 (34.3%)	40 (38.1%)	16 (15.2%)	5 (4.8%)
Extraversion	11 (10.5%)	24 (22.9%)	48 (45.7%)	18 (17.1%)	4 (3.8%)
Openness to Experience	14 (13.3%)	29 (27.6%)	43 (41.0%)	12 (11.4%)	7 (6.7%)
Agreeableness	9 (8.6%)	16 (15.2%)	45 (42.9%)	31 (29.5%)	4 (3.8%)
Conscientiousness	1 (1%)	20 (19%)	49 (46.7%)	24 (22.9%)	11 (10.5%)

Table 5.6: Summary of scores on the Coping Strategies of the Coping Strategies Questionnaire

Coping Strategy	N	Range	Mean (+ SD)	Median	Mode
Diverting Attention	104	0 – 33	13 ± 8	13	0
Reinterpreting Pain Sensations	104	0 – 29	6 ± 6	5	0
Coping Self Statements	104	0 – 36	24 ± 8	24	24
Ignoring Sensations	104	0 – 32	16 ± 8	15	15
Praying/Hoping	104	0 – 36	16 ± 8	15	15
Catastrophizing	104	0 – 32	9 ± 8	6	0
Increasing Behavioural Activities	104	0 – 35	16 ± 8	15	15

Note: the possible range of scores for coping strategies is 0 – 26.

Table 5.7: Summary of scores on the Pain Control Efficacy Scales of the Coping Strategies Questionnaire

Pain Control Efficacy Rating	N	Range	Mean (+ SD)	Median	Mode
Controlling Pain	104	0 – 6	3 ± 1	3	3
Decreasing Pain	104	0 - 5	3 ± 1	3	3

Note: the possible range of scores for pain control efficacy ratings is 0 -6.

There is no specific normative data for the CSQ available. Lawson et al. (1990) published the means and standard deviations for each of the coping strategies from 5 different samples of chronic pain patients. One-way ANOVAs and chi-square tests revealed that there were significant differences between the samples for all of the coping strategies except reinterpreting pain sensations and perceived ability to decrease pain. The mean scores (and standard deviations) from my patient sample for these two strategies matches those reported by Lawson et al. (1990).

The discrepancy in the mean, median and mode for the coping strategies in Table 5.6 indicates that these factors are not normally distributed. Therefore, histograms (fig 5.3 – 5.9) for each of the coping strategies are included below for reference. The scores were normalised using transformations before the multiple regression analysis was conducted (see Appendix page 635 for further details).

Figure 5.3: Histogram showing spread of scores for Diverting Attention

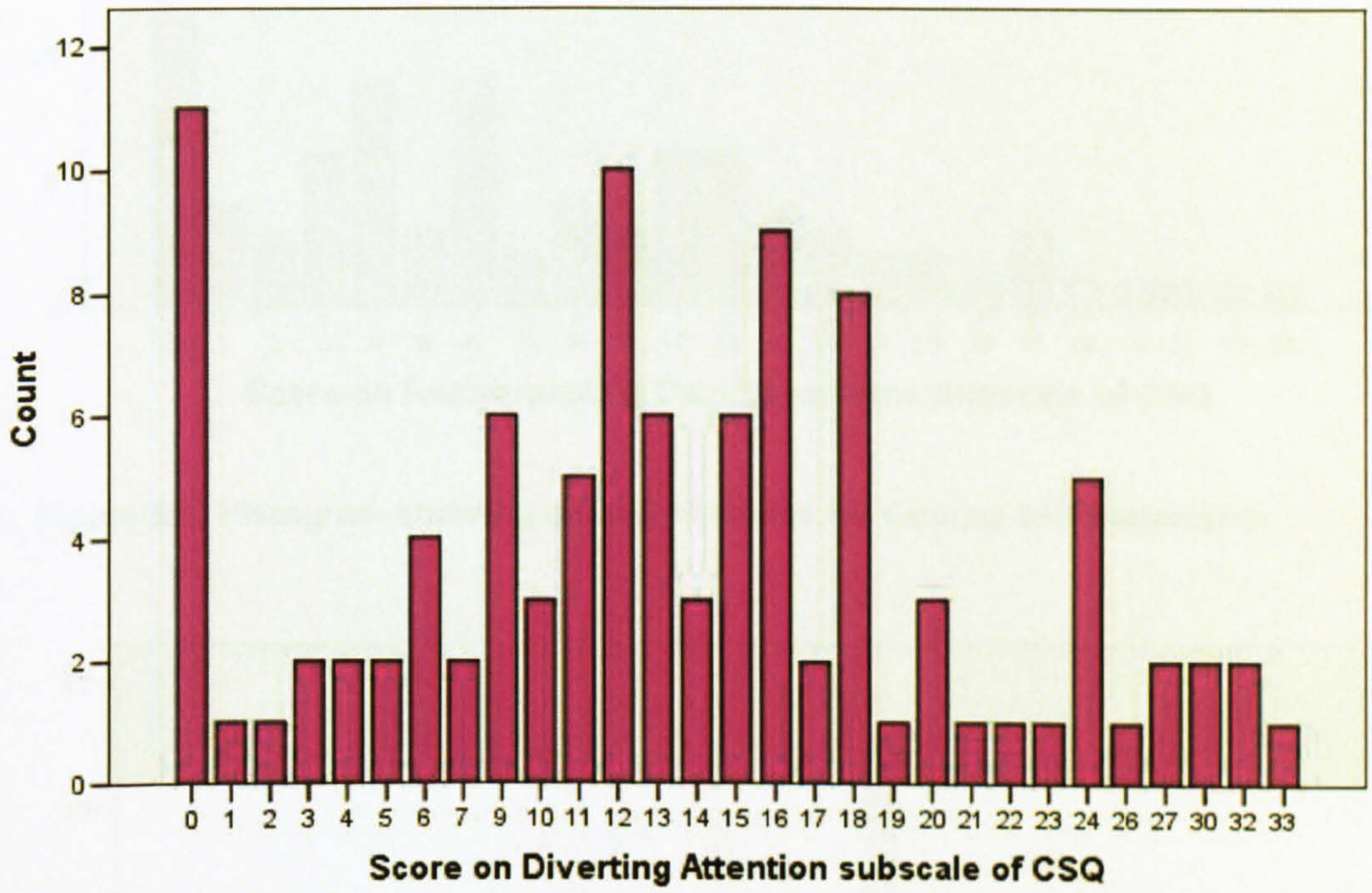


Figure 5.4: Histogram showing spread of scores for Reinterpreting Pain Sensations

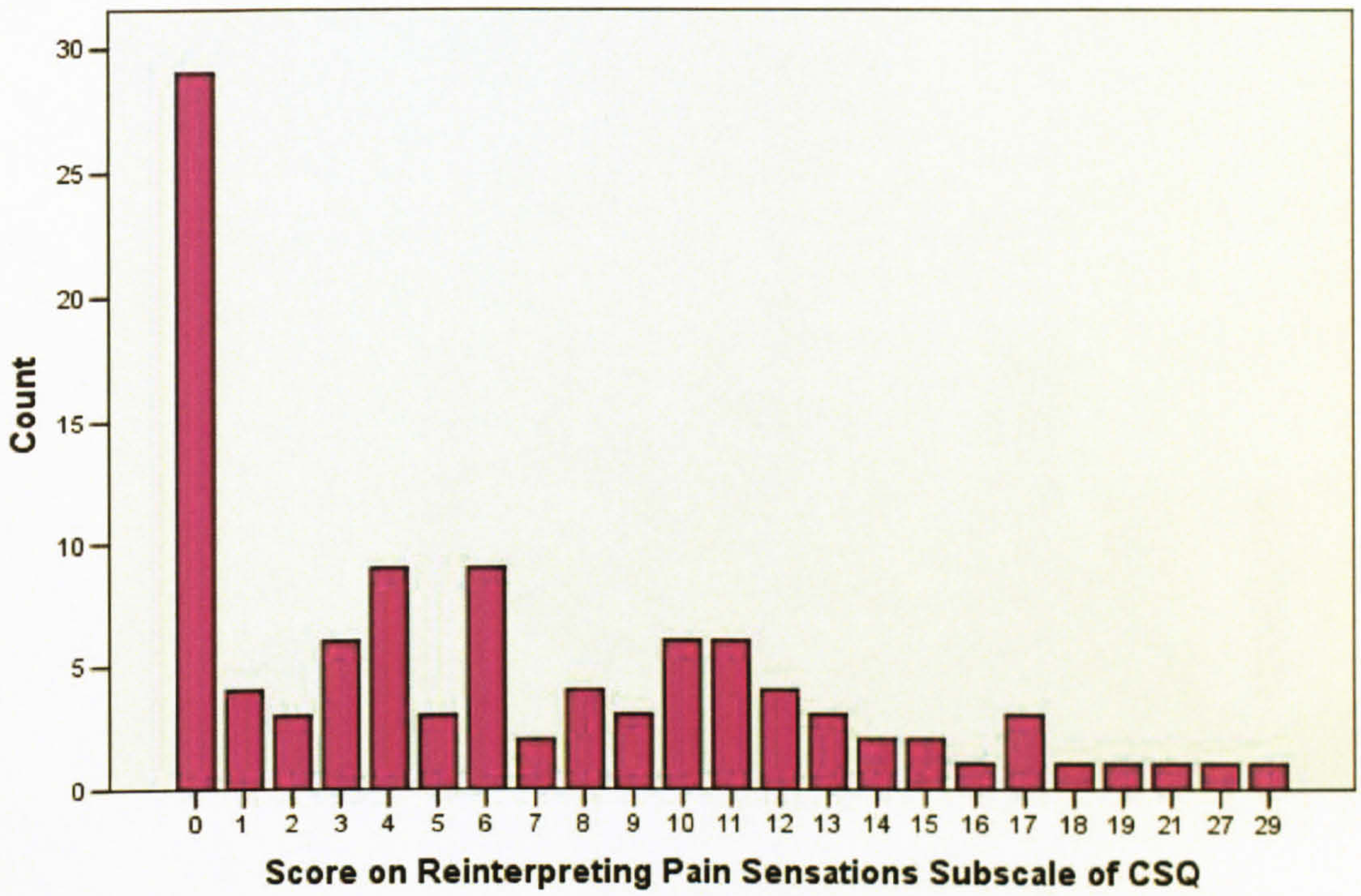


Figure 5.5: Histogram showing spread of scores for Coping Self Statements

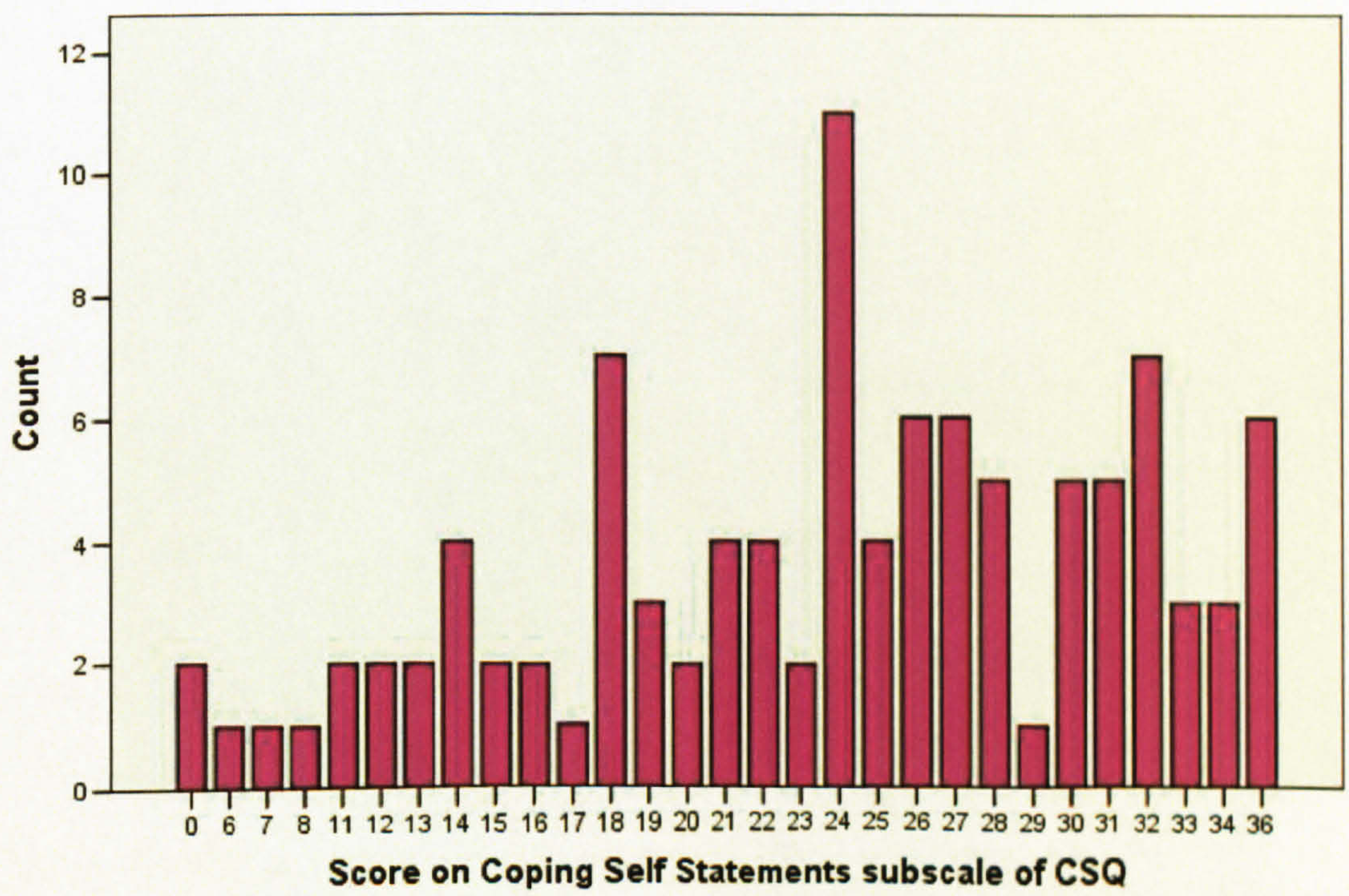


Figure 5.6: Histogram showing spread of scores for Ignoring Sensations

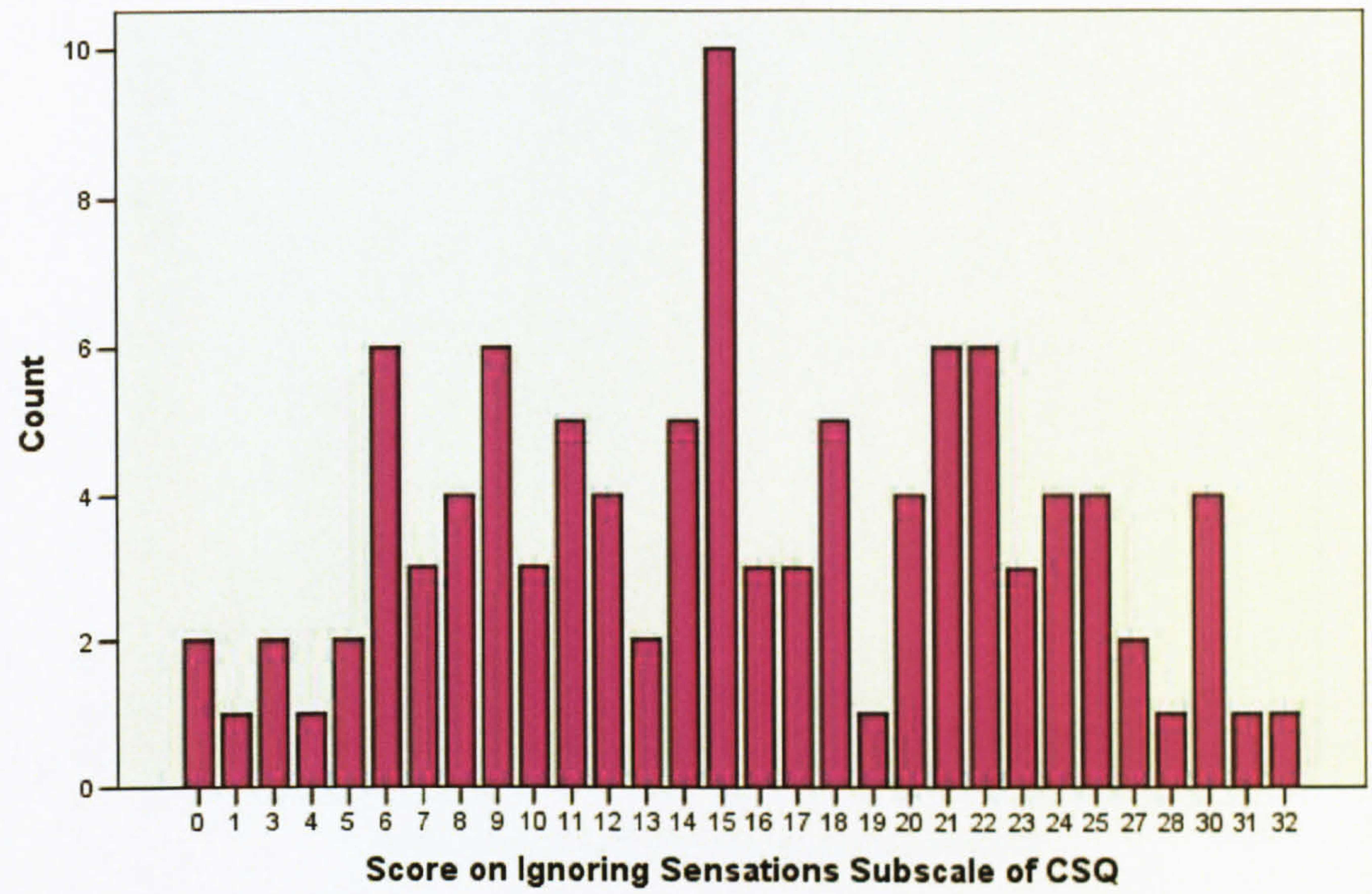


Figure 5.7: Histogram showing spread of scores for praying/hoping

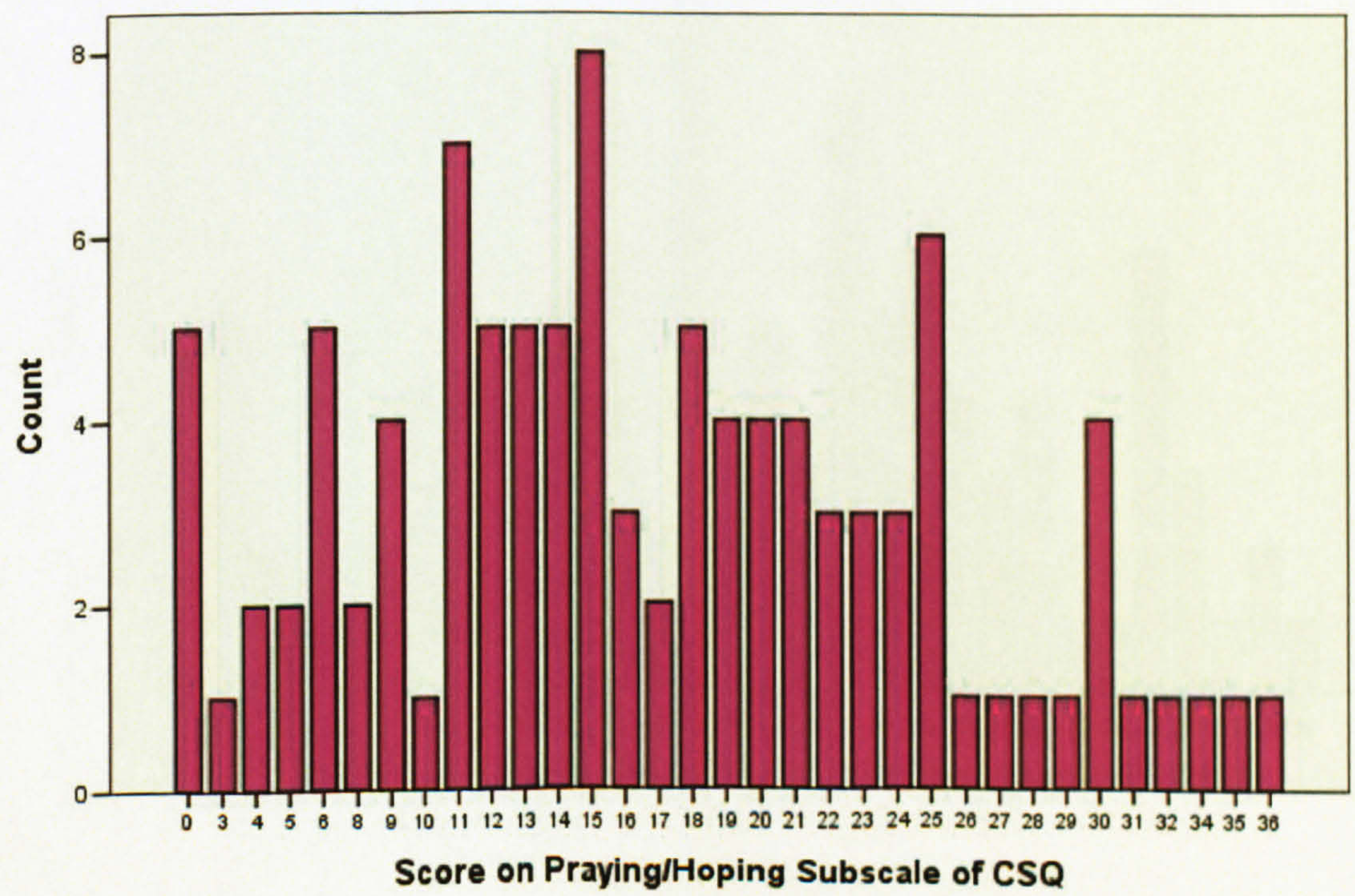


Figure 5.8: Histogram showing spread of scores for catastrophizing

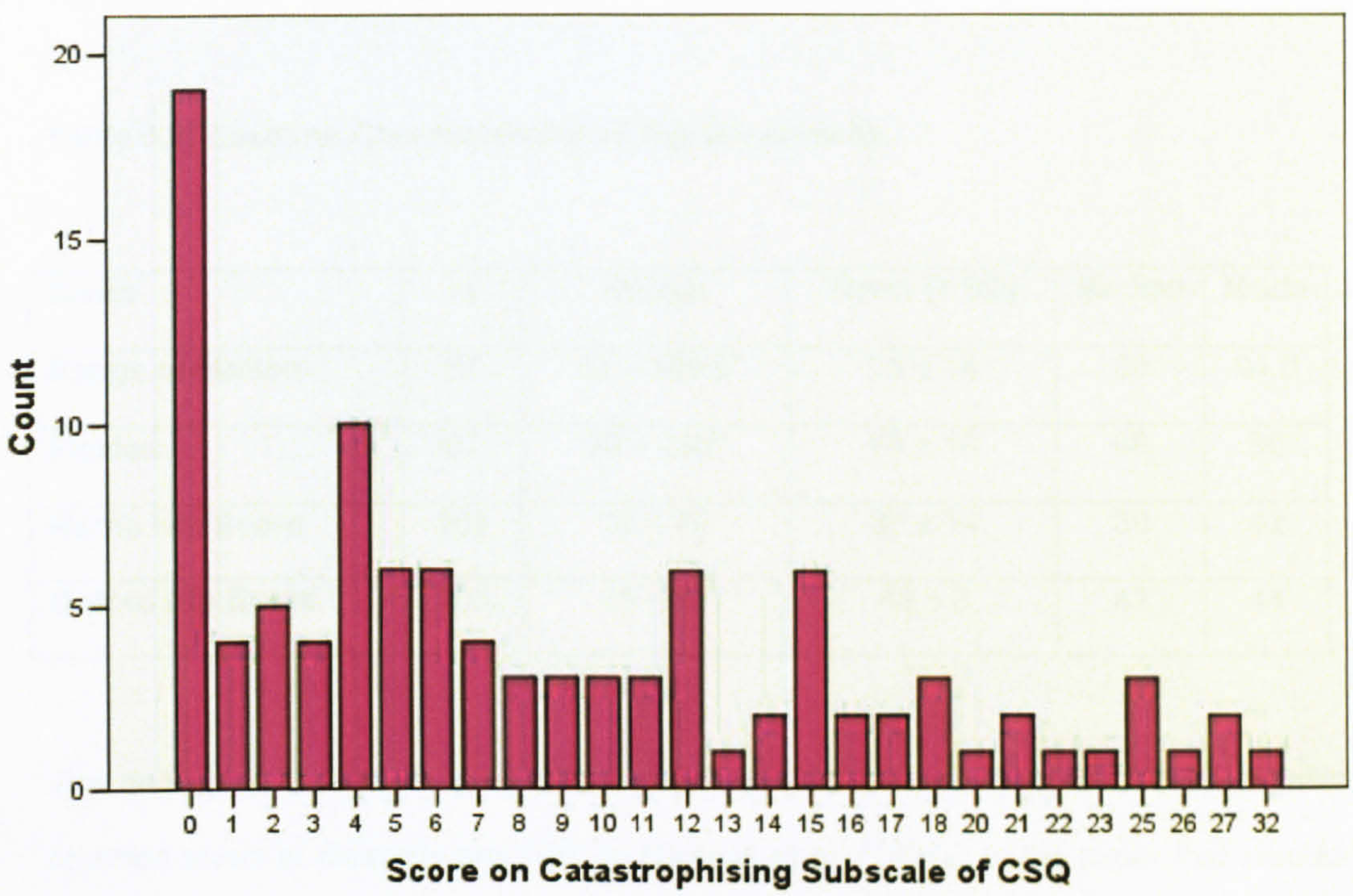
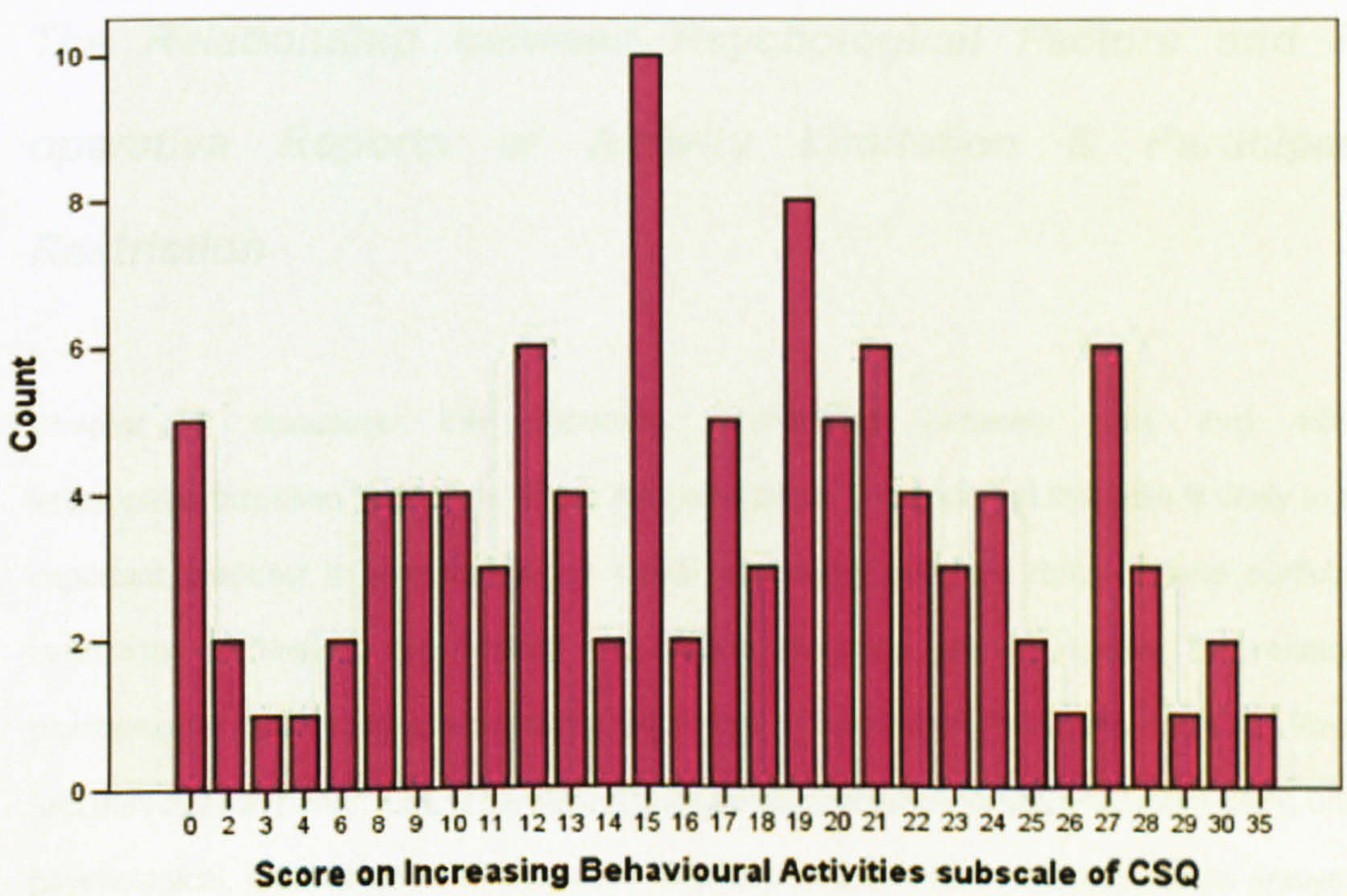


Figure 5.9: Histogram showing spread of scores for increasing behavioural activities



Baseline orthopaedic characteristics

Table 5.8 summarises the baseline scores achieved on the joint-specific questionnaires.

Table 5.8: Baseline Characteristics of Hip OA severity

Score	N	Range	Mean (+ SD)	Median	Mode
Range of Motion	97	32 – 100.5	79 ± 14	80	94.5
Flexion	97	20 – 130°	75 ± 18	89	90
Harris Hip Score	105	12 – 76	38 ± 14	39	42
Oxford Hip Score	105	15 – 59	42 ± 8	42	44

The degree of impairment and activity restriction, as measured by the OHS is similar to the reported levels of disability pre-THR by Dawson et al. (1996a) in the paper that introduced the OHS. Unfortunately, I have not been able to source any data providing pre-operative scores on the self-report Harris Hip Score for comparison.

The Relationship between Psychological Factors and Pre-operative Reports of Activity Limitation & Participation Restriction

Chapter 4 discusses the important relationship between pain and activities limitation/participation restriction. From the correlations it is apparent that pain is likely to be an important predictor in any regression model assessing activities limitation and participation restriction. However, the original aim of the research was to assess the relationship psychological factors and pre-operative recordings of self-reported disability (activities limitation and participation restriction). Therefore, the regression analysis is first conducted using only the psychological, demographic, and medical variables in the model. The regression analysis will then be repeated including reported level of pain, this will be reported and discussed later in the chapter.

In order to assess whether the data were normally distributed, histograms for each of the variables were plotted, and z-scores for skewness and kurtosis were calculated. Transformations were carried out on the data which had an unacceptable skew or kurtosis. Pages 628-638 of the Appendix detail the z-scores on the raw data, transformations used and the z-scores post-transformation. The results below (including the regressions involving pain) are using the transformed data.

Correlations

Pearson correlations were conducted to identify independent variables for inclusion in the regression analysis. These are summarised in Tables 5.9 (demographic variables), 5.10 (medical factors), 5.11 (Multi-dimensional Health Locus of Control), 5.12 (NEO Five Factor Inventory), and 5.13 (Coping Strategies Questionnaire). Independent variables which correlated significantly with the dependent variable ($p < .05$) were included in the subsequent multiple regression analysis.

Table 5.9: Correlations between the demographic factors and the dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
Age	-.03	-.05	-.03	-.08	-.07	-.10	.01	-.23*	.00	.05
Gender	.30**	-.28*	.30**	-.14	.28**	.22*	.32***	.22*	.27**	.25*
House	.01	.11	.08	.12	-.03	.01	-.12	.09	-.08	-.10
Employ.	-.08	-.04	-.10	-.16	.03	.02	.09	-.07	.07	.03
Social.	-.31***	-.32***	-.25**	-.13	.28**	.28**	.21*	.28**	.25*	.10
Educat.	.25*	.27**	.17	.19	-.14	-.17	-.05	-.13	-.11	-.03
School	.20*	.21*	.17	.15	-.13	-.16	-.07	-.09	-.13	-.05

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviations: HHS: Harris Hip Score: HHS F – HHS function component; HHS P – HHS pain component: HHS S – HHS socks question; OHS – Oxford Hip Score; OHS P1 – OHS pain component type 1; OHS F1 – OHS function component type 1; OHS P2 – OHS pain component type 2; OHS F2 – OHS functional component type 2; OHS S – OHS socks question; House = Number of people living in patient's house; Employ. = employment status; Social. = social class; Educat. = highest education level achieved; School = age left school.

Both gender and social class correlated significantly with nearly all of the dependent variables. Age only correlated with one of the dependent variables (OHS pain component type 2) although, it is likely that this is a result of multiplicity, rather than a real effect.

Table 5.10: Correlations between the dependent variables and medical factors

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
Co-morb.	-.19*	-.25**	-.10	.03	.07	.03	.06	-.06	.09	.00
Referral	-.06	-.06	-.06	-.01	.00	-.05	.08	-.12	.05	.04
Prev.TJA	-.16	-.01	-.20*	-.11	.05	.04	.12	.08	.05	.08

Note: * p ≤ .05.

Abbreviation: Co-morb. = co-morbidity; Referral = referral to physician to check suitability for surgery; Prev.TJA = previous total joint arthroplasty. Abbreviations for joint-specific questionnaires as noted in Table 5.9.

Co-morbidity negatively correlated with scores on HHS and HHS pain component i.e. co-morbidity was associated with less function and greater pain. Number of previous joint-arthroplasties negatively correlated with the HHS functional component.

Table 5.11: Correlations between dependent variables and Multi-dimensional Health Locus of Control (MHLC) variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
Internal	.01	.14	.03	.13	-.11	-.06	-.15	-.14	-.09	-.17
Chance	-.07	-.06	-.08	-.09	.04	.02	.05	-.04	.07	.09
Doctors	-.14	-.14	-.10	-.11	.18	.08	.20*	-.02	.24*	.25**
Others	-.13	-.16	-.09	-.06	.16	.07	.19	.01	.21*	.14

Note: * p ≤ .05, ** p ≤ .01. Abbreviations for joint-specific questionnaires as noted in Table 5.9.

The doctors scale of the MHLC significantly, positively correlated with scores on the OHS functional components and OHS socks question i.e. a greater score on the doctors scale was associated with less functional ability.

Table 5.12: Correlations between the NEO- Five Factor Inventory (NEO-FFI) and the dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
N	-.11	-.02	-.19	-.08	.07	-.00	.10	-.07	.11	.19
E	.00	-.05	.07	.06	.09	.14	.02	.17	.04	.03
O	.12	.21*	.01	.06	.00	-.08	.11	-.04	.04	.01
A	-.12	-.11	-.11	-.05	.12	.16	.08	.14	.10	.13
C	.19*	-.20*	-.14	-.10	.28**	.35***	.13	.38***	.20*	.13

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviations: N = neuroticism; E = extraversion; O = openness to experience; A = agreeableness; C = conscientiousness. Abbreviations for joint-specific questionnaires as noted in Table 5.9.

Conscientiousness was found to correlate weakly with most of the dependent variables. A higher score on conscientiousness was associated with worse functioning and greater pain. Other than this, there were no significant correlations between personality factors and the outcome variable except between openness to experience and the HHS pain component. As openness to experience did not correlate with any other of the dependent variables, this correlation may be a chance finding as a result of the number of correlations calculated.

Table 5.13: Correlations between factors in the Coping Strategies Questionnaire (CSQ) and the dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
DA	-.17	-.14	-.15	.20*	.08	.05	.09	-.05	.12	.15
RPS	-.07	-.05	-.05	.04	.01	.07	-.06	.07	-.02	.09
CSS	-.00	-.09	.13	.09	.02	.06	-.04	.14	-.04	-.07
IS	.12	.09	.15	.13	-.07	-.08	-.15	.11	-.13	.15
P/H	-.29**	-.32***	-.20*	-.24*	.18	.10	.21*	-.01	.23*	.26**
C	-.36***	-.35***	-.30**	-.20*	-.31**	.26**	.30**	.21*	.31***	.34***
IBA	.23*	-.24**	-.14	-.10	.10	.07	.08	-.01	.12	.24*
CP	.23*	.21*	.21*	.06	-.28**	-.29**	-.21*	-.18	-.28**	-.12
DP	.09	.05	.13	.15	-.21*	-.14	-.21*	-.10	-.22*	.09

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviations: DA = diverting attention; RPS = reinterpreting pain sensations; CSS = coping self statements; IS = ignoring sensations; P/H = praying/hoping; C = catastrophizing; IBA = increasing behavioural activities; CP = controlling pain; DP = decreasing pain. Abbreviations for joint-specific questionnaires a as noted in Table 5.9.

Weak significant correlations were found between catastrophizing and all of the dependent variables with catastrophizing being associated with worse function and more pain, suggesting that it may be an important factor in the multiple regression models. Similarly, weak significant correlations were found between praying/hoping and the dependent variables, and controlling pain and the dependent variables, suggesting that both of these factors may feature in the multiple regression models. A few significant correlations were also recorded between the dependent variables and decreasing pain and increasing behavioural activities. Diverting attention correlated significantly with only one of the dependent variables (HHS socks question) so this may be a result of multiplicity.

Forward Stepwise Multiple Regressions

Predictors of the Pre-operative Harris Hip Score (HHS)

A stepwise regression analysis was performed to predict pre-operative scores on the Self-Report Harris Hip Score from gender, social class, education level, age left school, co-morbidity, conscientiousness (NEO-FFI), praying/hoping (CSQ), catastrophizing (CSQ), increasing behavioural activities (CSQ), and controlling pain (CSQ). The regression model explained **26%** of the variance, adjusted R^2 = .23, F(3, 90) = 10.30, p < .001. Catastrophizing, conscientious, and social class were found to make significant contributions to the regression model. The results are displayed in Table 5.14.

Table 5.14: Summary of forward stepwise regression analysis for variables predicting Self-report Harris Hip Score

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	-.3.61	.97	-5.54	-1.68	-.34***
Conscientiousness	-.73	.23	-1.19	-.26	-.29**
Social class	-2.12	.78	-3.67	-.56	-.25**

Note: ** p ≤ .01, *** p ≤ .001, R^2 = .26, p < .001.

Predictors of the Pre-operative Harris Hip Score Pain Component

A stepwise regression analysis was performed to explain the pre-operative scores of the HHS pain component from gender, social class, education, age left school, co-morbidity, openness to experience (NEO-FFI), conscientiousness (NEO-FFI), praying/hoping (CSQ), catastrophizing (CSQ), increasing behavioural activities (CSQ), and controlling pain (CSQ). The regression model explained **31%** of the variance, adjusted R^2 = .28, F(4, 89) = 9.83, p < .001. Catastrophizing, conscientiousness, social class and co-morbidity were found to make significant contributions to the regression model (see Table 5.15).

Table 5.15: Summary of forward stepwise regression analysis for variables explaining HHS pain component

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	-.22	.06	-.34	-.10	-.33***
Conscientiousness	-.05	.01	-.08	-.02	-.30***
Social Class	-.14	.05	-.23	-.04	-.25**
Co-morbidity	-.20	.09	-.39	-.02	-.20*

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, $R^2 = .31$, $p < .001$.

Predictors of the pre-operative HHS Functional Component

A stepwise regression analysis was performed to predict the pre-operative scores on the HHS functional component from gender, social class, previous TJA, praying/hoping (CSQ), catastrophizing (CSQ), and controlling pain (CSQ). The regression model explained **15%** of the variance, adjusted $R^2 = .13$, $F(2, 92) = 8.21$, $p = .001$). Controlling pain and gender were found to make significant contributions to the regression model (see Table 5.16)

Table 5.16: Summary of forward stepwise regression analysis for variables predicting the HHS functional component

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Controlling Pain	-4.89	1.51	.20	2.18	-.31*
Gender	1.19	.50	-7.88	-1.90	.23**

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .15$, $p = .001$.

Predictors of Response to the Pre-operative HHS Socks Question

A stepwise regression analysis was performed to explain scores on the socks question on the pre-operative HHS from diverting attention (CSQ), praying/hoping (CSQ), and catastrophizing (CSQ). The regression model explained **6%** of the variance, adjusted $R^2 = .05$, $F(1, 98) = 6.06$, $p = .016$. Praying/hoping was found to make a significant contribution to the regression model (see Table 5.17).

Table 5.17: Summary of forward stepwise regression analysis for variables explaining HHS socks question

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Praying/Hoping	-.03	.01	-.06	-.01	-.24*

Note: * $p > .05$, $R^2 = .06$, $p = .016$.

Predictors of the Pre-operative Oxford Hip Score (OHS)

A stepwise regression analysis was performed to predict pre-operative OHS from gender, social class, conscientiousness (NEO-FFI), catastrophizing (CSQ), controlling pain (CSQ), and decreasing pain (CSQ). The regression model explained **26%** of the variance, adjusted $R^2 = .23$, $F(3, 95) = 10.95$, $p < .001$. Catastrophizing, conscientiousness and controlling pain were found to make significant contributions to the regression model (see Table 5.18).

Table 5.18: Summary of forward stepwise regression analysis for variables predicting scores on OHS

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
Catastrophizing	1.45	.56	.33	2.56	.23**
Conscientiousness	.53	.13	.26	.79	.35***
Controlling Pain	-1.62	.50	-2.60	-.63	.23**

Note: ** p ≤ .01, *** p ≤ .001, R^2 = .26, p < .001.

Predictors of the pre-operative OHS Pain Component Type 1

A stepwise regression analysis was performed to explain pre-operative scores on the OHS pain component type 1 from gender, social class, conscientiousness (NEO-FFI), catastrophizing (CSQ), and controlling pain (CSQ). The regression model explained **32%** of the variance, adjusted R^2 = .29, F(4, 94) = 11.06, p < .001. Catastrophizing, conscientiousness, controlling pain, and social class were found to make significant contributions to the regression model (see Table 5.19).

Table 5.19: Summary of forward stepwise regression analysis for OHS pain component type 1

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
Catastrophizing	.59	30	.01	1.18	.17*
Conscientiousness	.34	.07	.20	.48	.42***
Controlling Pain	-.88	.27	-1.41	-.36	-.29***
Social Class	.51	.24	.04	.99	.19*

Note: * p ≤ .05, *** p ≤ .001, R^2 = .32, p < .001.

Predictors of the Pre-operative OHS Functional Component Type 1

A stepwise regression analysis was performed to explain the pre-operative scores on the OHS functional component type 1 from gender, social class, doctors subscale of MHLC, praying/hoping (CSQ), catastrophizing (CSQ), controlling pain (CSQ), and decreasing pain (CSQ). The regression model explained **25%** of the variance, adjusted R^2 = .23, F(3, 93) = 10.58, p< .001. Catastrophizing, decreasing pain and gender were found to make significant contributions to the regression model (see Table 5.20).

Table 5.20: Summary of forward stepwise regression analysis for variables predicting OHS functional component type 1

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	.12	.04	.04	.20	.26**
Decreasing Pain	-.53	.17	-.87	-.18	-.28**
Gender	.40	.11	.18	.63	.33***

Note: ** p ≤ .01, *** p ≤ .001, R^2 = .25, p < .001.

Predictors of the Pre-operative OHS Pain Component Type 2

A regression analysis was performed to explain the pre-operative scores of the OHS pain component type 2 from age of subject, gender, social class, conscientiousness (NEO-FFI), and catastrophizing (CSQ). The regression model accounted for **31%** of the variance, adjusted R^2 = .28, F(4, 94) = 10.29, p < .001. Conscientiousness, catastrophizing, age on date of surgery and social class were found to make significant contributions to the regression model (see Table 5.21).

Table 5.21: Summary of forward stepwise regression analysis for variables predicting OHS pain component type 2

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	.10	.04	.01	.18	.20*
Conscientiousness	.05	.01	.03	.07	.41***
Age	-.02	.01	-.03	-.00	-.24*
Social Class	.10	.04	.03	.17	.26**

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, $R^2 = .31$, $p < .001$.

Predictors of the OHS Functional Component Type 2

A stepwise regression analysis was performed to predict the pre-operative scores on OHS functional component type 2 from gender, social class, doctors subscale of MHLC, others subscale of MHLC, conscientiousness (NEO-FFI), praying/hoping (CSQ), catastrophizing (CSQ), controlling pain (CSQ), and decreasing pain (CSQ). The regression model explained 33% of the variance, adjusted $R^2 = .29$, $F(5, 91) = 9.19$, $p < .001$). Conscientiousness, catastrophizing, doctors subscale of MHLC, decreasing pain and gender were found to make significant contributions to the regression model (see Table 5.22).

Table 5.22: Summary of forward stepwise regression analysis for variables predicting scores on OHS functional component type 2

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Conscientiousness	.32	.11	.10	.53	.27**
Catastrophizing	1.15	.46	.24	2.01	.24**
Doctors	.45	.18	.08	.81	.21*
Decreasing Pain	-6.61	1.73	-10.04	-3.12	-.35***
Gender	3.01	1.22	.58	5.44	.23*

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, $R^2 = .33$, $p < .001$.

Predictors of the Pre-operative OHS Socks Question

A stepwise regression analysis was conducted to explain pre-operative scores on the OHS socks question from gender, doctors subscale of MHLC, praying/hoping (CSQ), catastrophizing (CSQ), and increasing behavioural activities (CSQ). The regression model produced explained 11% of the variance, adjusted $R^2 = .10$, $F(1, 99) = 12.15$, $p = .001$. Catastrophizing was found to make a significant contribution to the regression model (see Table 5.23).

Table 5.23: Summary of forward stepwise regression analysis for variables explaining scores on OHS socks question

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	.26	.07	.11	.41	.33***

Note: *** $p \leq .001$, $R^2 = .11$, $p = .001$.

Summary of results

Tables 5.24 and 5.25 summarises the percentage of variance explained and the direction of effect for each of the factors in the model, for each of the regression analyses conducted:

Table 5.24: Summary of forward stepwise analyses for variables predicting HHS components

Outcome	% variance explained	Factors in model	Direction of effect
HHS	26%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain and poorer functioning.
		Conscientiousness NEO-FFI)	A greater score on conscientiousness was associated with more pain and poorer functioning.
		Social Class	A higher social class was associated with less pain and better functioning.
HHS pain	31%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with greater pain.
		Conscientiousness (NEO-FFI)	A greater score on conscientiousness was associated with more pain.
		Social Class	A higher social class was associated with less pain.
		Co-morbidity	Presence of co-morbidity was associated with more pain.
HHS function	15%	Controlling Pain (CSQ)	A greater score on controlling pain was associated with better functioning.
		Gender	Males reported higher functioning than females.
HHS socks	6%	Praying/Hoping (CSQ)	A greater score on praying/hoping was associated with less functional ability.

Table 5.25: Summary of forward stepwise analyses for variables predicting OHS components

Outcome	% variance explained	Factors in model	Direction of effect
OHS	26%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain and poorer functioning.
		Conscientiousness (NEO-FFI)	A greater score on conscientiousness was associated with more pain and poorer functioning.
		Controlling Pain (CSQ)	A greater score was associated with less pain and better functioning.
OHS pain 1	32%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain.
		Conscientiousness (NEO-FFI)	A greater score on conscientiousness was associated with more pain.
		Controlling Pain (CSQ)	A higher score on controlling pain was associated with less pain.
		Social Class	A higher social class was associated with less pain.
OHS pain 2	31%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain.
		Conscientiousness (NEO-FFI)	A greater score on conscientiousness was associated with more pain.
		Age	A greater age was associated with more pain
		Social class	A higher social class was associated with less pain.

Table 5.25 continued: Summary of forward stepwise analyses for variables predicting OHS components

Outcome	% variance explained	Factors in model	Direction of effect
OHS function 1	25%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with poorer functioning.
		Decreasing Pain (CSQ)	A greater score on decreasing pain was associated with better functioning.
		Gender	Males report higher functioning than females.
OHS function 2	33%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with poorer functioning.
		Conscientiousness (NEO-FFI)	A greater score on conscientiousness was associated with poorer functioning.
		Doctors Subscale (MHLC)	A greater score on doctors was associated with poorer functioning.
		Decreasing Pain (CSQ)	A greater score on decreasing pain was associated with better functioning.
		Gender	Males reported higher functioning than females.
OHS socks	11%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with less functional ability

Tables 5.24 and 5.25 reveal that catastrophizing (CSQ) and conscientiousness (NEO-FFI) are the main psychological variables (of the ones studied) which affect perception of pain and disability pre-operatively. In addition, patient's views on their ability to control pain and decrease pain (measured using the CSQ) also appear to impact on these outcomes. Demographic factors which affected outcome were gender and social class. A discussion of

these factors will take place in Chapter 8 (Hip discussion) and Chapter 13 (Compare and Contrast).

The relationship between Psychological Factors and Pain with Pre-operative Recordings of Self-Reported Activities Limitation & Participation Restriction

One of the aims of study was to examine the relationship between pre-operative recordings of impairment with activities limitation and participation and restriction. In Chapter 4 it has been discussed how only a weak relationship was found between these measures; however, strong correlations were found between the patients reported level of pain and self-reported level of activities limitation and participation restriction (recorded using the joint specific questionnaires). As such, pain is likely to be an important predictor of the pre-operative outcome variables. The recordings of pain were not included in the regression analyses above as one of the original aims of the study was to assess whether psychological factors affected pre-operative function. However, given the findings that pain influences activities limitation and participation restriction, the analyses are repeated including the scores on the pain components. In addition, where ROM had significantly correlated with the outcome measures (see Table 4.1) it was entered into the regression analysis. The other independent variables entered into the regression models are the same as before. The regression analyses were only repeated for the functional components and the questions regarding socks. This is to prevent overlap between the pain component and questions in the complete instruments referring to pain. Likewise, the OHS pain component type 2 (which just contains three questions relating to pain) was used to prevent any overlap with function.

Predictors of Pre-operative HHS Function Score

A stepwise regression analysis was performed to predict the pre-operative scores on the HHS functional component from gender, social class, previous total joint arthroplasty, praying/hoping (CSQ), catastrophizing (CSQ), controlling pain (CSQ), and OHS pain component type 2. The regression model explained **30%** of the variance, adjusted $R^2 = .29$, $F(2, 92) = 19.97$, $p = .001$.

OHS pain component 2 and gender were found to make significant contributions to the regression model (see Table 5.26).

Table 5.26: Summary of forward stepwise regression analysis for variables predicting score on the HHS functional component where pain is included as a predictor

Variable	B	SE B	95% CI		ß
			Lower	Upper	
OHS Pain 2	-5.76	1.11	-7.97	-3.55	-.46***
Gender	-3.33	1.40	-6.11	-.55	-.21*

Note: * $p \leq .05$, *** $p \leq .001$, $R^2 = .30$, $p = .001$.

Predictors of the Pre-operative HHS Socks Question

A stepwise regression analysis was performed to explain the pre-operative scores on the HHS socks question from diverting attention (CSQ), praying/hoping (CSQ), catastrophizing (CSQ), OHS pain component type 2, and range of motion (ROM). The regression model explained 16% of the variance, adjusted $R^2 = .14$, $F(3, 89) = 5.80$, $p = .001$. OHS pain component type 2, praying/hoping, and ROM were found to make significant contributions to the regression model (see Table 5.27).

Table 5.27: Summary of forward stepwise regression analysis for variables explaining scores on the HHS socks question where pain and ROM are included as predictors

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
OHS Pain 2	-.50	.17	-.83	-.18	-.30**
Praying/Hoping	-.03	.01	-.05	-.00	-.20*
ROM	.02	.01	.00	.03	.20*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .16$, $p = .001$.

Predictors of OHS Function Component Type 1

A stepwise regression analysis was performed to predict the pre-operative scores on the OHS functional component type 1 from gender, social class, doctors subscale of MHLC, praying/hoping (CSQ), catastrophizing (CSQ), controlling pain (CSQ), decreasing pain (CSQ), HHS pain component and ROM. The regression model explained **41%** of the variance, adjusted $R^2 = .39$, $F(3, 86) = 19.85$, $p < .001$. HHS pain component, gender and ROM were found to make significant contributions to the regression model (see Table 5.28).

Table 5.28: Summary of forward stepwise regression analysis for variables predicting scores on the OHS functional component type 1 where pain and ROM are included as predictors

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
HHS Pain	-.32	.06	-.43	-.21	-.49***
Gender	.29	.10	.09	.50	.25**
ROM	-.12	.03	-.18	-.05	-.30888

Note: ** $p \leq .01$, *** $p \leq .001$, $R^2 = .41$, $p < .001$.

Predictors of the Pre-operative OHS Socks Question

A stepwise regression analysis was conducted to explain the pre-operative scores on the OHS socks question from gender, doctors subscale of MHLC, praying/hoping (CSQ), catastrophizing (CSQ), increasing behavioural activities (CSQ), HHS pain component, and ROM. The regression model explained **27%** of the variance, adjusted R^2 = .24, F(3, 90) = 10.99, p < 001. HHS pain component, catastrophizing and ROM were found to make significant contributions to the regression model (see Table 5.29).

Table 5.29: Summary of forward stepwise regression analysis for variables explaining scores on the OHS socks question where pain and ROM were included as predictors

Variable	B	SE B	95% CI		ß
			Lower	Upper	
HHS Pain	-.29	.11	-.50	-.07	-.25***
Catastrophizing	.19	.08	.04	.35	.25*
ROM	-.20	.06	-.32	-.08	-.25***

Note: * p ≤ .05, *** p ≤ .001, R^2 = .27, p < .001.

Summary of results

Table 5.30 summarises the percentage of variance explained and the direction of effect for each of the factors in the model, for each of the regression analyses conducted.

Table 5.30: Summary of forward stepwise regression analyses for functional components including pain and ROM as predictors

Outcome	% variance explained	Factors in model	Direction of effect
HHS function	30%	OHS Pain	Higher levels of pain were associated with worse functioning.
		Gender	Males reported higher functioning than females.
HHS socks	16%	OHS Pain	Higher levels of pain were associated with worse functional ability.
		Praying/Hoping (CSQ)	A greater score on praying/hoping was associated with less functional ability.
		Range of Motion	A more restricted range of motion was associated with less functional ability.
OHS function 1	41%	HHS Pain	Higher levels of pain were associated with worse functioning.
		Gender	Males reported higher functioning than females.
		Range of Motion	A more restricted range of motion was associated with less functional ability.
OHS socks	27%	HHS Pain	Higher levels of pain were associated with worse functional ability.
		Catastrophizing (CSQ)	A greater score on catastrophizing was associated with less functional ability.
		Range of Motion	A more restricted range of motion was associated with less functional ability.

The inclusion of a measurement of pain and range of motion as predictors of function increased the percentage variance explained in each of the regression models for the dependent variables.

Including pain as a predictor in the regression analysis resulted in some independent variables becoming non-significant in the models. Table 5.31 compares the factors which are significant in the regression models when including or excluding pain as a predictor.

Table 5.31: Comparison of predictors of regression analysis for functional components when including or excluding pain and range of motion as predictors

Outcome	Factors in regression model including pain and ROM as predictors	Factors in regression model excluding pain as a predictor
HHS Function	OHS Pain Gender	Controlling Pain Gender
HHS Socks	OHS Pain Praying/Hoping (CSQ) Range of Motion	Praying/Hoping (CSQ)
OHS Function 1	HHS Pain Gender Range of Motion	Catastrophizing Decreasing Pain Gender
OHS Socks	HHS Pain Catastrophizing Range of Motion	Catastrophizing

Including OHS pain as a predictor in the regression analysis for HHS functional component meant that controlling pain was no longer a significant predictor. This is not unexpected as controlling pain (CSQ) was a predictor of OHS pain in first analysis.

Including the HHS pain component as a predictor in the regression analysis for OHS functional component type 1 resulted in catastrophizing becoming non-significant predictor. However, catastrophizing was found to be a significant predictor of the OHS socks component even when pain was included in the regression model. This may suggest that catastrophizing affects the level of pain which in turn affects functional level.

Summary of Chapter

This chapter has reported:

- The recruitment and retention of participants to the hip study.
- The demographics of participants in the hip study.
- The baseline characteristics of participants on the hip study.
- The psychological characteristics of participants on the hip study.
- That catastrophizing, conscientiousness, social class and gender are important predictors of activity limitation and participation restriction pre-operatively.
- That pain is an important predictor of activity limitation and participation restriction pre-operatively.

Chapter 6: Hip Study: Physiotherapy Key Milestone Findings

Introduction

This chapter will report and discuss the relationships between the independent variables (demographic, medical and psychological) and the key physiotherapy milestones. For this analysis, patients experiencing post-operative complications were excluded.

In order to assess whether the data were normally distributed, z-scores for skewness and kurtosis were calculated. Transformations were carried out on the data which had an unacceptable skew or kurtosis. Pages 628-638 in the appendix detail the z-scores on the raw data, transformations used and the z-scores post-transformation. The results reported below used the transformed variables.

Patient Characteristics

Four patients experienced serious post-operative complications which caused them to be excluded from this section of the study (the descriptive statistics do not include these patients). The majority of the patients (76.2%) received their treatment at the Northern General Hospital (NGH). 17.8% of patients received their treatment at Thornbury Hospital (TBH), whilst 5.9% received their treatment at Claremont Hospital (CMH). Further descriptive statistics of patients inpatient stay are contained in Tables 6.1 and 6.2.

Table 6.1: Statistics on patient's hospital stay

	Range	Mean (+ SD)	Median	Mode
Number of physiotherapy session	3 – 14	6.51 ± 2.26	6.00	8.00
Average number of physiotherapy sessions per day	0.67 – 2.00	1.17 ± 0.30	1.00	1.00
Length of Stay	3 – 17	6.71 ± 2.26	6.00	5.00

Table 6.2: Statistics on the achievement of inpatient key physiotherapy milestones

Key Milestone	Range	Mean (+ SD)	Median	Mode
Bed transfer	2 – 8	3.51 ± 1.23	3.00	3.00
Chair transfer	1 – 6	3.33 ± 1.08	3.00	3.00
Independence with frame	1 – 8	3.82 ± 1.27	4.00	3.00
Independence with crutches	2 – 12	4.97 ± 1.94	5.00	4.00

The Outcome Measures

The key physiotherapy milestones chosen for analysis in this project reflect the inpatient recovery pattern. It is assumed that achievement of these milestones would be inter-related i.e. an earlier achievement of one key milestone should be associated with earlier achievement of another. In order to assess this, Pearson correlations were conducted between the transformed outcome measures. These are summarised in Table 6.3.

Table 6.3: Correlations between the physiotherapy key milestones

Chair[b]	Frame[c]	Crutches[c]	Disch.[c]	LOS[c]	
.77***	.70***	.62***	.62***	.54***	**Bed[a]**
	.68***	.64***	.60***	.49***	**Chair[b]**
		.78***	.72***	.61***	**Frame[c]**
			.84***	.69***	**Crutches[c]**
				.73***	**Disch.[c]**

Note: *** $p \le .001$, [a] n = 91, [b] n = 92, [c] n = 99. Abbreviations: Bed - time taken to achieve independence in bed transfer; Chair - time taken to achieve independence in chair transfer; Frame - time taken to achieve independence in use of frame; Crutches - time taken to achieve independence in use of crutches; Disch. - number of days postoperatively until deemed ready for discharge from physiotherapy; LOS - postoperative length of stay

Strong correlations were found between most of the key physiotherapy milestones suggesting that they measure similar outcomes. The correlations between time taken to achieve independence in bed transfer, time taken to achieve independence in chair transfer, time taken to achieve independence with frame, and time taken to achieve independence with crutches with the number of days to physiotherapy discharge are of the slightly greater magnitude than the correlations between those for variables and length of stay. It was anticipated in the planning or the study that length of stay might not be an ideal outcome measure as factors other than the patient's rehabilitation e.g. availability of transport, medical fitness etc. are likely to affect this outcome measure. Therefore the study was planned to include the outcome measure of number of days until physiotherapy discharge as an outcome measure as it was thought that this outcome measure would more accurately represent the patient's success in rehabilitation; the correlations support this.

Correlations

Pearson correlations were conducted to identify independent variables for inclusion in the regression analyses are summarised in Tables 6.4 (demographic variables), 6.5 (medical factors), 6.6 (Multi-dimensional Health Locus of Control), 6.7 (NEO Five Factor Inventory), and 6.8 (Coping Strategies Questionnaire). Independent variables which correlated significantly with the dependent variable ($p < .05$) were included in the subsequent multiple regression analysis.

Table 6.4: Correlations between the demographic factors and the dependent variables

	Bed transfer	Chair transfer	Frame	Crutches	Physio discharge	Length of stay
Age	.07	.21*	.24*	.40***	.33***	.33***
Gender	.08	.13	.12	.19	.13	-.01
No. in house	-.15	-.21*	-.22*	-.31**	-.22*	-.08
Employment	-.11	.04	.12	.19	.12	.09
Social class	.23*	.12	.15	.27**	.20	.22*
Education	-.24*	-.26*	-.15	-.03	.02	.07
School	-.07	-.05	-.08	-.16	-.12	-.13

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviations: No. in house = Number of people living in patient's house; Education = highest education level achieved; School = age left school.

Age correlated weakly but significantly with most of the key physiotherapy milestones suggesting that it may be important in predicting outcome. This is in agreement with Peerbhoy et al. (1999) who found that more elderly patients were slower in achievement of use of stairs (either assisted or unassisted) and discharge from hospital.

The number of people living in the patient's house (used as an indicator of the level of support they might have after discharge) correlated significantly with chair transfer, independence with frame, independence with crutches and physiotherapy discharge.

Social class correlated significantly with bed transfer, chair transfer and post-surgical LOS. Education level correlated significantly with bed transfer and chair transfer.

Table 6.5: Correlations between medical factors and dependent variables

	Bed transfer	Chair transfer	Frame	Crutches	Physio discharge	Length of stay
Co-morb.	.03	-.10	.02	.09	.07	.09
Referral	.20	.01	.10	.05	.13	.21*
Prev. TJA	.07	.11	.15	.08	.07	.07
Phys. Int.	-.21*	-.20	-.31**	-.29**	-.16	-.28**
Hospital	-.25*	-.17	-.42***	-.37***	-.24*	-.35***

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviations: Co-morb. = co-morbidity; Referral = referral to physician to check suitability for surgery; Prev. TJA = previous TJA; Phys. Int. = physiotherapy intensity - calculated by dividing the total number of physiotherapy sessions by the number of days until physiotherapy discharge.

Physiotherapy intensity and the hospital in which the patient had their surgery significantly correlated with most of the functional milestones.

Referral to a physician to check for suitability for surgery weakly but significantly correlated with post-surgical LOS. The key physiotherapy milestones correlated well with each other (coefficients between .49 and .84) where one of the independent variables correlated significantly with only one of the outcomes it is likely to be a result of multiplicity rather than a true effect.

Table 6.6: Correlations between dependent variables and Multi-dimensional Health Locus of Control (MHLC) variables

	Bed transfer	Chair transfer	Frame	Crutches	Physio discharge	Length of stay
Internal	-.06	.01	-.05	-.00	-.07	.03
Chance	-.04	-.13	-.15	-.00	.00	-.01
Doctors	.14	.16	.16	.18	.21*	.19
Others	.08	.10	.14	.27**	.31**	.15

Note: * $p \leq .05$, ** $p \leq .01$

Significant correlations existed between the external locus of control components (doctors and significant others) and some of the key functional milestones. A higher score on the doctors scale was associated with a longer length of time until discharge from physiotherapy; a higher score on the others scale was also associated with this milestone and time taken to achieve independence in crutches.

Table 56.7: Correlations between the NEO- Five Factor Inventory (NEO-FFI) and the dependent variables

	Bed transfer	Chair transfer	Frame	Crutches	Physio discharge	Length of stay
N	.16	.18	.14	.11	.13	.08
E	.03	.05	.01	-.03	-.04	-.05
O	.02	.12	.09	-.01	-.07	-.10
A	-.01	.06	.00	.09	.11	.05
C	-.10	-.09	-.10	-.09	-.07	-.06

Note: Abbreviations: N = neuroticism; E = extraversion; O = openness to experience; A = agreeableness; C = conscientiousness.

No significant correlations were found between NEO-FFI and the key physiotherapy milestones.

Table 6.8: Correlations between factors in the Coping Strategies Questionnaire (CSQ) and the dependent variables

	Bed transfer	Chair transfer	Frame	Crutches	Physio discharge	Length of stay
DA	-.15	.01	.07	.09	.12	.13
RPS	-.08	-.03	.02	-.08	-.01	.06
CSS	-.04	-.12	-.02	-.01	.02	.01
IS	-.13	-.14	-.14	-.12	-.15	-.12
P/H	-.02	.02	.20	.29**	.31**	.29**
C	.12	.22*	.21*	.24*	.29**	.16
IBA	-.15	.02	.06	.14	.19	.18
CP	-.17	-.13	-.11	-.12	-.04	-.09
DP	-.27*	-.16	-.10	-.11	-.03	-.05

Note: * $p \leq .05$, ** $p \leq .01$.

Abbreviations: DA = diverting attention; RPS = reinterpreting pain sensations; CSS = coping self statements; IS = ignoring sensations; P/H = praying/hoping; C = catastrophizing; IBA = increasing behavioural activities; CP = controlling pain; DP = decreasing pain.

Praying/hoping significantly positively correlated with time taken to achieve independence with crutches, length of time until physiotherapy discharge, and post-surgical LOS indicating that a higher score on this coping strategy was associated with a longer time taken to achieve these milestones. Catastrophizing significantly positively correlated with time taken to achieve chair transfer, independence with frame, independence with crutches and physiotherapy discharge. Decreasing pain significantly negatively correlated with bed transfer; this result may a result of multiplicity.

Forward Stepwise Multiple Regressions

Predictors of Time to Achieve Independence in Bed Transfer

A stepwise regression analysis was performed to predict the number of days taken to achieve independence in bed transfer from social class, education, decreasing pain (CSQ), physiotherapy intensity, and hospital. The regression model explained **14%** of the variance, adjusted $R^2 = .12$, $F(2, 83) = 6.62$, $p = .001$. Education, and hospital in which patient had their surgery were found to make significant contributions to regression model (see Table 6.9).

Table 6.9: Summary of forward stepwise regression analysis of variables predicting number of days to achieve independence in bed transfer

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Hospital	-.05	.02	-.09	-.02	-.30**
Education	-.03	.01	-.06	-.01	-.26**

Note: ** $p \leq .01$, $R^2 = .12$, $p = .001$.

Predictors of Time to Achieve Independence in Chair Transfer

A stepwise regression analysis was performed to predict the number of days taken to achieve independence in chair transfer from age, number of people in patient's household, education, and catastrophizing (CSQ). The regression model explained **12%** of the variance, adjusted $R^2 = .10$, $F(2, 89) = 6.13$, $p < .01$. Age on date of surgery and education were found to make significant contributions to the regression model (see Table 6.10).

Table 6.10: Summary of forward stepwise regression analysis for variables predicting the number of days to achieve independence in chair transfer

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Education	-.03	.01	-.06	-.01	-.28**
Age	.00	.00	.00	.01	.23*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .12$, $p < .01$.

Predictors of Time to Achieve Independence in Use of Zimmer Frame

A stepwise regression analysis was performed to explain the number of days taken to achieve independence in use of Zimmer frame from age, number of people in household, catastrophizing (CSQ), hospital in which the patient had their surgery and physiotherapy intensity. The regression model explained **18%** of the variance, adjusted $R^2 = .17$, $F(1, 95) = 20.84$, $p < .001$. Hospital in which the patient had their surgery was found to make a significant contribution to the regression model (see Table 6.11).

Table 6.11: Summary of forward stepwise regression analysis for variables explaining the number of days to achieve independence in use of Zimmer frame

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Hospital	-.08	.02	-.12	-.05	-.42***

Note: *** $p \leq .001$, $R^2 = .18$, $p < .001$.

Predictors of Time to Achieve Independence in Use of Crutches

A stepwise regression analysis was performed to predict the number of days taken to achieve independence in use of crutches from age, number of people in household, social class, other subscale of MHLC, praying/hoping (CSQ), catastrophizing (CSQ), hospital in which patient had surgery, and physiotherapy intensity. The regression model explained **27%** of the variance, adjusted $R^2 = .25$, $F(3, 87) = 10.78$, $p < .001$. The others subscale of MHLC, age, and hospital were found to make significant contributions to the regression model (see Table 6.12).

Table 6.12: Summary of forward stepwise regression analysis for variables predicting the number of days to achieve independence in use of crutches

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Others	.01	.00	.00	.02	.20*
Age	.00	.00	.00	.01	.28**
Hospital	-.06	.02	-.10	-.02	-.29***

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, $R^2 = .27$, $p < .001$.

Predictors of Number of Days until Discharged by Physiotherapy

A stepwise regression analysis was performed to explain the number of days until discharge from inpatient physiotherapy from age, number of people in patient's household, doctors subscale of MHLC, others scale (MHLC), praying/hoping (CSQ), catastrophizing (CSQ), and hospital. The regression model explained **22%** of the variance, adjusted $R^2 = .19$, $F(3, 91) = 8.42$, $p < .001$. Others subscale of MHLC, catastrophizing, and age were found to make significant contributions to the regression model (see Table 6.13).

Table 6.13: Summary of forward stepwise regression analysis for variables explaining number of days until discharge from inpatient physiotherapy

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Others	.01	.00	.00	.02	.22*
Catastrophizing	.02	.01	.00	.04	.22*
Age	.00	.00	.00	.01	.26*

Note: * $p \leq .05$, $R^2 = .22$, $p < .001$.

Predictors of Length of Stay

A stepwise regression analysis was performed to predict post-operative length of stay from age, social class, praying/hoping (CSQ), physiotherapy intensity, referral to physician to check for suitability for surgery, and hospital in which patient had surgery. The regression model explained **19%** of the variance, adjusted $R^2 = .16$, $F(2, 87) = 10.36$, $p < .001$. Hospital in which the patient had their surgery and age were found to make significant contributions to the regression model (see Table 6.14).

Table 6.14: Summary of forward stepwise regression analysis for variables predicting length of stay

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Hospital	-.06	.02	-.10	-.02	-.32**
Age	.00	.00	.00	.01	.23*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .19$, $p < .001$.

Summary of Results

Table 6.15 summarises the percentage of variance explained and the direction of effect for each of the factors in the model, for each of the regression analyses conducted.

Table 5.15: Summary of stepwise regression analyses

Milestone	% variance explained	Factors in model	Direction of effect
Bed transfer	14%	Hospital	TBH < CMH < NGH
		Education	A higher education level was associated with earlier achievement of this milestone.
Chair transfer	12%	Education	A higher education level was associated with earlier achievement of this milestone.
		Age	A greater age was associated with slower achievement of this milestone.
Frame	18%	Hospital	TBH < CMH < NGH.
Crutches	27%	Others (MHLC)	A greater score on others was associated with slower achievement of this milestone.
		Age	A greater age was associated with slower achievement of this milestone.
		Hospital	TBH < CMH < NGH.
Physio. Discharge	22%	Others (MHLC)	A greater score on others was associated with slower achievement of this milestone.
		Catastrophizing (CSQ)	A greater score on catastrophizing was associated with slower achievement of this milestone.
		Age	A greater age was associated with slower achievement of this milestone.
LOS	19%	Age	A greater age is associated with a longer LOS.
		Hospital	TBH < CMH < NGH.

Note: CMH - Claremont Hospital; NGH - Northern General Hospital; TBH - Thornbury Hospital

The main impetus for the study was to assess whether personality and psychological variables were important in the recovery following THR. The analysis revealed that few psychological variables were important in the immediate post-operative recovery period. Having a high external locus of control (measured using the others scale of the MHLC) was associated with a longer time taken (in number of days) until achievement of independence in use of crutches, and was also associated with a greater time (again in days) until the physiotherapist deemed the patient ready for discharge from physiotherapy. Catastrophizing was also a significant predictor of time taken to physiotherapy discharge.

It must be considered whether these results are a true reflection of the predictors involved in these key physiotherapy milestones or whether they are spurious results given the multiple endpoints under investigation. The laws of probability suggest that by chance some relationships will come out a statistically significant when they are not. This may well be the case here. As all of the key physiotherapy milestones correlated strongly with each other it would be expected that a predictor in one model would also feature in the other models for the key physiotherapy milestones. It is unlikely that the tasks on which the key physiotherapy milestones are based are sufficiently different that they would rely on different psychological mechanisms.

Hospital and age were found to be predictors in time taken to achieve key physiotherapy milestones following THR. These factors shall be discussed in Chapter 8 (Hip Discussion) and Chapter 13 (Compare and Contrast).

Summary

The analysis of factors which influence time taken to achieve key physiotherapy milestones as an inpatient following total hip replacement revealed that few psychological variables were important. However, hospital at which the patient had their surgery and age were found to be important predictors.

Chapter 7: Hip Study: Three-month Post-operative Findings

This chapter will report:

- Descriptive statistics of hip functioning 3-months post-THR.
- The relationship between psychological factors and post-operative scores on the joint-specific questionnaires.
- The relationship between psychological factors and scores on components the joint-specific questionnaires when including pre-operative scores for these.
- The relationship between psychological factors and pain with post-operative recordings of activity limitation and participation restriction.

Three-month Post-operative Hip Function

This section provides descriptive statistics of the scores achieved 3-months post-THR and the degree of improvement from pre- to post-surgery (see Table 7.1)

Table 7.1: Three-month post-operative scores for hip function

Score	N	Range	Mean (+ SD)	Median	Mode
Range of Motion	68	78 – 100.5	93.27 ± 5.52	94.50	95
Flexion	69	65 – 110	91.45 ± 10.88	91.45	90
Harris Hip Score	88	23 – 90	68.18 ± 15.68	72.5	76
Improvement Harris Hip Score	88	-25 – 69	26.13 ± 20.11	30.00	30
Oxford Hip Score	88	13 – 48	22.34 ± 8.76	21.00	19
Improvement Oxford Hip Score	88	-3 – 34	18.72 ± 9.09	20.00	18

The Relationship between Psychological Factors and Post-operative Scores on the Components of the Joint-Specific Questionnaires

Chapter 4 discusses the relationship between activities limitation/participation restriction (as recorded by the joint specific questionnaires) and pain. From the correlations recorded it is apparent that pain may be an important predictor in the regression models predicting activities limitation and participation restriction. However, the original aim of the research was to assess the relationship between psychological factors and activities limitation/participation restriction pre-operatively. Therefore, the regression analysis is first conducted using only the psychological, demographic, and medical variables in the model.

The regression models are repeated with the pre-operative score for the variable included in the model (i.e. the pre-operative HHS pain component included in the regression analysis of variables predicting post-operative HHS pain component, pre-operative HHS functional component included as a variable in the post-operative regression analysis for HHS functional component etc.). These regression analyses were completed as there is evidence to suggest that pre-operative pain predicts post-operative pain (Fortin et al. 1999;Holtzman et al. 2002) whilst pre-operative functional levels predict post-operative functioning (Fortin et al. 1999;Holtzman et al. 2002;Caracciolo and Giaquinto 2005).

The regression analysis will then be repeated including post-operative reported level of pain as section one of this chapter details that strong were correlations were recorded between post-operative pain and function.

In order to assess whether the data were normally distributed, Z-scores for skewness and kurtosis were calculated. Transformations were carried out on the data which had an unacceptable skew or kurtosis. Pages 628-638 in the appendix detail the z-scores on the raw data, transformations used and the z-scores post-transformation. The results below (including the regressions involving pain) are using the transformed data.

Correlations

Pearson correlations were conducted to identify independent variables for inclusion in the regression analysis. These are summarised in Tables 7.2 (demographic variables), 7.3 (medical factors), 7.4 (Multi-dimensional Health Locus of Control), 7.5 (NEO Five Factor Inventory), and 7.6 (Coping Strategies Questionnaire). Independent variables which correlated significantly with the dependent variable ($p < .05$) were included in the subsequent regression analysis. The correlations between the pre-operative outcome measure and post-operative outcome measure are included in the medical factors table.

Table 7.2: Correlations between the demographic factors and the dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
Age	.03	.20	-.03	.07	-.05	-.13	.03	-.12	-.01	.04
Gender	-.15	-.06	-.26*	-.04	.10	.00	.18	-.03	.15	.18
House	.07	-.06	.12	.06	-.06	-.02	-.10	-.04	-.08	-.03
Employ.	-.14	.00	-.17	-.02	.06	.01	.09	.01	.08	.03
Social	-.20	-.18	-.17	-.06	.23*	.24*	.20	.29**	.19	.10
Educat.	.27*	.18	.19	.14	-.22*	-.24*	-.18	-.27*	-.19	-.15
School	.20	.16	.15	.09	-.27*	-.26*	-.23*	-.27*	-.25*	-.18

Note: * $p \leq .05$, ** $p \leq .01$.

Abbreviations: House = Number of people living in patient's house; Employ. = employment status; Social. = social class; Educat. = highest education level achieved; School = age left school; HHS: Harris Hip Score: HHS F – HHS function component; HHS P – HHS pain component: HHS S – HHS socks question; OHS – Oxford Hip Score; OHS P1 – OHS pain component 1; OHS F1 – OHS function component 1; OHS P2 – OHS pain component 2; OHS F2 – OHS functional component 2; OHS S – OHS socks question.

Pre-operatively both gender and social class significantly correlated with most of the outcome measures. By contrast, few significant correlations were recorded between these variables post-operatively. Social class was significantly correlated with the complete OHS score and the two components measuring pain from this instrument. Gender significantly correlated only with HHS functional component; this may be a chance finding as a result of having multiple outcomes within the study.

The two measures of education (highest education level achieved and age left school) both significantly weakly correlated with a number of the outcome measures.

Table 7.3: Correlations between medical factors and dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
Co-morb.	-.09	-.09	-.05	-.16	.05	.09	-.03	-.00	.07	.23*
Referral	.07	.10	.08	.06	-.04	-.06	-.01	-.12	-.01	.06
Prev.TJA	-.35***	-.35***	-.29**	-.22*	.33**	.30**	.32**	.25*	.34**	.20
Hospital	.22*	.09	.20	.09	-.17	-.13	-.17	-.16	-.14	-.06
Complic.	.04	.13	-.06	.05	-.01	.12	.03	-.11	.03	.15
Pre-op	.43***	.33**	.51***	.37***	.42***	.33**	.45***	.29**	.47***	.28**

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviation: Co-morb. = co-morbidity; Referral = referral to physician to check suitability for surgery; Prev.TJA = previous TJA; Complic. - post-operative complications; Pre-op - pre-operative score on corresponding component of questionnaire. Abbreviations for joint-specific questionnaires as noted in Table 7.2.

Pre-operative status (assessed with the corresponding pre-operative score) correlated significantly with all the outcome measures studied.

In agreement with the pre-operative results few significant correlations were found between co-morbidity and other dependent variables, and referral to medic to check for suitability for surgery and the dependent variables.

Although several correlations were found between hospital and the physiotherapy key milestones, at three months post-operatively it appears that the hospital in which the patient had their surgery is no longer of importance.

The number of previous TJA that patient had correlated with most of the outcome measures. A greater number of previous TJA was associated with greater pain and worse function. This relationship was not found pre-operatively.

Table 7.4: Correlations between dependent variables and Multi-dimensional Health Locus of Control (MHLC) variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
Internal	.05	.05	.08	-.07	-.08	.03	-.18	.01	-.12	-.05
Chance	-.01	.04	-.04	-.11	.01	.01	-.00	-.02	.05	.04
Doctors	.12	.20	.07	.23*	-.04	-.00	-.06	-.06	-.02	-.11
Others	-.04	-.01	-.02	.09	.01	.04	-.04	-.01	.03	.00

Note: * $p \leq .05$. Abbreviations for joint-specific questionnaires as noted in Table 7.2.

Only one statistically significant correlation was found between locus of control and the outcome measures. The significant correlation is between the doctor subscale of the MHLC and socks question on the HHS. This may be a spurious finding as a result of multiplicity.

Table 7.5: Correlations between the NEO- Five Factor Inventory (NEO-FFI) and the dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
N	-.21	-.12	-.19	-.24*	.20	.15	.23*	.07	.24*	.22*
E	.17	.07	.10	.19	-.06	.02	-.13	.06	-.10	-.09
O	.08	.07	.02	.01	-.10	-.12	-.07	-.16	-.07	.03
A	-.15	-.08	-.19	-.07	.15	.09	.17	.16	.14	.18
C	-.01	-.10	-.01	-.10	.05	.07	.02	.06	.04	.01

Note: * $p \leq .05$.

Abbreviations: N = neuroticism; E = extraversion; O = openness to experience; A = agreeableness; C = conscientiousness. Abbreviations for joint-specific questionnaires as noted in Table 7.2.

Pre-operatively conscientiousness correlated with the number of the outcome measures. This is not seen post-operatively. Post-operatively, neuroticism significantly weakly correlated with four of the outcome measures relating to functional ability (HHS socks, OHS functional components 1 & 2, and OHS socks); no significant correlations were seen between neuroticism and the outcome measures pre-operatively.

Table 7.6: Correlations between factors in the Coping Strategies Questionnaire (CSQ) and the dependent variables

	HHS	HHS P	HHS F	HHS S	OHS	OHS P1	OHS F1	OHS P2	OHS F2	OHS S
DA	-.01	.02	-.02	.04	-.09	-.09	-.06	-.09	-.07	.11
RPS	.17	.14	.14	.15	-.24*	-.19	-.26*	-.22*	-.24*	-.01
CSS	.14	.04	.14	.31**	-.11	-.03	-.16	-.03	-.12	-.18
IS	.21	.16	.13	.17	-.17	-.10	-.23*	-.13	-.18	-.15
P/H	-.17	-.13	-.08	-.01	.06	.09	.03	.04	.08	.13
C	-.36***	-.26*	-.33**	-.15	.33**	.31**	.32**	.18	.37***	.26*
IBA	.07	.07	.06	.23*	-.15	-.16	-.10	-.21*	-.09	-.05
CP	.20	.15	.13	.16	-.27*	-.30*	-.20	-.31**	-.21	-.13
DP	.09	.04	.04	.08	-.18	-.20	-.14	-.28*	-.13	.04

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Abbreviations: DA = diverting attention; RPS = reinterpreting pain sensations; CSS = coping self statements; IS = ignoring sensations; P/H = praying/hoping; C = catastrophizing; IBA = increasing behavioural activities; CP = controlling pain; DP = decreasing pain. Abbreviations for joint-specific questionnaires as noted in Table 7.2.

In agreement with the pre-operative findings, catastrophizing significantly correlated with most of the outcome measures. Pre-operatively, praying/hoping correlated with many of the outcome measures, however, this is not replicated here. Controlling pain significantly correlated with the same outcome measures (OHS, OHS pain components 1 & 2) as it did pre-operatively. A few significant correlations were recorded between reinterpreting pain sensations and the OHS and its components. No significant correlations were recorded between these pre-operatively. Coping self statements and ignoring sensations correlated with only one outcome measure each; this may be a result of multiplicity.

Forward Stepwise Multiple Regressions

Predictors of the Post-operative Harris Hip Score (HHS)

A stepwise regression analysis was performed to explain post-operative scores on the self-report Harris hip score (HHS) from education level, number of previous TJA, and catastrophizing. The regression model explained **22%** of the variance, adjusted R^2 = .20, F(2, 81) = 11.21, p < .001. Catastrophizing and number of previous TJA were found to make significant contributions to the regression model (see Table 7.7). The stepwise regression analysis was repeated including the pre-operative score on HHS as a variable. This regression explained **29%** of the variance, adjusted R^2 = .27, F(3, 80) = 10.93, p < .001. Catastrophizing, pre-operative scores on HHS, and number of previous TJA were found to make significant contributions to this regression model (see Table 7.8).

Table 7.7: Summary of forward stepwise regression analysis for variables predicting score on the post-operative HHS

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	-.43	.13	-.68	-.18	-.34***
Previous TJA	-.68	.25	-1.19	-.18	-.27**

Note: * p ≤ .05, ** p ≤ .01, R^2 = .22, p < .001.

Table 7.8: Summary of forward stepwise regression analysis for variables predicting scores on the post-operative HHS including pre-operative HHS score as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	-.27	.13	-.54	-.00	-.21*
Pre-op HHS	.04	.01	.01	.06	.31**
Previous TJA	-.54	.25	-1.03	-.05	-.21*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .29$, $p < .001$.

Predictors of the Post-operative Harris Hip Score Pain Component

A stepwise regression analysis was performed to explain post-operative scores on the self-report Harris Hip Score pain component from number of previous TJA, and catastrophizing (CSQ). The regression model explained **14%** of the variance, adjusted $R^2 = .11$, $F(2, 81) = 6.28$, $p \leq .001$. Both variables were found to make significant contributions to the regression model (see Table 7.19). The stepwise regression analysis was repeated including the pre-operative score on the HHS pain component as a variable. The model explained **19%** of the variance, adjusted $R^2 = .17$, $F(2, 81) = 9.68$, $p < .001$. Pre-operative scores on HHS pain component and number previous of TJA were found to make significant contributions to the regression model (see Table 7.10).

Table 7.9: Summary of forward stepwise regression analysis for variables explaining scores on post-operative HHS pain component

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
Catastrophizing	-.25	.12	-.48	-.01	-.22*
Previous TJA	-.587	.24	-1.06	-.12	-.26**

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .14$, $p < .001$.

Table 7.10: Summary of forward stepwise regression analysis for variables explaining scores on post-operative HHS pain component including pre-operative HHS pain component as a variable

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
Pre-op HHS Pain	.52	16	.20	.85	.33**
Previous TJA	-.55	.23	-1.01	-.10	-.25**

Note: ** $p \leq .01$, $R^2 = .17$, $p < .001$.

Predictors of Post-operative Harris Hip Score Function Component

A stepwise regression analysis was performed to predict post-operative scores on the self-report Harris Hip Score functional component from gender, number of previous TJA, and catastrophizing (CSQ). The regression model explained **18%** of the variance, adjusted $R^2 = .16$, $F(2, 81) = 8.95$, $p < .001$. Catastrophizing and number of previous TJA were found to make significant contributions to the regression model (see Table 7.11). The regression analysis was repeated including pre-operative function as a variable. This model explained **31%** of the variance, adjusted $R^2 = .29$, $F(2, 81) = 17.83$, $p < .001$. Pre-operative scores on the HHS functional component and catastrophizing were found to make significant contributions to the regression model (see Table 7.12).

Table 7.11: Summary of forward stepwise regression analysis for predictors of scores on post-operative HHS function component

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	- 2.28	.73	-3.73	-.84	-.32**
Previous TJA	- 3.23	1.45	-6.10	-.35	-.25*

Note: * $p \le .05$, ** $p \le .01$, $R^2 = .18$, $p < .001$.

Table 7.12: Summary of forward stepwise regression analysis for variables predicting scores on post-operative HHS function component including pre-operative HHS function as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Pre-op HHSF	.53	.12	.30	.76	.45***
Catastrophizing	- 1.44	.70	-2.84	-.04	-.20*

Note: * $p \le .05$, *** $p \le .001$, $R^2 = .31$, $p < .001$. Abbreviation: pre-op HHSF = pre-operative HHS function score.

Predictors of the Post-operative Scores on Harris Hip Score Socks Question

A stepwise regression analysis was performed to explain post-operative scores on HHS socks question from number of previous TJA, doctors subscale of MHLC, neuroticism (NEO-FFI), coping self statements (CSQ), and increasing behavioural activities (CSQ). The model explained **9%** of the variance, adjusted R^2 = .08, F(1, 81) = 8.16, p < .01. Coping self statements was found to make a significant contribution to the regression model (see Table 7.13). The regression analysis was repeated with ability to don socks preoperatively included as a variable in the model. This model explained **25%** of the variance, adjusted R^2 = .22, F(3, 79) = 8.70, p < .001. Pre-operative ability to don socks, coping self statements and the doctors subscale of MHLC were all found to make significant contributions to the regression model (see Table 7.14).

Table 7.13: Summary of forward stepwise regression analysis for variables explaining scores on the post-operative HHS socks question

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Cop. Self State.	.06	.02	.02	.09	.30**

Note: ** p ≤ .01, R^2 = .09, p < .01. Abbreviation: Cop. Self State. = coping self statements.

Table 7.14: Summary of forward stepwise regression analysis for variables explaining scores on the post-operative HHS socks question including pre-operative response to HHS socks question as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Pre-op HHS Socks	.44	.12	.20	.70	.36***
Cop. Self State.	.05	.02	.01	.08	.27**
Doctors	.10	.04	.01	.18	.22*

Note: * p ≤ .05, ** p ≤ .01, *** p ≤ .001, R^2 = .25, p < .001. Abbreviation: Cop. Self State. = coping self statements.

Predictors of the Post-operative Oxford Hip Score

A stepwise regression analysis was performed to predict the post-operative scores on the Oxford Hip Score from social class, highest education level achieved, age left school, number of previous TJA, reinterpreting pain sensations (CSQ), catastrophizing (CSQ), and controlling pain (CSQ). The model explained **25%** of the variance, adjusted $R^2 = .22$, $F(3, 74) = 8.05$, $p < .001$. Catastrophizing, reinterpreting pain sensations, and age left school were found to make significant contributions to the regression model (see Table 7.15). The regression analysis was repeated with the pre-operative score for the OHS included as a variable. The model explained **29%** of the variance, $R^2 = .26$, $F(3, 74) = 10.00$, $p < .001$. Pre-operative scores on the OHS, reinterpreting pain sensations, and age left school were found to make significant contributions to the regression model (see Table 7.16).

Table 7.15: Summary of forward stepwise regression analysis for variables predicting scores on the post-operative OHS

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
Catastrophizing	.22	.07	.09	.34	.34***
RPS	-.22	.07	-.36	-.07	-.31**
Age Left School	-.15	.07	-.29	-.02	-.23*

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, $R^2 = .25$, $p < .001$. Abbreviation: RPS = reinterpreting pain sensations.

Table 7.16: Summary of forward stepwise regression analysis for variables predicting scores on the post-operative OHS including pre-operative score on OHS as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Pre-op OHS	.04	.01	.02	.06	.40***
RPS	-.18	.07	-.31	-.04	-.25**
Age Left School	-.14	.07	-.27	-.01	-.21*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .32$, $p < .001$. Abbreviation: RPS = reinterpreting pain sensations.

Predictors of the Post-operative Oxford Hip Score Pain Component Type 1

A stepwise regression analysis was performed to predict post-operative scores on the OHS pain component type 1 from social class, highest education level achieved, age left school, number of previous TJA, catastrophizing (CSQ) and controlling pain (CSQ). The model explained **10%** of the variance, adjusted $R^2 = .09$, $F(1, 76) = 8.86$, $p < .01$. Controlling pain was found to make a significant contribution to the regression model (see Table 7.17). The regression analysis was repeated with the scores from the pre-operative OHS pain component type 1 included as a predictor. This model explained **14%** of the variance, adjusted $R^2 = .13$, $F(1, 76) = 13.25$, $p \leq .001$. Scores on the pre-operative OHS pain component type 1 were found to make a significant contribution to the regression model (see Table 7.18).

Table 7.17: Summary of forward stepwise regression analysis for variables predicting scores on post-operative OHS pain component type 1

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Controlling Pain	-.13	.05	-.22	-.04	-.32**

Note: ** $p \leq .01$, $R^2 = .10$, $p < .01$.

Table 7.18: Summary of forward stepwise regression analysis for variables predicting scores on post-operative OHS pain component type 1 including scores pre-operative OHS pain component type 1 as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Pre-op OHS Pain 1	.06	.02	.03	.09	.38***

Note: *** $p \leq .001$, $R^2 = .13$, $p < .001$.

Predictors of the Post-operative Oxford Hip Score Function Component Type 1

A stepwise regression analysis was performed to explain post-operative scores on the OHS functional component type 1 from subject's social class, number of previous TJA, neuroticism (NEO-FFI), reinterpreting pain sensations (CSQ), ignoring sensations (CSQ), and catastrophizing (CSQ). The model explained **23%** of the variance, adjusted $R^2 = .21$, $F(2, 77) = 11.44$, $p < .001$. Catastrophizing and reinterpreting pain sensations were found to make significant contributions to the regression model (see Table 7.19). The regression analysis was repeated with scores from the pre-operative OHS functional component type 1 included in the model as a variable. This model explained **33%** of the variance, adjusted $R^2 = .31$, $F(3, 76) =$

12.55. Scores on catastrophizing, reinterpreting pain sensations pre-operative OHS functional component type 1 were found to make significant contributions to the regression model (see Table 7.20).

Table 7.19: Summary of forward stepwise regression analysis for variables predicting post-operative scores on the OHS functional component type 1

Variable	B	SE B	95% CI		ß
			Lower	Upper	
RPS	-.19	.05	-.29	-.08	-.36***
Catastrophizing	.17	.05	.07	.27	.35***

Note: *** $p \leq .001$, $R^2 = .23$, $P < .001$. Abbreviation: RPS = reinterpreting pain sensations.

Table 7.20: Summary of forward stepwise regression analysis for variables predicting scores on the post-operative OHS functional component type 1 including pre-operative OHS functional component type 1 as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
RPS	-.16	.05	-.26	-.07	-.32***
Catastrophizing	.10	.05	.01	.20	.22*
Pre-op OHSF	.36	.11	.15	.57	.35***

Note: * $p \leq .01$, *** $p \leq .001$, $R^2 = .33$, $p < .001$. Abbreviations: RPS = reinterpreting pain sensations, Pre-op OHSF = pre-operative OHS functional component type 1.

Predictors of the Post-operative Oxford Hip Score Pain Component Type 2

A stepwise regression analysis was performed to explain post-operative scores on the OHS pain component type 2 from social class, highest education level achieved, age left school, number of previous TJA, reinterpreting pain sensations (CSQ), increasing behavioural activities (CSQ), controlling pain (CSQ), and decreasing pain (CSQ). The model explained **18%** of the variance, adjusted $R^2 = .16$, $F(2, 75) = 8.07$, $p \leq .001$. Controlling pain and social class were found to make significant contributions to the regression model (see Table 7.21). The regression was repeated with scores on pre-operative OHS pain component type 2 included in the model as variable; this did not change the resulting model.

Table 7.21: Summary of forward stepwise regression analysis for variables explaining scores on the post-operative OHS pain component type 2

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Controlling Pain	-.04	.01	-.06	-.01	-.29**
Social Class	.03	.01	.00	.06	.25*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .18$, $p < .001$.

Predictors of the Post-operative Oxford Hip Score Function Component Type 2

A stepwise regression analysis was performed to predict post-operative scores on the OHS functional component type 2 from age left school, number of previous TJA, neuroticism (NEO-FFI), reinterpreting pain sensations (CSQ), and catastrophizing (CSQ). The model explained **25%** of the variance, adjusted $R^2 = .22$, $F(3, 78) = 8.67$, $p < .001$. Catastrophizing, reinterpreting pain sensations, and number of previous TJA were found to make significant contributions to the regression model (see Table 7.22). The regression model was repeated with pre-operative scores on the OHS functional component type 2 included in the model as a variable. This model explained **30%** of the variance, adjusted $R^2 = .29$, $F(2, 79) = 17.21$, $p < .001$. Scores on pre-operative OHS functional component type 2 and number of previous TJA were found to make significant contributions to the regression model (see Table 7.23).

Table 7.22: Summary of forward stepwise regression analysis for variables predicting scores on the post-operative OHS functional component type 2

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	.21	.06	.09	.32	.37***
RPS	-.15	.06	-.27	-.02	-.24*
Previous TJA	.28	.12	.05	.51	.25*

Note: * $p \leq .05$, *** $p \leq .001$, $R^2 = .26$, $p < .001$. Abbreviation: RPS = reinterpreting pain sensations.

Table 7.23: Summary of forward stepwise regression analysis for variables predicting scores on the post-operative OHS functional component type 2 including pre-operative OHS functional component type 2 as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Pre-op OHSF	.06	.01	.03	.08	.46***
Previous TJA	.28	.11	.06	.50	.24**

Note: ** $p \leq .01$, *** $p \leq .001$, $R^2 = .31$, $p < .001$. Abbreviation: Pre-op OHSF = pre-operative OHS functional component type 1.

Predictors of the Post-operative Scores on Oxford Hip Score Socks Question

A stepwise regression analysis was performed to explain post-operative scores on the OHS socks question from co-morbidity, neuroticism (NEO-FFI), and catastrophizing (CSQ). The model produced explained **13%** of the variance, adjusted R^2 = .11, F(2, 81) = 5.87, p < .01. Catastrophizing and co-morbidities were found to make significant contributions to the regression model (see Table 7.24). The regression analysis was repeated with the pre-operative response to OHS socks question included as a variable. The model again explained **14%** of the variance, adjusted R^2 = .12, F(2, 80) = 6.41, p < .01. Ability to don socks pre-operatively and co-morbidities were found to make a significant contribution to the regression model (see Table 7.25).

Table 7.24: Summary of forward stepwise regression analysis for variables explaining scores on the post-operative OHS socks question

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Catastrophizing	.07	.03	.01	.14	.24*
Co-morbidities	.12	.05	.02	.21	.25*

Note: * $p \leq .05$, $R^2 = .13$, $p < .01$.

Table 7.25: Summary of forward stepwise regression analysis for variables explaining scores on the post-operative OHS socks question including pre-operative score on socks question as a variable

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Pre-op OHS socks	.11	.04	.03	.19	.29**
Co-morbidities	.11	.05	.01	.20	.23*

Note: * $p \leq .05$, ** $p \leq .01$, $R^2 = .14$, $p < .01$.

Summary of results

Tables 7.26 and 7.27 summarises the regression models which **did not include the pre-operative scores** for the outcome measure as a variable. Tables 7.28 and 7.29 summarise the regression models which **included the pre-operative scores** for the outcome measure as a variable. The tables summarise the percentage of variance explained and the direction of effect for each of the factors in the model, for each of the regression analyses conducted. Table 7.30 compares the difference in variables in the regression models when pre-operative scores of the dependent factor are added as a variable in the model.

Table 7.26: Summary of regression analyses for variables predicting HHS components (where pre-operative status is excluded as a predictor)

Outcome	% variance explained	Factors in model	Direction of effect
HHS	22%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain and poorer functioning.
		Previous TJA	A greater number of previous TJAs were associated with more pain and poorer functioning.
HHS pain	14%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain.
		Previous TJA	A greater number of previous TJAs were associated with more pain.
HHS function	18%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with worse functioning.
		Previous TJA	A greater number of previous TJAs were associated with worse function.
HHS socks	9%	Coping Self Statements (CSQ)	A greater score on coping self statements was associated with a greater functional ability.

Table 7.27: Summary of regression analyses for variables predicting OHS components (where pre-operative status is excluded as a predictor)

Outcome	% variance explained	Factors in model	Direction of effect
OHS	25%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain and poorer functioning.
		Reinterpreting Pain Sensations (CSQ)	A greater score on reinterpreting pain sensations was associated with less pain and better functioning.
		Age Left School	Leaving school earlier was associated with more pain and poorer functioning.
OHS pain 1	10%	Controlling Pain (CSQ)	A greater score on controlling pain was associated with less pain.
OHS pain 2	18%	Controlling Pain (CSQ)	A greater score on controlling pain was associated with less pain.
		Social Class	A higher social class was associated with less pain.

Table 7.27 Continued: Summary of regression analyses for variables predicting OHS components (where pre-operative status is excluded as a predictor)

Outcome	% variance explained	Factors in model	Direction of effect
OHS function 1	23%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with worse functioning.
		Reinterpreting Pain Sensations (CSQ)	A greater score on reinterpreting pain sensations was associated with better functioning.
OHS function 2	26%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with worse functioning.
		Reinterpreting Pain Sensations (CSQ)	A greater score on reinterpreting pain sensations was associated with better functioning.
		Previous TJA	A greater number of previous TJAs were associated with worse function.
OHS socks	13%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with less functional ability.
		Co-morbidities	Presence of co-morbidity was associated with less functional ability.

Table 7.28: Summary of regression analyses for variables predicting scores on HHS components where pre-operative status is included as a predictor

Outcome	% variance explained	Factors in model	Direction of effect
HHS	29%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with more pain and poorer functioning.
		Pre-op HHS Score	Better functioning and less pain pre-operatively were associated with better functioning and less pain post-operatively.
		Previous TJA	A greater number of TJAs was associated with more pain and poorer functioning.
HHS pain	17%	Pre-op HHS Pain	Less pain pre-operatively was associated with less pain post-operatively.
		Previous TJA	A greater number of previous TJAs was associated with more pain.
HHS function	31%	Catastrophizing (CSQ)	A greater score on catastrophizing was associated with poorer functioning.
		Pre-op HHS Function	Better function pre-operatively is associated with better function post-operatively.
HHS socks	25%	Coping Self Statements (CSQ)	A greater score on coping self statements associated with greater functional ability.
		Doctors (MHLC)	A greater score on doctors was associated with greater functional ability.
		Pre-op HHS Socks	A greater functional ability pre-operatively is associated with a greater functional ability post-operatively.

Table 7.29: Summary of regression analyses for variables predicting scores on OHS components where pre-operative status is included as a predictor

Outcome	% variance explained	Factors in model	Direction of effect
OHS	32%	Reinterpreting Pain Sensations (CSQ)	A greater score on reinterpreting pain sensations was associated with less pain and better functioning.
		Age Left School	Leaving school younger was associated with more pain and poorer functioning.
		Pre-op OHS Score	Better functioning and less pain pre-operatively were associated with better functioning and less pain post-operatively.
OHS pain 1	13%	Pre-op OHS Pain 1	More pain pre-operatively was associated with more pain post-operatively.
OHS pain 2	18%	Controlling Pain	A greater score on controlling pain was associated with less pain.
		Social Class	Higher social class was associated with less pain.

Table 7.29 Continued: Summary of regression analyses for variables predicting scores on OHS components where pre-operative status is included as a predictor

Outcome	% variance explained	Factors in model	Direction of effect
OHS function 1	33%	Pre-op OHS Function 1	Better function pre-operatively was associated with better function post-operatively.
		Catastrophizing (CSQ)	A greater score on catastrophizing was associated with worse functioning.
		Reinterpreting Pain Sensations (CSQ)	A greater score on reinterpreting pain sensations was associated with better functioning.
OHS function 2	31%	Pre-op OHS Function 2	Better function pre-operatively was associated with better function post-operatively.
		Previous TJA	A greater number of previous TJA was associated with worse function
OHS socks	14%	Pre-op OHS socks	More ability pre-operatively was associated with more ability post-operatively.
		Co-morbidities	Presence of co-morbidity was associated with less functional ability.

Table 7.30: Comparison of variables in regression models when excluding/including pre-operative scores on outcome as a predictor

Outcome	Factors in regression excluding pre-op scores	Factors in regression including pre-op scores
HHS	Catastrophizing Previous TJA	Catastrophizing Pre-op HHS Score Previous TJA
HHS pain	Catastrophizing Previous TJA	Pre-op HHS Pain Previous TJA
HHS function	Catastrophizing Previous TJA	Catastrophizing Pre-op HHS Function
HHS Socks	Coping Self Statements	Coping Self Statements Doctors Pre-op HHS Socks
OHS	Catastrophizing Reinterpret. Pain Sensations Age Left School	Reinterpret. Pain Sensations Age Left School Pre-op OHS Score
OHS pain 1	Controlling Pain	Pre-op OHS Pain 1
OHS Function 1	Catastrophizing Reinterpret. Pain Sensations.	Pre-op OHS Function 1 Catastrophizing Reinterpret. Pain Sensations.
OHS pain 2	Controlling Pain Social Class	Controlling Pain Social class
OHS function 2	Catastrophizing Reinterpret. Pain Sensations Previous TJA	Pre-op OHS Function 2 Previous TJA
OHS Socks	Catastrophizing Co-morbidities	Pre-op OHS Socks Co-morbidities

Tables 7.26 and 7.27 reveal that (when pre-operative status was not included as a predictor) catastrophizing predicted pain and function; controlling pain predicted pain; reinterpreting pain sensation affected function; and number of previous TJA was a significant predictor of pain and function. In addition, education level was found to predict HHS; coping self statements predicted HHS socks; age left school predicted OHS; social class predicted OHS pain 2; and co-morbidity predicted OHS socks. As education, age left school, social class, co-morbidity and coping self statements were each predictors of only one outcome measure, it is possible that these results are spurious as a result of a study involving multiple end-points. These factors will be discussed in Chapter 8 (Hip Discussion) and Chapter 13 (Compare and Contrast).

When pre-operative status was included in the regression analysis (summarised in Tables 7.28 and 7.29), it was found to be a predictor in of the models for the outcome measures except OHS pain type 2. Including pre-operative status as a predictor in the regression analysis resulted in some independent variables becoming non-significant in the regression models (see Table 7.30). The effect of pre-operative status on outcome shall be discussed in Chapters 8 and 13.

The Relationship between Psychological Factors and Pain with Post-operative Recordings of Activities Limitation & Participation Restriction

One of the aims of study was to examine the relationship between impairment, activity limitation and participation restriction in patients three-month post-THR. In Chapter 4 it has been discussed how only a weak relationship was found between the ROM and activity limitation and participation restriction measured using the joint-specific questionnaires. However, strong correlations were recorded between the patients reported level of pain and activity limitation and participation restriction (recorded using the joint specific questionnaires). As such, pain may be an important predictor of the post-operative outcome variables. The recordings of pain were not included in the regression analyses above as one of the original aims of the study was to assess whether psychological factors affected post-operative functioning (activity and participation). However, given the findings that pain influences function, the analyses will now be repeated including the scores on the pain components. Where a significant correlation was recorded between ROM and the dependent variable (see Table 4.1); ROM also included in as a variable in the regression analysis. The other independent factors entered into the regressions are the same as above. The regression analyses were only repeated for the functional components and the questions regarding socks. This is to prevent overlap between the pain component and questions in the complete instruments referring to pain. Likewise, the OHS pain component type 2 was used to prevent any overlap with function.

Predictors of the Post-operative Harris Hip Score Function Component

A stepwise regression analysis was performed to predict post-operative scores on the Self-report Harris Hip Score functional component from gender, number of previous TJA, catastrophizing (CSQ), pre-operative score on HHS functional component, post-operative ROM, and post-operative OHS pain component type 2. The model explained **53%** of the variance, adjusted $R^2 = .51$, $F(2, 59) = 32.65$, $p < .001$. Scores on the pre-operative HHS functional component and the post-operative OHS pain component type 2 were found to make significant contributions to the regression model (see Table 7.31).

Table 7.31: Summary of forward stepwise regression analysis for variables predicting post-operative HHS functional component where post-operative pain and ROM are included as variables

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Post-op OHS Pain	-26.16	4.14	-34.45	-17.88	-.58***
Pre-op HHS Funct.	.41	.11	.19	.63	.34***

Note: *** $p \leq .001$, $R^2 = .53$, $p < .001$.

Predictors of the Post-operative Scores on the Harris Hip Score Socks Question

A stepwise regression analysis was performed to explain the post-operative scores on the HHS socks question from number of previous TJA, doctors subscale of MHLC, neuroticism (NEO-FFI), coping self statements (CSQ), increasing behavioural activities (CSQ), pre-operative score of the HHS socks question, post-operative ROM, and post-operative OHS pain component type 2. The model explained **47%** of the variance, adjusted $R^2 = .44$, $F(3, 57) = 16.85$, $p < .001$. Scores on the post-operative OHS pain component type 2, pre-operative HHS socks question, and the doctors subscale of MHLC were found to make significant contributions to the regression model (see Table 7.32).

Table 7.32: Summary of forward stepwise regression analysis for predictors of post-operative HHS socks question where post-operative pain and ROM are included as variables

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Post-op OHS Pain	-3.81	.70	-5.23	-2.41	-.53***
Pre-op HHS Socks	.39	.12	.15	.63	.32***
Doctors	.14	.05	.04	.24	.27**

Note: ** $p \leq .01$, *** $p \leq .001$, $R^2 = .47$, $p < .001$.

Predictors of the Post-operative Oxford Hip Score Function Component Type 1

A stepwise regression analysis was performed to explain post-operative scores on the OHS functional component type 1 from subject's social class, number of previous TJA, neuroticism (NEO-FFI), reinterpreting pain sensations (CSQ), ignoring sensations (CSQ), catastrophizing (CSQ), pre-operative score on OHS functional component type 1, post-operative ROM, and post-operative HHS pain component. The model explained **45%** of the variance, adjusted R^2 = .42, F(3, 54) = 14.56, p < .001. Scores on post-operative HHS pain component, pre-operative OHS functional component type 1 and reinterpreting pain sensations were found to make significant contributions to the regression model (see Table 7.33).

Table 7.33: Summary of forward stepwise regression analysis for variables explaining scores on post-operative OHS functional component type 1 including post-operative pain and ROM as variables

Variable	B	SE B	95% CI		ß
			Lower	Upper	
Post-op HHS Pain	-.15	.05	-.25	-.05	-.32**
Pre-op OHS Funct.	.33	.11	.11	.56	.33**
RPS	-.17	.06	-.29	-.06	-.33**

Note: ** p ≤ .01, R^2 = .45, p < .001. Abbreviation: RPS = reinterpreting pain sensations

Predictors of the Post-operative Oxford Hip Score Socks Question

A stepwise regression analysis was performed to explain post-operative scores on the OHS socks question from co-morbidity, neuroticism (NEO-FFI), catastrophizing (CSQ), pre-operative OHS socks question and post-operative HHS pain. The model explained **27%** of the variance, adjusted R^2 = .24, F(3, 79) = 9.70, p > .001. Scores on post-operative HHS pain component, pre-operative ability to don socks, and co-morbidity were found to make significant contributions to the regression model (see Table 7.34).

Table 7.34: Summary of forward stepwise regression analysis for variables explaining post-operative scores on OHS socks question including post-operative pain as a variable

Variable	B	SE B	95% CI Lower	95% CI Upper	ß
Post-op HHS Pain	-.10	.03	-.15	-.05	-.37***
Pre-op OHS Socks	.10	.04	.02	.17	.24**
Co-morbidity	.09	.05	.00	.18	.20*

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, $R^2 = .27$, $p < .001$.

Summary of results

Tables 7.35 and 7.36 summarises the percentage of variance explained and the direction of effect for each of the factors in the model, for each of the regression analyses conducted.

Table 7.35: Summary of regression analyses for HHS functional components where post-operative pain and ROM are included as predictors

Outcome	% variance explained	Factors in model	Direction of effect
HHS function	53%	Post-operative OHS Pain 2	Higher levels of pain were associated with worse functioning.
		Pre-operative HHS Function	Better function pre-operatively was associated with better function post-operatively.
HHS socks	47%	Post-operative OHS Pain 2	Higher levels of pain were associated with worse functioning.
		Pre-operative HHS Socks Question	Better function pre-operatively was associated with better function post-operatively.
		Doctors subscale of MHLC	A greater score on doctors was associated with greater functional ability.

Table 7.36: Summary of regression analyses for OHS functional components where post-operative pain and ROM are included as predictors

Outcome	% variance explained	Factors in model	Direction of effect
OHS function 1	45%	Post-operative HHS Pain	Higher levels of pain were associated with worse functioning.
		Pre-operative OHS Function 1	Better function pre-operatively was associated with better function post-operatively.
		Reinterpreting Pain Sensations (CSQ)	A greater score on reinterpreting pain sensations was associated with greater function.
OHS socks	27%	Post-operative HHS Pain	Higher levels of pain were associated with worse functioning.
		Pre-operative OHS Socks Question	Better function pre-operatively was associated with better function post-operatively.
		Co-morbidity	Co-morbidity was associated with less functional ability.

Range of motion was not a significant variable in any of the functional components. Including post-operative pain as a variable in the regression analyses predicting function increased the percentage of variance explained. Pain was a significant predictor for each of the outcome variables. Including pain as a predictor in the regression analysis resulted in some independent variables becoming non-significant in the regression analyses. Table 7.37 compares the factors which are significant in the regression models when including or excluding pain as a predictor.

Table 7.37: Comparison of predictors of regression analysis for functional components when including or excluding pain and range of motion as predictors

Outcome	Factors in regression model including pains as a predictor	Factors in regression model excluding pain as a predictor
HHS Function	Post-op OHS Pain 2 Pre-op HHS Function	Catastrophizing Pre-op HHS Function
HHS Socks	Post-op OHS Pain 2 Pre-op HHS Socks Doctors (MHLC)	Coping Self Statements Pre-op HHS Socks Doctors (MHLC)
OHS Function 1	Post-op HHS Pain Pre-op OHS Function 1 Reinterpret. Pain Sensations	Catastrophizing Pre-op OHS Function 1 Reinterpret. Pain Sensations
OHS Socks	Post-op HHS Pain Pre-op OHS Socks Co-morbidity	Pre-op OHS Socks Co-morbidity

Including post-operative pain as a variable in the regression analyses predicting both functional components (HHS function and OHS function component type 1) resulted in catastrophizing becoming non-significant. When pain was excluded as a predictor, catastrophizing was a significant predictor of the HHS pain component. This may suggest that catastrophizing influences level of pain which affects functional level. These findings are in agreement with the pre-operative findings.

Including post-operative pain as a variable in the regression analysis predicting HHS socks resulted in coping self statements becoming non-significant; the reason for this is unknown.

Summary of Chapter

- This chapter has reported:
- That catastrophizing, controlling pain, reinterpreting pain sensations, and number of previous total joint arthroplasties are important predictors of activities limitation and participation restriction post-operatively.
- That pre-operative status in an important predictor of level of pain and self-reported disability as measured with the joint-specific questionnaires post-operatively.
- That pain is an important predictor of activities limitation and participation restriction post-operatively.

Chapter 8: Discussion of Findings of Hip Study

This chapter will:

- Summarise the findings from the three time points in the study.
- Discuss the relationship between the psychological factors, pain, and activities limitation and participation restriction:
    - Catastrophizing.
    - Ability to control and decrease pain.
    - Reinterpreting pain sensations.
    - Conscientiousness.
- Discuss the relationship between the demographic and medical factors with pain and self-reported function.
- Discuss the relationship between pre-operative status and post-operative self-reported function (activities limitation and participation restriction).
- Discuss the relationship between psychological factors and post-operative recordings of self-reported disability (activities limitation and participation restriction) when including pain as predictor.
- Discuss the relationship between pain and function.
- Provide a summary of chapter.

Predictors of Hip Pain and Activities Limitation/Participation Restriction

As the study was exploratory in nature, many variables were recorded in the study. Variables which significantly correlated with the outcome measures were included in the regression analyses. However, it is still possible that some of the findings of the multiple regression analysis occurred by chance as having many variables and multiple end-points in the study. Therefore, in order develop a picture of which variables are likely to be important predictors of pain and function (both pre- and post-operatively) it is important to look across the results in order to identify those which were repeatedly significant predictors in the regression models. To assist the reader, the collated results are summarised in Tables 8.1 (combined results), 8.2 (functional components) and 8.3 (pain components). (This data is generated from Tables 5.24-5.25, 6.15, and 7.27-7.28.)

Table 8.1: Summary of number of outcome measures each independent variable predicts pre-operatively, during in-patient physiotherapy and at 3-months post-operatively

		No. of regression models in which the variable is a significant predictor			
Questionnaire	**Variable**	**Pre-op**	**Physio.**	**Post-op**	**Total**
NEO-FFI	Conscientiousness	6	-	-	6
Coping Strategies Questionnaire	Reinterpreting Pain Sens.	-	-	3	3
	Coping Self Statements	-	-	1	1
	Praying/Hoping	1	-	-	1
	Catastrophizing	7	1	7	15
	Controlling Pain	4	-	2	6
	Decreasing Pain	2	-	-	2
MHLC	Doctors	1	-	-	1
	Others	-	2	-	2
Demographics	Age	-	3	-	3
	Gender	3	-	-	3
	Social Class	4	1	1	6
	Education	-	2	1	3
	Age Left School	-	1	1	2
Medical factors	Co-morbidity	1	-	-	1
	Hospital	-	3	-	3
	Previous TJA	-	-	4	4

Note: The regression models used in summating the data are the regression models which exclude pain and pre-operative status as predictors. All components were included (i.e. complete questionnaires e.g. OHS, HHS, functional components (including socks question) and pain components. Abbreviations: Pre-op = pre-operative recordings; Physio. = inpatient post-operative recordings of achievement of key physiotherapy milestones; Post-op = 3-month post-operative recordings; Reinterpreting Pain Sens. = reinterpreting pain sensations.

Catastrophizing (CSQ) and social class were the only variables to be significant predictors of outcome at all three time points. Catastrophizing was a significant predictor in the most regression models (a total of 15); featuring in seven out of a possible eight regression models pre-operatively and at 3-months post-operatively.

Controlling pain (CSQ) was found to be a significant predictor in models both pre- and three-months post-operatively. Conscientiousness (NEO-FFI) was an important predictor pre-operatively, appearing in 6 out of a possible 8 pre-operative regression models, but this was not replicated in the in-patient or three-month post-operative results. Decreasing pain (CSQ) and gender also appear to be important variables in the regression models of pre-operative status.

Catastrophizing (CSQ) and others (MHLC) were the only two psychological variables predicting outcomes of the physiotherapy key milestones. Physiotherapy outcome measures tended to be predicted by demographic and medical variables; age, social class, education, age left school, and hospital were all significant predictors in at least one physiotherapy regression model.

At 3-months post-operatively (in addition to catastrophizing and controlling pain which have already been noted) reinterpreting pain sensations (CSQ) and number of previous TJA appear to be important predictors of function.

Coping self statements (CSQ), praying/hoping (CSQ), doctors (MHLC), co-morbidity and physiotherapy intensity each appear in only one regression model and therefore these results may have occurred by chance as a result of having a study with multiple variables and end-points.

Table 8.2: Summary of number of outcome measures relating to function that each independent variable predicts pre-operatively and 3-months post-operatively

		No. of regression models in which the variable is a significant predictor		
Questionnaire	**Variable**	**Pre-op**	**Post-op**	**Total**
NEO-FFI	Conscientiousness	1	-	1
Coping Strategies Questionnaire	Reinterpreting Pain Sens.	-	2	2
	Praying/Hoping	1	-	1
	Catastrophizing	3	3	6
	Controlling Pain	1	-	1
	Decreasing Pain	2	-	2
MHLC	Doctors	1	-	1
Demographics	Gender	3	-	3
Medical Factors	Co-morbidity	-	1	1
	Previous TJA	-	2	2

Note: The regression models used in summating the data are the regression models which exclude pain and pre-operative status as predictors. All components relating to function were included (HHS function, HHS socks, OHS functional component type 1, OHS functional component type 2, OHS socks). Abbreviations as noted in Table 8.1.

Catastrophizing (CSQ) is the only variable which was found to be a predictor in regression models for function both pre- and post-operatively; catastrophizing is also the most ubiquitous variable in the regression models.

Gender appears to be an important predictor of function pre-operatively, whilst reinterpreting pain sensations (CSQ) may be an important predictor of function post-operatively. Conscientiousness (NEO-FFI), praying/hoping (CSQ), controlling pain (CSQ), and doctors

(MHLC) each only appear in one regression model predicting function and therefore these may be chance findings.

Table 8.3: Summary of number of outcome measures relating to pain that each independent variable predicts pre-operatively and 3-months post-operatively

		No. of regression models in which the variable is a significant predictor		
Questionnaire	**Variable**	**Pre-op**	**Post-op**	**Total**
NEO-FFI	Conscientiousness	3	-	3
Coping Strategies Q.	Catastrophizing	2	1	3
	Controlling Pain	2	2	4
Demographics	Social Class	3	1	4
Medical Factors	Co-morbidity	1	-	1
	Previous TJA	-	1	1

Note: Regression models in which pain and pre-operative status were excluded were used in calculating the number of regression models. All components relating to pain were included (HHS pain, OHS pain component type 1, OHS pain component type 2). Abbreviations as noted in Table 8.1.

Catastrophizing (CSQ), controlling pain (CSQ) and social class are all predictors of pain both pre- and post-operatively. Controlling pain (CSQ) and social class appear in the most regression models (4 each out of a total possible 6). Conscientiousness is an important predictor of pain pre-operatively appearing in all three regression models. Co-morbidity and previous TJA each only appear in one regression model; these may be chance findings as a result of conducting a study with multiple end-points.

To summarise, catastrophizing, appears to be the most important predictor of pre- and post-operative status predicting both outcomes of pain and function. In addition, conscientiousness (NEO-FFI) was found to be an important predictor of pain and function pre-operatively. Gender, reinterpreting pain sensations (CSQ), decreasing pain (CSQ), and previous TJA appear to influence function, whilst controlling pain (CSQ) and social class were found to be predictors of pain. Each of these factors shall be discussed in more detail below.

The discussion focuses more heavily on catastrophizing than the other variables predicting outcomes for the following reasons. First, in my study, catastrophizing was the most consistent predictor of pain and function both pre- and post-operatively. Second, a great deal of research in health psychology has focussed on catastrophizing and therefore there is an in depth reflection required to place these findings in amongst the current research into this coping strategy. Third, the literature relating to the other variables which were found to be important in the prediction of pain or function in this study is much less extensive.

Catastrophizing

Introduction to Catastrophizing

Catastrophizing is defined as

> *"A method of cognitively coping with pain characterized by negative self-statements and overly negative thoughts about the future"* (Keefe et al. 1989:51).

Catastrophizing has been defined in the literature as a maladaptive coping strategy (Keefe et al. 1989;Keefe and Williams 1990;Keefe et al. 1997b) and a passive coping strategy (Snow-Turek et al. 1996).

In my hip study, catastrophizing was found to be a predictor of greater pain and worse function both pre- and post-operatively, as well as predicting length of time (in days) until inpatient physiotherapy discharge. In the 3-month post-operative analysis of predictors of function, catastrophizing remained a significant predictor of HHS, HHS function component, OHS, and OHS function 1 on the inclusion of pre-operative status as a predictor. This suggests that catastrophizing influences pain and function post-operatively independently from it's effects pre-operatively.

Catastrophizing has previously been linked to the experience of more intense and prolonged pain, impaired function and disability, adverse health outcomes, psychosocial disability, depression and negative mood in other areas of health research. This shall now be discussed in more detail.

Relationship between Catastrophizing, Pain and Function

The relationship between catastrophizing, pain and function has previously been investigated in arthritis. Edwards et al. (2006) conducted a review on the effect of catastrophizing in arthritis, fibromyalgia and other rheumatological conditions. They reported that catastrophizing was related to pain severity, pain-related disability, poor outcomes of treatment of pain, muscle and joint tenderness, and affective distress. Keefe et al. (1989) conducted a longitudinal study examining the effect of catastrophizing on outcome in rheumatoid arthritis patients. Higher levels of catastrophizing at baseline were predictive of greater functional impairment, pain and depression six months later.

Catastrophizing is known to be an important psychological factor in the pain and disability associated with chronic back pain conditions. Rosenstiel and Keefe (1983) reported that helplessness (a component created by using factor analysis on the CSQ which is characterised by high levels of catastrophizing, low usage of increasing behavioural activities, and low ability to control or decrease pain) was associated with high levels of pain and anxiety in patients with chronic low back pain. In agreement with this, Peters et al. (2005a) reported that catastrophizing was a predictor of pain intensity in participants with non-specific low back pain. Main and Waddell (1991) reported that catastrophizing was associated with more pain, disability, psychological distress and illness behaviours in individuals with low back pain. Similarly, Buer and Linton (2002) reported that in individuals with back pain within the general population (as opposed to a clinical population), catastrophizing was found to relate to both pain severity and reported impairment in completing activities of daily living.

Catastrophizing has also shown to be an important predictor of outcome in musculoskeletal and soft tissue pain. Severeijns et al. (2004) reported that in a community sample of individuals with musculoskeletal pain, higher levels of catastrophizing were associated with an increase in specialist consultation, use of medication and absenteeism from work. Sullivan et el. (1998) reported that in individuals with soft tissue injuries as a result of work or traffic accidents, higher levels of catastrophizing were associated with heightened pain intensity and disability. In addition these individuals were less likely to be in employment. In Sullivan et al.'s (1998) study, catastrophizing was found to be a predictor of functional disability even after controlling for the effects of pain intensity.

Much research has focussed on the role of catastrophizing in chronic pain conditions. Keefe and Williams (1990) reported that in chronic pain patients, higher levels of catastrophizing were associated with greater pain intensity, depression and psychological distress. Consistent with this, Snow-Turek et al. (1996) reported that passive coping, which was characterized in their study by high levels of catastrophizing and praying/hoping, was related to psychological distress and depression in patients with chronic pain conditions. Severeijns et al. (2001) reported that in patients with chronic pain of back, musculoskeletal or miscellaneous origin, high levels of catastrophizing were predictive of greater pain intensity, disability and psychological distress after controlling for the effects of physical impairment. Similar findings have been reported by Vervoot et al. (2006) who assessed the effect of pain catastrophizing in school children and children with chronic pain. They found that catastrophizing was associated with pain intensity, functional disability and somatic complaints. The relationship between catastrophizing and heightened pain and disability has also been replicated by Sullivan et al. (2005) in patients with neuropathic pain conditions resulting from diabetic neuropathy, post-herpetic neuralgia, and post-surgical or post-traumatic neuropathic nerve pain.

Catastrophizing has also been shown to influence levels of pain and disability in temporomandibular disorder (Turner et al. 2004), in women with gastrointestinal disorders (Drossman et al. 2000), in men with chronic prostatitis/pelvic pain (Tripp et al. 2006), in multiple sclerosis (Osborne et al. 2006), in patients with spinal cord injury (Turner et al. 2002), and in patients with phantom limb syndrome following amputation (Whyte and Carroll 2004).

Catastrophizing and Surgery

Despite the large body of evidence relating catastrophizing to heightened experience of pain and disability in chronic disorders, there has been little published research on the impact of catastrophizing on outcome following a surgical intervention. Ayers et al. (2004) examined psychological factors which were predictive of a low mental component score (from SF-36) and found that amongst other psychological factors, patients with low mental component scores used more catastrophizing as a mechanism of coping than patients with high mental component scores. In their pilot study Ayers et al. (2003) revealed that patients with a low mental component score were four times less likely to improve pre- to post-TJA than patients with a high mental component score. It can therefore be inferred (but previous research actually examining this is unavailable) that catastrophizing affects pre- to post-operative improvement following TJA. Pavlin et al. (2005) assessed the relationship between pre-operative levels of catastrophizing and immediate post-operative pain in patients undergoing anterior cruciate ligament repair. They reported that use of catastrophizing was associated with greater pain and more prolonged experience of pain when compared to patients who scored low on catastrophizing. Kendell et al. (2001) reported that catastrophizing was associated with a longer time to achieve 90° bend in TKR patients following surgery. Kendell et al.'s (2001) study was designed to identify "psychological factors associated with short-term recovery from total knee replacement". The other key milestones used as outcome measures in the study were number of days taken to achieve straight leg raise and number of days to discharge. Whilst it is an interesting finding that catastrophizing was predictive of time taken to achieve 90° bend, the fact that it is not predictive of the other two outcome measures (which should be inter-related with time taken to achieve 90° bend) may raise the possibility that this result arose by chance due to type I error. Finally, Stephens et al. (2002) reported that patients with higher levels of catastrophizing two-weeks pre-operatively experienced less reduction in pain and less of an improvement in function compared to individuals who did not show a tendency to catastrophize.

I have not identified any previous research which focuses on the role of catastrophizing in recovery/rehabilitation following THR. As a result, the research conducted for this thesis is unique in assessing the impact of psychological characteristics (measured pre-operatively) on post-operative recovery/rehabilitation outcomes.

Considering the body of research discussed above, it appears that the findings of this study fit well with the current knowledge of the effects of catastrophizing. With respect to the post-operative findings (that catastrophizing was associated with greater pain and more functional limitation) it is unknown whether catastrophizing impacts on the rehabilitation process following THR or whether pre-operative relationship between these variables is maintained.

Factors Affecting Catastrophizing

It is known that catastrophizing impacts on pain and disability but what factors may affect the likelihood of catastrophizing? Both demographic and psychological factors have been found to be associated with catastrophizing. For example, Keefe et al. (2000) reported that women (compared with men) experienced more pain and disability in osteoarthritis. In addition, in an observed session, women displayed more pain behaviours and as hypothesised, catastrophizing was found to mediate this effect. Turner et al. (2004) reported that being of a younger age was a predictor of greater daily catastrophizing in patients with temporomandibular disorder. In addition, both marital/civil status and economic status have been shown to moderate the effectiveness of coping strategies. Spitzer et al. (1995) reported that active cognitive coping is more effective for single than married people, and that active behavioural coping is more effective in people on low income (compared to those receiving high income).

Psychological factors have also been found to be associated with catastrophizing. Sinclair (2001) reported that in women with rheumatoid arthritis that high levels of pessimism, passive coping, venting and arthritis helplessness at baseline were predictive of catastrophizing five weeks later. Härkäpää et al. (1996) studied the relationship between locus of control and coping strategies in back pain patients and reported that catastrophizing was associated with a weaker belief in internal control over general health and back pain, and a stronger belief in external control being responsible for their health. Keefe et al. (1997b) reported that in patients with osteoarthritis of the knee, catastrophizing was associated with a lower self-efficacy for pain and other symptoms of osteoarthritis of the knee. Similarly, Jensen et al. (2003) reported that participants (with chronic pain or fibromyalgia) who scored high on catastrophizing were not ready to self-manage their condition; this is not surprising if (as in arthritis) they have little self-efficacy in controlling pain and symptoms.

Whilst it is clear that catastrophizing influences pain and function, and that it is related to the activity of other psychological variables, there is no clear consensus as how catastrophizing exerts its actions. This following section will discuss the main theories proposed.

Models of Catastrophizing

Sullivan et al. (2001) and Edwards et al. (2006) have recently provided reviews on the possible mechanisms of action of catastrophizing. For example, the **schema activation model** suggests that catastrophizers possess schema (a set of rules about how to understand the world) relating to pain which contain an overly negative view about pain. These schema may exert control over emotional or cognitive functioning resulting in the experience of more severe pain. Related to this theory is the **appraisal model** in which catastrophizers appraise pain as more threatening that non-catastrophizers.

In contrast, is the **attentional model** in which catastrophizers focus more of their attention to pain than non-catastrophizers. Focusing more attention to pain may lead to the perceptions of higher pain intensity. Crombez et al. (1998) showed that, in a laboratory situation, catastrophizers experienced marked interference in completing the assigned task when threatened with pain (as their attentions have been turned to pain). Similarly, Van Damme et al. (2004) reported that (again in a laboratory situation) participants high in catastrophizing experienced difficulty in disengaging from thoughts about pain and returning to the assigned task. This may explain why catastrophizing is related to functional impairment; if a patient has difficulty in disengaging from pain and turning attention to other environmental factors then this may prevent the patient, for example, completing activities of daily living, exercising their joint etc. Related to the attentional model, Lefebvre and Keefe (2002) reported that catastrophizing in patients with rheumatoid arthritis is associated with a better recall at the end of a 30 day study period of pain intensity and variability in levels of pain experienced during the study period.

Finally, the **communal coping model** suggests that catastrophizing is employed to gain support from others in the social environment. Catastrophizing is associated with increased display of pain behaviours such as guarding, rubbing, and facial expressions. It is thought that these are used to convey to others the feelings of pain to gain support. In line with this theory, Sullivan et al. (2006) reported that observers inferred higher levels of pain when catastrophizers were completing a cold presser task compared with non-catastrophizers completing the same task. However, in the clinical setting, there is mixed support for this theory. Manne and Zautra (1989) reported that in patients with rheumatoid arthritis, spousal criticism led the patient to use more maladaptive coping strategies which was responsible for worse psychological adjustment. More recently, Buenaver et al. (2006) researched the relationship between catastrophizing and social responses in patients with chronic pain. They found small mediational effects between catastrophizing, social support and pain, as a result of which they concluded that whilst this may be one of the mechanisms by which catastrophizing exerts it actions, it is unlikely to be the primary mechanism.

Interventions targeting Catastrophizing

Despite the fact that there is no firm understanding of the mechanism by which catastrophizing exerts its effects on pain and function, several interventions have been developed to reduce catastrophizing and alter outcome. Snow-Turek et al. (1996) suggested that there may be greater value in trying to reduce passive coping strategies (such as catastrophizing) rather than trying to increase active coping strategies as the negative effects of passive coping strategies were of a greater magnitude than the positive effects conferred by active coping strategies. Keefe et al. (2004) reviewed the different methods of delivering behavioural and psychological intervention for chronic pain. These included telephone and internet based treatment, care-giver assisted treatment, and exposure-based protocols where the participant is encouraged to expose themselves to behaviours they may normally avoid. The authors emphasised the importance of tailoring the treatment to the individual.

Turner and Clancy (1986) completed a trial assessing the benefits of cognitive behavioural therapy and operative behavioural therapy in patients with chronic low back pain. In both treatment groups there was a significant reduction in the level of catastrophizing; moreover this was associated with decreased levels of disability and pain. Similarly, Jensen et al. (2001) provided chronic pain patients with a 3-week pain management program which contained a variety of therapies including physiotherapy and cognitive behavioural therapy. Patients experienced a decrease in catastrophizing and increase in perceived control. They reported improvements in levels of pain and function which was still evident 12-months after the intervention. However, cognitive behavioural therapy is not necessarily required to reduce catastrophizing. Smeets et al. (2006) completed a trial comparing the effects of physical treatment versus cognitive behavioural therapy on the reduction of pain and disability in patients with chronic back pain. They found that both groups reported a reduction in pain and disability, and that catastrophizing mediated these effects. The authors conclude that therapies which are not specifically designed to target cognitive factors can be successful in reducing catastrophizing.

Based on the above literature, as catastrophizing is a prominent factor of both pre- and post-operative pain and function in the hip patients studied, there would be great value in developing an intervention to reduce catastrophizing and thus alter outcome. So far there is little published research is available on therapy designed to alter coping strategies in orthopaedic patients. Peerbhoy et al. (1998) reported that they attempted to increase either passive or active control prior to TJA. However, the intervention focused more on locus of control encouraging either internal or external locus of control beliefs. Their intervention did not have the desired effect; attempts to increase what they termed passive coping (but in fact focussed on the importance of doctors, physiotherapists, and other powerful others) was successful. However, the active intervention, which focused on the patient taking responsibility for their care (i.e. internal locus of control) failed to enhance active coping receiving a similar response to that provided by those in the passive coping group.

Summary of Catastrophizing

In my hip study, catastrophizing was found to be an important predictor of pain and function both pre- and post-operatively. This finding is an agreement with the literature where the relationship between catastrophizing, pain and function has been well-documented. Despite, the great wealth of literature describing this relationship the mechanism by which catastrophizing exerts its mechanism is poorly understood. Nonetheless, there has been success in developing appropriate therapies in the chronic pain setting to reduce catastrophizing which in turn reduces pain and disability. Future research should be directed at therapies targeted at catastrophizing in patients undergoing total hip replacement as this may have positive effects (reduced pain and increased function) on long-term outcomes.

Perceived Effectiveness of Controlling Pain and Decreasing Pain

Introduction to Perceived Effectiveness of Controlling Pain and Decreasing Pain

Two items on the CSQ (Rosenstiel and Keefe 1983) deal with efficacy in controlling and decreasing pain. In my hip study, controlling pain was found to predict level of pain both pre- and 3-months post-operatively. A greater score on ability to control pain was associated with a lower level of pain. In addition, controlling pain and decreasing pain were found to predict pre-operative function. A greater score on the scales was associated with a better functioning. This finding is consistent with the literature which is discussed below.

Relationship between Pain Control Efficacy, Pain and Function

The relationship between coping efficacy and pain and function in arthritis has been well documented. Keefe et al. (1997a) assessed the relationship between daily coping efficacy and outcome measured in terms of pain and mood in patients with rheumatoid arthritis. They reported that a higher coping efficacy (calculated by summing the scores of the two items together) was associated with less pain, less negative mood and more positive mood that day. In addition, coping efficacy was predictive of pain intensity the following day. Lefebvre et al. (1999) completed a similar study in patients with rheumatoid arthritis but instead used the pain management subscale of the Arthritis Self Efficacy Scale to assess control over pain. The found that in women scores self-efficacy in control of pain related to scores on the functional performance inventory which assessed difficulty in completing activities of daily living and movement. The findings were not replicated in men. Keefe et al. (1987a) examined the effect of coping strategies on functional limitation (assessed with AIMS) in patients with osteoarthritis of the knee. The completed CSQ was subjected to factor analysis; two factors were identified. The 'pain control and rational thinking' factor is characterised by low levels of catastrophizing and high ratings of ability to control and decrease pain. They reported that patients scoring high on this factor were much less functionally impaired being able to complete a timed walk more rapidly and move from a standing to sitting position more quickly in the observed task. Related to this, Keefe et al. (1987b) reported that, again in patients with osteoarthritis of the knee, patients scoring highly on the 'pain control and rational thinking' factor reported lower levels of pain and psychological distress and a better health status.

The same relationship has also been reported in chronic pain. Toomey et al. (1991) reported that a greater perceived control predicted less severe and less frequent pain in patients with chronic pain of myofascial origin. Keefe and Williams (1990) examined the relationship in patients with non-malignant chronic pain as a result chronic low back pain, leg pain, neck pain and headaches. Compared with patients with low scores, patients with high scores on the item assessing ability to decrease pain had lower ratings of pain intensity and disability. Tan et al. (2002) reported that, in patients with chronic pain, perceived control over pain was predictive of function, disability and pain interference.

Pain Control Efficacy and Surgery

Few studies have researched the impact of control efficacy on recovery following surgery. Pellino and Ward (1998) investigated the relationship between perceived control of pain and pain intensity following elective orthopaedic surgery. They reported that a greater rating of perceived control of pain was associated with low pain intensity in the immediate post-operative period. In addition, a higher rating of perceived control was associated with a greater satisfaction of pain relief. Keefe et al. (1991) examined the use of pain coping strategies in patients with rheumatoid arthritis who have undergone TKR. A higher score on the 'pain control and rational thinking factor' of the CSQ was associated with lower levels of pain and less psychological disability. The study, however, was cross-sectional in design and therefore it is not possible to make inferences as to the direction of the effect.

Summary of Pain Control Efficacy

In my hip study, coping efficacy (ratings of ability to control and decrease pain) was predictive of level of pain both pre- and post-operatively. In addition, this factor was predictive of function pre-operatively. These findings are in line with the literature which has reported the relationship between control efficacy and pain and function in arthritis and chronic pain. Most of the previous findings have been cross-sectional in nature and therefore it is not possible to make inferences about the direction of the effect. However, the 3-month findings of my hip study are prospective in nature and therefore suggest that coping efficacy is predictive of pain.

Reinterpreting Pain Sensations

Reinterpreting pain sensations was found to be a predictor of better post-operative function. It remained a predictor of function on the inclusion of pre-operative status into the regression models. The finding that a high score on reinterpreting pain sensations is associated with better outcome is consistent with Rapp et al. (2000) who reported that greater use of reinterpreting pain sensations was associated with better physical function and less disability in older individuals with knee pain. Haythornthwaite et al. (1998) reported that subjects scoring highly on reinterpretation of pain sensations was associated with a greater perception of control over pain. Perceived control over pain is known to influence function (see section above) and therefore this may be the mechanism by which reinterpreting pain sensations influences functional level.

The very limited discussion on reinterpreting pain sensations is a reflection on the lack of literature regarding this coping strategy. For example, a literature search in Medline (PubMed) for reinterpreting pain sensations/reinterpretation of pain sensations yielded a total of 13 results whilst the same search in PsychInfo yielded only four results. Most of these articles related to factor analysis of the CSQ rather than the impact of the coping strategy.

Conscientiousness

Introduction to Conscientiousness

Conscientiousness was found to be a predictor of pre-operative levels of function and pain. Patients scoring highly on the conscientiousness scale of the NEO-FFI reported more pain and worse functioning.

Conscientiousness and Health

The findings of my hip study are not line with previous literature has linked conscientiousness to positive health behaviours. For example, Roberts (2005) reported a relationship between conscientiousness and longevity, and, McCrae and Costa (1991) reported that conscientious individuals had a greater overall well-being which was related to less negative affect and more positive affect. Booth-Kewley and Vickers (1994) reported that conscientiousness was associated with more healthy behaviours, more accident control and less traffic risk taking. In line with this, Lemos-Giráldez and Fidalgo-Aliste (1997) reported that conscientious individuals engaged in healthy behaviours such as following a healthy diet, not smoking and not drinking too much. Additionally, conscientious individuals are less likely to engage in drug and alcohol abuse (Walton and Roberts 2004). Similarly, Vollrath et al. (1999) reported that conscientious individuals were less likely to be drunk, smoke or engage in risky sexual behaviours. In addition, conscientious individuals reported that they felt they had a low susceptibility of diseases relating to these habits such as lung cancer, alcoholism and sexually transmitted diseases. It has been proposed that problem-based coping strategies mediate the relationship between conscientiousness and healthy behaviours (Bermúdez 1999). Conscientiousness has also been linked to an "optimistic control factor" which is defined by instruments measuring optimism, hope, internal control and self-esteem (Marshall et al. 1994).

Theory of the Relationship between Conscientiousness, Pain and Disability

Given the body of evidence above, it may seem surprising that, in my study, conscientiousness was found to be related to worse functioning and pain. It would be expected that, as conscientious individuals engage in health-promoting behaviours that they would have less pain and disability. Why then did I find conscientiousness to be associated with more pain and disability?

It is possible that conscientiousness is not actually related to greater experience of pain and disability but instead over-reporting of these symptoms. Adjectives which describe conscientiousness include scrupulous and hardworking (McCrae and Costa 1987), and thorough (McCrae and John 1992). Additionally, the Oxford English Dictionary describes conscientiousness as "diligent and thorough in carrying out one's work" (2005). If the participant was being diligent and thorough, then they may over-report their symptoms in an attempt to be accurate. This may be a result of trying to provide as much information as possible for the study or as a result of how a conscientious individual would behave in a real-life situation faced with a new sign or symptom of disease.

Jerram and Coleman (1999) reported that conscientious women reported more lumps and growths to their general practitioner than individuals scoring low on the conscientiousness scale. Feldman et al. (1999) provided experimental evidence that conscientious individuals over-report unfounded symptoms of illness. They inoculated healthy volunteers with the cold virus and then kept them in quarantine for a period of five days where they completed self-report measures of symptoms and illness. The report of illness was compared with the objective measures (mucus production and mucociliary clearance function) of presence of a cold. The authors reported that conscientious individuals were more likely to report cold symptoms when objectively there were none. In fact, participants scoring in the top third of conscientiousness were five times more likely to report symptoms than participants scoring in the bottom third for conscientiousness. The authors hypothesised that conscientious individuals have a lower threshold for signs of illness as they are cautious and wish to report the symptom so that they can receive the appropriate treatment earlier. Support for this interpretation comes from Kirmayer et al. (1994)

who reported that high conscientiousness may lead individuals to be hyper-vigilant when looking for signs of illness.

Summary of conscientiousness

In my hip study, patients who scored highly in conscientiousness reported worse pain and function pre-operatively. This finding was unexpected as most research has linked conscientiousness to positive health behaviours and therefore it was anticipated that conscientious individuals would function better and have less pain. However, it may be that conscientious individuals have a lower threshold for symptoms and are eager to report symptoms to allow a speedy treatment. Jerram and Coleman (1999), Feldman et al. (1999) and Kirmayer et al. (1994) support this hypothesis.

Demographic Variables

Gender was found to be a predictor of pre-operative function; women reported greater disability than men. Social class was found to predict of level of pain both pre- and post-operatively; lower social classes reported greater pain. Age was a predictor of time taken to achieve key physiotherapy milestones as an inpatient; patients more senior in years took longer to achieve the milestones. These findings are in agreement with previously published literature relating demographic to pain and function in osteoarthritis and in hip replacement.

Gender

Kennedy et al. (2002) assessed the gender-difference in function and physical performance in patients awaiting THR and TKR. They reported that self-reported function measured with the Lower Extremity Activity Profile and an objective assessment of walking were both worse in women compared to men. This suggests that functional impairment was more severe in women rather than men rather than just over-reporting of symptoms in women. Additionally, Hawker et al. (2000) reported that in the general population, in individuals with osteoarthritis, women (when compared to men) reported having worse symptoms and greater disability measured using the SF-36 and WOMAC.

Social Class

In a longitudinal study of progression of hip and knee pain, Peters et al. (2005b) reported that being of a lower social class was associated with a greater deterioration in symptoms over the course of the seven year study. However, there is uncertainty as to whether lower social class is associated with worse pain and function or just report of worse pain and functioning. Brinker et al. (1996;1997) completed two studies assessing whether demographic factors affected the scoring of outcome measures used in THR and TKR. Their participants were health individuals with no history of "injury, pathologic condition or treatment of the hips, knees, lower extremities or spine". In both studies having a lower socio-economic status had a negative impact on the scoring of the instruments. Therefore, there is uncertainty as to whether social class is actually associated with worse pain and functioning or rather the reporting of worse functioning.

Age

Finally, there is literature to support the finding that age was associated with slower achievement of key physiotherapy milestones. Forrest et al. (1998) reported that age predicted a longer length of stay post-THR and TKR. Related to this, Epps (2004) reported that patients (in America) who were more advanced in years were more likely to be discharged to another facility (such as a rehabilitation facility) than directly to their homes.

Previous Total Joint Arthroplasty

Data regarding the number of previous total joint arthroplasties (TJA) was collected in the study as it was hypothesised that patients who had had previous joint replacements may be quicker at achieving key physiotherapy milestones due to a knowledge of the process involved in rehabilitation from their previous operations. This hypothesis was rejected when the analysis of the physiotherapy inpatient data was conducted (see Chapter 6). However, as the data had been collected, it was included in the analyses of the pre-operative and three-month post-operative data. There were no specific hypotheses relating to the relationship between number of previous TJA and pre-operative status or three-month outcome.

In the three-month analyses, a greater number of previous TJA was found to be associated with worse pain and functioning when both excluding and including pre-operative status in the regression analysis. The possible explanations for this finding are discussed below.

First, a prosthetic joint replacement (whilst being better than an osteoarthritic joint) is unlikely to be as good as the natural osteoarthritis-free joint, and therefore when comparing people who have had more TJAs than others there is a cumulative effect of increased pain and limitation of function. As the post-operative data was only collected up until three-months, it cannot be known whether this affect persists longer term or whether having previous TJA just slows down the recovery process when an individual is dependent on more than one artificial joint. Pre-operatively, no relationship was found between previous TJA and any of the outcome measures suggesting that worse outcome as a result of multiple prosthetic joints is only temporary.

Second, patients who have undergone a greater number of joint replacements may have a tendency towards generalised osteoarthritis/polyarticular osteoarthritis. For example, the patient may have a degree also have osteoarthritis in their back, necks or upper limbs (which has not been assessed by a physician or documented in their notes as this would have lead to exclusion from the study) which is contributing to the limitation in function.

Hospital

The hospital in which the patient had their surgery was found to be a predictor of time taken to achieve several of the key physiotherapy milestones. These were: number of days taken to independently use frame, number of days taken to be independent use of crutches, and post-operative length of stay. Patients receiving their care at either Thornbury or Claremont Hospital (private hospitals) recovered quicker than patients receiving their treatment at the Northern General Hospital. The possible explanations for this finding are discussed below.

First, the demographics of people selected to have their surgery at one of the private hospitals are slightly different from those that have their surgery at the Northern General Hospital. The mean age of patients (excluding patients who experienced post-operative complications) attending for their surgery at Thornbury Hospital is 62 years compared with 68 years at the Northern General hospital (significant at < .05). This reflects the fact that nobody over the age of 80 received their care in one of the private hospitals. The results of the current study have shown age to be an important predictor in time taken to independently chair transfer, time taken to achieve independence of crutches, the number of days until deemed ready for discharge from physiotherapy, and post-operative LOS. Other studies have shown age to be an important predictor of LOS (Peerbhoy et al. 1999) and outcome of THR (Nilsdotter et al. 2001).

Patients chosen to receive their care at one of the private hospitals were less likely to have co-morbidity. At the Northern General Hospital 12% of patients had a cardiovascular co-morbidity, 11% suffered and respiratory co-morbidity, and 7% suffered both cardiovascular and respiratory co-morbidities. By contrast, 8% of patients attending one of the private hospitals have a cardiovascular co-morbidity, 4% of patients had a respiratory co-morbidity, and no patients had both cardiovascular and respiratory co-morbidities. The results of the current study did not show co-morbidity to be a predictor of outcome however, this is in contrast to many other studies (Greenfield et al. 1993;MacWilliam et al. 1996;Davis et al. 2006) that have shown co-morbidity to be an important predictor of success.

Second, patients receive more physiotherapy input at the private hospitals (especially Thornbury) than is possible at the Northern General Hospital. During the course of their stay, patients at Thornbury Hospital received an average 1.6 physiotherapy sessions per day compared with an average of 1 session per day at the Northern General Hospital ($p < .001$). Physiotherapy intensity significantly correlated with most of the key physiotherapy outcome measures but was not found to be a predictor in the regression analyses. Whilst physiotherapy intensity was not found to be a predictor of time taken to achieve key physiotherapy milestones in my hip study, other research suggests that it may be an important factor. Jette et al. (2005) reported that, in their study involving patients with stroke, orthopaedic conditions, and cardiovascular and pulmonary conditions, a higher therapy intensity was associated with greater functional improvement and decreased LOS. Additionally, when hospital in which the patient had their surgery was excluded from the regression analysis (not shown), physiotherapy intensity was found to be a predictor of several of the outcome measures.

Finally, hospital in which the patient has their surgery may impact length of stay as the great deal of variability in time between the point when the patient is deemed ready for discharge from a physiotherapy viewpoint and actual length of stay. The mean length of stay after deemed ready for physiotherapy at NGH was 1.26 days (median 1 day, minimum 0 days, maximum 13 days) compared with 0.40 days at Claremont (median 0 days, minimum 0 days, maximum 1 days) and 0.56 days at Thornbury (median 0 days, minimum 0 days, maximum 3 days). The reason for the delayed discharge in other cases at NGH is unknown, however, one might speculate that availability of transport, equipment, social services etc. may be partially responsible for the delay.

The Relationship between Pre-operative Status and Post-operative Status

In a second level of analyses, pre-operative status was included as a variable predicting function and pain in the three-month post-operative analyses. Pre-operative function was a predictor of all post-operative function components. Pre-operative pain was predictive of post-operative pain levels for all of the outcome measures except OHS pain component type 2 (see Tables 7.36 and 7.37 for further details). The positive relationship between pre-operative function and post-operative function measured using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) has been documented in TJA (Fortin et al. 1999;Caracciolo and Giaquinto 2005) and TKR (Lingard et al. 2004). The same relationship has also been demonstrated in THR using the Health Assessment Questionnaire as an outcome measure (MacWilliam et al. 1996) and using a questionnaire assessing activities of daily living as an outcome measure (Holtzman et al. 2002); and in TKR using the OKS and KSKS as outcome measures (Lim et al. 2006). The importance of pre-operative pain in predicting pain post-operatively has been demonstrated using WOMAC pain as an outcome measure in THR revision surgery (Davis et al. 2006) and in TKR (Lingard et al. 2004). In addition this relationship has been demonstrated following THR using a questionnaire assessing pain associated with completion of activities of daily living (Holtzman et al. 2002); and in the early post-operative period following TJA using visual analogue pain scales and using the McGill Pain Questionnaire (Thomas et al. 1998)

In most instances (see Table 7.38) catastrophizing remained a significant predictor of the 3-month recordings on inclusion of pre-operative status as a variable in the regression models. This suggests that catastrophizing influences both pre- and post-operative function and pain levels (rather than simply influencing pre-operative levels of pain and function which then in turn influenced post-operative levels of pain and function). As such, there may be benefit in an intervention designed to reduce the level of catastrophizing either pre- or post-operatively.

The Relationship between Pain and Function

Both pre- and post-operatively pain was an important predictor in the regression models for function. This is in line with the findings of Chui et al. (2005), Leveille et al. (2001), Creamer et al. (2000) and Rietman et al. (2004) (discussed further in Chapter 4). Inclusion of pain as a predictor in the regression models of function, in most cases, caused catastrophizing (which was previously a predictor of function) to become non-significant. This suggests that catastrophizing influences the level of pain which in turn influences the level of disability. As such, interventions such as cognitive behavioural therapy which attempt to alter a patient's response to pain (and reduce levels of catastrophizing) may be of benefit in improving function.

Summary

The multiple regression analyses of baseline, inpatient physiotherapy, three-month post-operative data revealed that of the psychological variables studied catastrophizing consistently predicted outcomes of pain and function. This finding is in agreement with a large body of research from many different areas of health psychology that has documented the relationship between catastrophizing and greater pain and worse functioning. In some areas of health psychology and pain research, interventions have been developed to target catastrophizing and thus alter outcome. Given the ubiquity that catastrophizing exerts its effects on the outcomes measured in this study, a valuable future direction of research may be to develop an appropriate therapy targeting catastrophizing in THR patients.

In addition, reinterpreting pain sensations, pain coping appraisals, age and social class were found to predict outcome. These findings are largely in agreement with the literature available.

A surprising finding was the relationship between conscientiousness and poorer function and worse pain pre-operatively. This is not in line with the majority of the literature which associates conscientiousness with healthy behaviours. However, this association may be a result of over-reporting of symptoms.

Another unexpected finding was the impact of previous TJA on outcome at 3-months post-operatively. A cumulative effect of number of prostheses may be responsible for the slight deterioration in function and worse pain reported (when compared to patients who have had fewer joint replacements).

Pre-operative status was found to be a predictor of post-operative status, this is line with previous research.

Finally, pain was found to be a strong predictor of function both pre- and post-operatively. Inclusion of pain in the regression analysis resulted in many other variables becoming non-significant. However, several of these were predictive of pain and therefore it is possible that psychological variables predict the level of pain (or interpretation of pain) which in turn influences function.