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SPARKS: Social and Psychological Aspects of Replacement Knee Surgery - A Prospective Longitudinal Study

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Abstract

SPARKS: Social and Psychological Aspects of Replacement Knee Surgery

Joanne Brennan

Background: Total Knee Replacement (TKR) surgery is typically performed to alleviate symptoms of severe, advanced osteoarthritis of the knee. TKR surgery has been shown to be an effective treatment to relieve pain and increase functional ability in the affected knee. However, after surgery a substantial subset of patients continue to experience pain, do not demonstrate anticipated functional improvements, and/or are dissatisfied with the outcomes. Recent literature has suggested that psychosocial factors can influence recovery following TKR however, the most influential psychosocial factor has not been identified. A greater understanding of the factors that affect TKR surgery outcomes is needed.

Aims: The aims of the current study were: (1) to conduct a systematic review the literature investigating the influence of preoperative psychosocial factors in TKR outcomes; and to (2) investigate the relationship between preoperative psychosocial variables and rehabilitation engagement and TKR outcomes in a sample of Irish patients.

Methods: The study adopted a prospective cohort design. Patients were recruited during their pre-surgical assessment. Variables were assessed using self-report measures at two time points: two-six weeks before surgery (Time 1) and six-months after surgery (Time 2). Engagement in rehabilitation was assessed during inpatient physiotherapy.

Results: Eighty-two participants were included at Time 1 and 46 were included at Time 2. Mental health, measured at Time 1, contributed significantly to the variance of postoperative patient satisfaction. Unfulfilled expectations, measured at Time 2,

contributed significantly to the variance of postoperative pain intensity. These findings suggest that people with lower preoperative mental health and unfulfilled expectations are at risk of poor outcomes after TKR.

Thirty-two articles were included in the systematic review. Thirty articles reported significant associations between that preoperative psychosocial factors and TKR outcomes (e.g. pain intensity, functional ability and patient satisfaction).

Clinical implications: Preoperative psychological screening may help to identify those in need of preoperative counselling or education regarding the formation of realistic postoperative expectations. This could ultimately improve outcomes and rates of dissatisfied patients.

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To my parents, thank you for your unconditional love and support. You have always gone above and beyond to ensure that I have every opportunity to succeed. Your capacity for kindness and listening has helped me to overcome all the ups and downs. I am eternally grateful for everything you have done for me.

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Introduction

The following section provides an outline of the structure of the research study and will detail the contents of each chapter.

Chapter one provides the background and rationale for the objectives of the current study. It introduces and details concepts that will be discussed, while also addressing strengths and limitations of the current literature. Chapter two consists of a systematic review of the literature outlining the methods and results of the systematic search, and discussion of the literature identified. The aim of this chapter is to systematically review the literature investigating the associations of preoperative psychosocial variables and outcomes after TKR. Chapter three is a description of the methods employed in the current study. It details, research design, recruitment procedure, ethical considerations, measures employed, statistical analyses chosen and power analyses. Chapters four and five describe the cross-sectional and longitudinal results, respectively. The last chapter provides the discussion and interpretation of the results and concludes the findings of the current study.

Chapter 1: Background and current study

1.1 Total knee replacement

Total knee replacement (TKR) surgery is among the most effective treatments for reducing pain and increasing functional ability in people suffering with knee osteoarthritis (OA). Arthritis is the greatest cause of disability in Ireland with approximately 915,000 people currently living with arthritis (Health Information and Quality Authority, 2014). OA is a degenerative joint disease and is the most common form of arthritis. It is commonly associated with chronic pain, functional restriction and reductions in quality of life. In Ireland, and internationally, demand for TKR is increasing due to the steady increase in incidence of OA associated with an ageing demographic and rising obesity. Typically, TKR is performed when the pain intensity and functional restriction associated with OA is impacting on patients' quality of life despite medical intervention (Ravi et al., 2012). Chronic pain associated with OA is the reason for surgery in over 90% of people who undergo knee replacement surgery in Ireland (Health Information and Quality Authority, 2014) with approximately 1,500 knee replacement surgeries performed each year (Health Service Executive, 2017). Typically, a person undergoing TKR in Ireland will be over 60-years old, female, married and retired (French, Galvin, Horgan, Kenny, & French, 2015). TKR is a largely successful surgery and has demonstrated effectiveness in providing substantial pain reduction and functional improvements (Ravi et al., 2012). Improvements in prosthetic implant design and surgical techniques has meant that early failure of TKR is uncommon (less than 5%) (Wylde, Dieppe, Hewlett, & Learmonth, 2007).

1.2 Total knee replacement outcomes

1.2.1 Pain relief and functional restriction

As chronic pain and functional restriction associated with arthritis are the primary motivators for undergoing TKR, pain relief and gains in functional ability are key indicators of improvement (Wylde et al., 2007). Clinical factors such as range of motion of the knee, joint alignment and joint stability are regularly recorded to assess surgical outcomes. However, it has been well documented that there can be a discordance between patients and clinicians with regards to outcomes after TKR (Harris et al., 2013; Janse et al., 2004). This has resulted in the increasing emphasis on assessing patient-rated outcomes as indicators of surgical success.

1.2.2 Patient satisfaction

Even after a technically well performed surgery, up to 20% of patients are dissatisfied with their outcomes (Ali, Lindstrand, Sundberg & Flivik, 2017; Bourne, Chesworth, Davis, Mahomed, & Charron, 2010; Gandhi, Davey, & Mahomed, 2008; Judge et al., 2012; Scott, Howie, MacDonald, & Biant, 2010) and patients can be less satisfied with their outcomes than surgeons expect (Choi & Ra, 2016). As a result, patient-rated satisfaction has become an increasingly important indicator of surgical success (Lau, Gandhi, Mahomed, & Mahomed, 2012). The recent publication of a 'satisfaction subscale' in the Knee Society Score (KSS) (Noble et al., 2012) highlights the growing recognition of the importance of patient-rated satisfaction in understanding TKR outcomes.

Patient satisfaction has been defined in many ways in the literature. It has previously been defined as satisfaction with the replaced knee or the overall outcome of surgery (e.g. Heck, Robinson, Partridge, Lubitz, & Freund, 1998; Judge et al., 2012;

Kim, Chang, Kang, Kim, & Seong, 2009). Other studies have looked patient satisfaction as a multi-dimensional construct assessing satisfaction with pain relief, functional ability and care received (Gandhi et al., 2008; Scott et al., 2010). The diversity of definitions of patient satisfaction impacts the ability to compare results and interpret findings across studies. A recent systematic review highlighted the need for consistency in definition of patient satisfaction in TKR research (Gunaratne et al., 2017).

Another limitation of the literature can be seen in the heterogeneity of the measures used to assess patient satisfaction. Patient satisfaction is typically measured in the literature using a variety of bespoke single- or multi-item Likert scales. (Ali et al., 2017; Baker, van der Meulen, Lewsey, & Gregg, 2007; Bourne et al., 2010; Duivenvoorden et al., 2013; Gandhi, Davey, et al., 2008; Jacobs & Christensen, 2014; Neuprez et al., 2016; Scott et al., 2010). While the publication of the patient satisfaction subscale of the KSS (Nobel et al., 2012) highlights the importance of patient satisfaction in TKR outcomes, it also highlights the need for psychometrically validated measures. Previous systematic reviews have been unable to perform meta-analyses due to the heterogeneity in the definitions and measures usedacross studies (Khatib, Madan, Naylor, & Harris, 2015; Vissers et al., 2012).

Limited research investigates the impact of preoperative psychosocial factors on (dis)satisfaction after TKR. Khatib et al. (2015) identified just 5 studies, meeting the review inclusion criteria that directly assessed patient dissatisfaction (defined as being unhappy or unsure about the benefits of TKR). Four of the 5 studies reported that dissatisfaction (assessed 6 months postoperatively) was associated with preoperative psychological health; however, there is little evidence regarding which psychosocial factors are most important in predicting TKR outcomes. Psychosocial factors in TKR outcomes

Recent systematic reviews (Gunaratne et al., 2017; Khatib et al., 2015; Vissers et al., 2012) highlighted the role of psychological factors in TKR patients' post-surgical outcomes. Khatib et al. (2015) concluded that preoperative psychological health was a significant predictor of pain, function and satisfaction six-months after surgery in sixteen studies. Consistent with this finding, Vissers et al. (2012) found strong evidence that lower preoperative mental health was a predictor of worse pain and functional ability one-year after TKR. Vissers et al. (2012) also provided strong evidence for the predictive validity of pain catastrophizing in postoperative pain. Gunaratne et al. (2017) concluded that preoperative patient expectations were a consistent predictor of patient dissatisfaction. Other psychological factors such as self-efficacy and patient activation have also been investigated as potential predictors of patient outcomes after TKR surgery (Andrawis et al., 2015; Magklara, Burton, & Morrison, 2014). In the following section, findings related to these constructs are detailed.

1.3 Psychosocial factors in TKR outcomes

1.3.1 Pain catastrophizing

The relationship between catastrophizing and pain after TKR has been investigated in several studies (Burns et al., 2015). Catastrophizing has been defined as "an exaggerated negative mental set brought to bear during painful experiences" (Sullivan et al., 2001, p. 52). Catastrophizing has been thoroughly investigated as a maladaptive coping strategy for people experiencing pain (Edwards, Haythornthwaite, Smith, Klick, & Katz, 2009; Forsythe, Dunbar, Hennigar, Sullivan, & Gross, 2008; Høvik, Winther, Foss, & Gjeilo, 2016; Keefe, Brown, Wallston, & Caldwell, 1989; Riddle, Wade, Jiranek, & Kong, 2010; Sullivan et al., 2009). Studies conducted by Keefe et al. (1987) in patients with OA found catastrophizing scores significantly contributed to pain intensity scores explaining 10% of the variance.

Studies have consistently demonstrated the positive association between catastrophizing and pain in patients undergoing TKR. For example, a study conducted by Forsythe et al. (2008) found that preoperative pain catastrophizing scores predicted residual pain two-years after surgery (area under the curve = 0.713 ($p < .05$)). Similarly, Edwards et al. (2009) found that preoperative catastrophizing was a significant predictor of chronic pain at night time (estimate = .51, $p = .04$). Riddle et al. (2010) also showed that those with higher preoperative pain catastrophizing scores were six times more likely to experience greater preoperative pain intensity (odds ratio = 6.04, $p = .005$).

A systematic review by Burns et al. (2015) investigated catastrophizing as a predictor of chronic pain post-TKR surgery. The review, which included six longitudinal studies, provided moderate-level evidence for catastrophizing as a significant independent predictor of postoperative pain in patients who had undergone TKR surgery. Burns et al. (2015) also provided evidence for the stability of levels of catastrophizing over time, indicating that catastrophizing is a trait-like construct, however, contradicting research indicates that catastrophizing decreases as pain decreases (Høvik et al., 2016). Wade et al. (2012) also found that catastrophizing scores decreased with pain intensity which supports the notion that catastrophizing may be subject to change (Wade, Riddle, & Thacker, 2012).

1.3.2 Mental health

Research has shown preoperative mental health to be a consistent predictor of TKR outcomes including pain intensity, functional restriction and satisfaction. General mental health according to Ware (2000) has been conceptualised as the level of psychological distress as well as the disability of daily roles due to emotional problems.. Escobar et al. (2007) investigated the association between preoperative mental health and TKR outcomes in 640 participants. Multivariate analyses found that preoperative

mental health was a significant predictor of pain intensity and functional limitations six months after surgery. A similar study of 952 participants found that participants with lower preoperative mental health scores reported significantly worse pain and function two-years after surgery (Lingard & Riddle, 2007). With regards to patient-rated satisfaction, Gandhi and colleagues (2008) investigated the relationship between preoperative mental health and patient satisfaction one-year after TKR surgery in a cohort of 1720 participants and found that preoperative mental health independently predicted patient satisfaction.

Two recent systematic reviews (Khatib et al., 2015; Vissers et al., 2012), provided strong evidence for the role of preoperative mental health as a significant predictor of postoperative pain intensity and/or functional restriction. Vissers et al. (2012) found that mental health was one of the psychological constructs assessed most often. In this review, six studies found a significant association between preoperative mental health and postoperative pain intensity and/or functional restriction in TKR samples. Khatib et al. (2015) identified 11 studies that found a significant association between preoperative mental health scores and postoperative pain intensity and/or functional restriction in TKR samples.

The association between mental illness and TKR outcomes has also been investigated. Anxious and depressive symptoms assessed preoperatively are predictive of post-operative pain and function (Hirschmann, Testa, Amsler, & Friederich, 2013; Brander, Gondek, Martin, & Stulberg, 2007; Brander et al., 2003). Brander and colleagues (2003) found that higher preoperative anxiety and depression scores were significantly associated with greater pain one-year after surgery. Consistent with this finding, Hirschmann et al. (2013) found that participants with higher anxiety preoperatively had worse pain and function scores ($r = .25$ and $r = .25$, respectively). A

similar study investigated the effect of psychopathology (defined as depression, anxiety, panic disorder or somatization) on TKR outcomes (Ellis, Howard, Khaleel, & Bucholz, 2012). Findings indicated that the psychopathology group had significantly worse pain scores one-year postoperatively when compared to the non-psychopathology group.

1.3.3 Patient expectations

The expectations of the patient prior to surgery and the fulfilment of these expectations are potentially important factors in recovery from TKR. A variety of definitions of 'patient expectations' can be seen in the literature (Haanstra et al., 2012). Expectations are typically related to outcomes of surgery, including expectations of recovery time (Mannion, Kämpfen, Munzinger, & Kramers-de Quervain, 2009), pain relief (Vissers et al., 2010), and functional ability (Nilsdotter, Toksvig-Larsen, & Roos, 2009). Haanstra et al. (2012) note that the concept of patient expectations lacks a reliable theoretical foundation which has resulted in inconsistencies across studies. There is also notable variation in the tools used to assess patient expectations. A review by Zywiel et al. (2013) identified seven validated tools and forty unvalidated tools to assess patient expectations in orthopaedic surgery, leading to difficulties in interpreting and comparing studies.

Recent reviews have concluded that patient satisfaction after TKR is associated with patient expectations and improvements in pain severity and functional ability (Choi & Ra, 2016; Lau et al., 2012). Noble et al. (2006) reported that overall satisfaction with TKR outcomes are driven primarily by patient expectations (OR = 6.01, $p < .001$). A study investigating the impact of preoperative expectations on satisfaction with TKR found that preoperative expectations was the strongest independent predictor of patient satisfaction and explained 41% of the variance of patient satisfaction (Neuprez et al., 2016). Another study found that patients who report unmet expectations (measured

postoperatively) are 10 times more likely to be dissatisfied with their TKR surgery (OR = 10.66, $p < .05$) (Bourne et al., 2010). Recent research has also looked into the discordance of surgeon and patient expectations and the impact this may have on TKR outcomes. Ghomrawi et al. (2013) reported that 37% of patients had significantly higher expectations than their surgeon. Discrepancies between patient-surgeon satisfaction after surgery has previously been predicted by unmet patient expectations (OR = 1.33, $p< 0.001$) (Harris et al., 2013). However, despite these positive associations, systematic reviews have highlighted inconsistencies in the literature and suggest that there is no conclusive association between patient expectations and TKR outcomes (Culliton, Bryant, Overend, MacDonald, & Chesworth, 2012; Haanstra et al., 2012).Self-efficacy

Self-efficacy is an important construct which potentially predicts outcomes after TKR. Self-efficacy is the belief in one's ability to successfully achieve goals (Asghari & Nicholas, 2001). With regard to TKR, it may contribute to the belief that they can successfully improve their functional ability and reduce the pain intensity in their knee (Wylde, Dixon, & Blom, 2012). Previous studies have reported the association between self-efficacy and pain intensity and functional restriction in patients with knee OA (Asghari & Nicholas, 2001; Keefe et al., 1987). Wylde et al. (2012) found that preoperative self-efficacy explained 6% of the variance in functional ability one-year after TKR when included in a regression model controlling for age, sex, comorbidities, anxiety and depression. However, Hartley et al. (2008) found no significant association between preoperative self-efficacy and postoperative function. Another study assessed whether pre- or postoperative self-efficacy was a better predictor of pain, functional restriction and physical health after TKR and Total Hip Replacement (THR) (van den Akker-Scheek, Stevens, Groothoff, Bulstra, & Zijlstra, 2007). The findings suggested that self-efficacy measured shortly after surgery rather than preoperatively was the best

predictor of long-term outcomes. Self-efficacy measured six-weeks postoperatively significantly predicted postoperative physical health, mental health and walking speed (explaining 30%, 53%, and 66% of the variance, respectively). A recent systematic review also concluded that preoperative self-efficacy did not consistently predict functional ability, but that self-efficacy measured postoperatively was more consistently associated with functional outcomes (Magklara et al., 2014). The malleable nature of self-efficacy in a given context may explain these inconsistencies. Magklara et al. (2014) suggest that postoperative self-efficacy scores may represent more realistic expectations and beliefs about recovery and are therefore more likely to predict surgical outcomes.

1.3.4 Patient activation

Patient activation refers to one's belief that the role of the patient is an important factor in healthcare, as well as having an active engagement in their healthcare (Hibbard, Stockard, Mahoney, & Tusler, 2004). Patient activation can be broken down into four domains: the importance of the role of the patient in health management; confidence and knowledge of the health-care system; being an active participant in the management of one's health care; and being able to manage one's health-care even under stress (Hibbard et al., 2004). Each domain assessed is directly related to healthcare management. Patient activation has been previously associated with better health outcomes such as less functional restriction (Lorig et al., 1999; Von Korff et al., 1998).

Few studies have looked at the role of patient activation in outcomes following TKR. Andrawis et al. (2015), investigated the effect of preoperative patient activation scores on postoperative patient-rated pain, function and satisfaction after TKR and THR. When entered into a regression model to predict pain and function, patient

activation scores explained 31% and 27% of the variance, respectively. Patient activation was also a significant independent predictor of postoperative satisfaction, explaining 5% of the variance. Patients with better preoperative activation scores reported better pain relief, function and satisfaction postoperatively. The impact of patient activation on pain relief and functional outcomes after TKR could be because patients who have higher levels of activation are more likely to engage in behaviours that will aid in their recovery (Skolasky, Mackenzie, Wegener, Riley, & Riley 3rd, 2008). For example, Skolasky et al. (2008) found that higher preoperative patient activation scores explained 28% of the variance in physical therapy attendance, and 56% of the variance in engagement with physical therapy. Patients who had higher preoperative patient activation scores had better attendance and engagement in physical therapy after surgery.

1.3.5 Participation restriction

Participation restriction has been described as a complex construct and is comprised of both social and environmental factors (Maxwell et al., 2013). The International Classification of Function, Disability and Health (ICF) has recognised the importance of a holistic and multidimensional approach to viewing functional disability (O'Donovan, Doyle, & Gallagher, 2009). This includes looking at bodily function, activity limitations, participation restriction and environmental barriers (O'Donovan et al., 2009). Patients undergoing TKR often experience activity limitations such as doing less housework, difficulties dressing themselves and walking more slowly or for short distances (Von Korff et al., 1998). Few studies have looked at the degree of participation restriction in TKR patients. One study found that while patients did experience improvements in participation restriction after TKR surgery, more than one third of the sample still experienced some participation restriction (Maxwell et al.,

2013). Another study found a significant association between activity limitations (defined as difficulties with completing activities) and participation restriction (Davis et al., 2011).

1.4 The current study

The current study aims to provide a better understanding into the influence of psychosocial factors on TKR outcomes by investigating the effect of various preoperative psychosocial factors on pain intensity, functional restriction and patient satisfaction six-months after TKR. In the current study, postoperative patient satisfaction is measured in two ways: by measuring participants' satisfaction with their pain relief and functional ability after TKR; and by assessing overall satisfaction with their knee replacement surgery. Expectations (both preoperatively and postoperatively) are measured using a validated scale, the KSS Expectations subscale (Noble et al., 2012). This scale looks at patient expectations with regard to the pain relief and functional ability they expect TKR surgery to provide, and whether these preoperative expectations have been met (assessed postoperatively). The experiences of participation restriction in patients undergoing TKR will also be documented pre- and post-surgery. This study will provide a greater understanding of the factors that affect knee replacement surgery outcomes from the patient's perspective. This will help to identify appropriate targets for intervention before surgery that could improve postoperative outcomes. This research is comprised of two studies: the systematic review, and the empirical study.

1.4.1 Objectives of the systematic review

Objective 1: To systematically review the literature which investigates the association between preoperative psychosocial factors and postoperative TKR outcomes.

Objective 2: To update a previous systematic review conducted by Khatib et al., (2015) and incorporate new research.

1.4.2 Objectives of the empirical study

Objective 1: To describe the characteristics of the current sample and to investigate the associations between demographic variables (age, sex, education, employment and marital status) and patient-reported variables (psychosocial variables and outcome variables (pain intensity, functional restriction, satisfaction) at Time 1.

Objective 2: To investigate whether psychosocial variables measured at Time 1 are associated with pain intensity, functional restriction and satisfaction at Time 1 and rehabilitation engagement.

Objective 3: To investigate any significant changes in psychosocial variables, outcome variables and participation restriction from Time 1 to Time 2.

Objective 4: To investigate whether pain intensity, functional restriction, satisfaction and global satisfaction at Time 2 are predicted by Time 1 psychosocial variables and fulfilment of expectations (measured at Time 2).

Chapter 2: Systematic Review

This chapter details a systematic review of the literature which investigates the impact of preoperative psychosocial factors on TKR outcomes (pain intensity, functional restriction and patient satisfaction).

2.1 Aims

The aim of this systematic review is to investigate the influence of preoperative psychosocial factors on outcomes after TKR surgery defined as pain intensity, functional restriction and patient satisfaction. This review will expand an earlier review conducted by Khatib et al. (2015) for which database searches were completed in 2013. Khatib et al concluded on that basis of 16 studies that preoperative mental health is an important predictor of patient satisfaction, pain intensity and functional ability. The current systematic review aims to incorporate more recent findings in light of newly published literature.

2.2 Methods

2.2.1 Database searches

An electronic search was conducted of MEDLINE, CINAHL, PsycINFO, and EMBASE. The aim of the search was to identify studies investigating the effect of preoperative psychological factors on TKR outcomes defined as pain intensity, functional restriction and patient satisfaction. The searches were conducted from the beginning of each database to April 2018. Search terms employed were a combination of mapped medical subject headings (MeSH) terms, keywords and text words relating to knee replacement surgery outcomes and psychological risk factors (see Appendix A). Articles were limited to studies published in English.

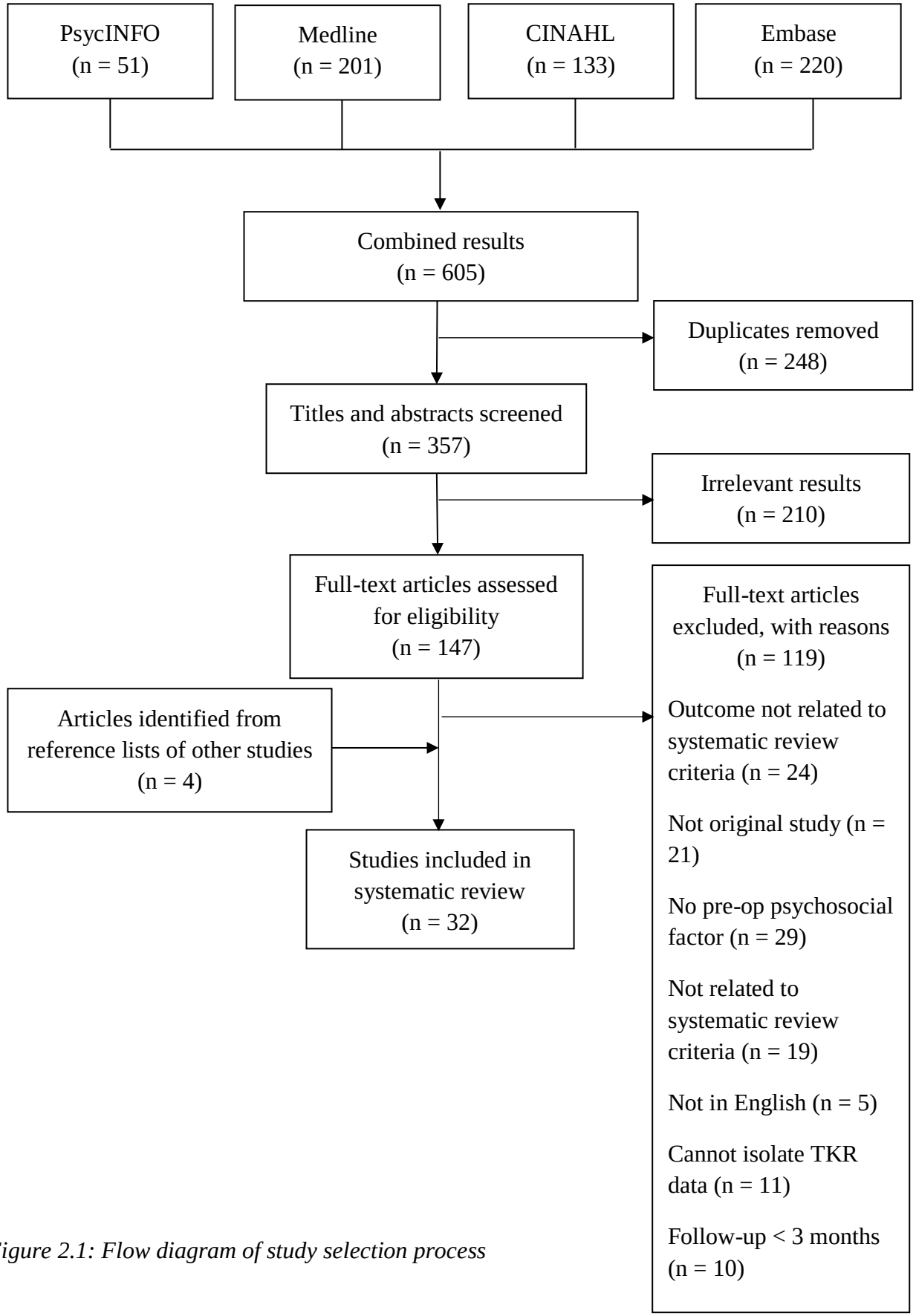

Figure 2.1: Flow diagram of study selection process

2.2.2 Study screening and selection

Articles identified using the search terms were exported into a systematic review programme (covidence.org) where duplicates were removed. Title and abstract screening were conducted via Covidence by two independent reviewers. Titles that were irrelevant and abstracts that clearly did not meet the review inclusion criteria were excluded at this stage. Inclusion criteria were: 1) prospective studies in adults undergoing TKR surgery; 2) preoperative psychosocial factor; 3) outcome measure of pain, function or satisfaction; 4) a comparison of postoperative outcomes based on preoperative psychosocial factor; 5) minimum of 3-month follow-up; and 6) original research paper. Studies that investigated the outcome of other joint surgeries were included if the TKR data could independently interpreted. The remaining articles were subjected to a full-text screening where they were assessed independently by two reviewers for eligibility. A manual search was also conducted of reference lists to identify any other eligible articles that were not included in the initial search. Any conflicts regarding inclusion or exclusion of studies were resolved via consensus at each step.

2.2.3 Quality assessment

Studies included in the final review were assessed for quality of evidence and methodology by two independent reviewers using the Critical Appraisal Skills Programme (CASP) cohort study checklist (Critical Appraisal Skills Programme, 2018). The checklist consists of eleven items which look at quality of methodology and validity of results. Responses for each item were ‘Yes’, ‘No’, and ‘Unclear’. If the article met the criteria of an item (‘Yes’), it was given a score of one. If the criteria weren’t met (‘No’) or insufficient information was given to accurately assess the item (‘Unclear’), it was given a score of zero. Items were then summed for a maximum

possible score of 11 (Table 2.2). The checklist was used as a guide to quality assessment rather than a tool for exclusion, therefore no articles were excluded on the basis of quality.

2.2.4 Data extraction

Data extraction was conducted via Covidence by two independent reviewers. Information such as funding, country of study, recruitment method, design, setting, preoperative and postoperative measures and procedure were documented. Other figures documented or calculated where possible were total number of participants, mean age, male to female ratio, length of follow-up, and follow-up rate. To determine the main results, reviewers also recorded baseline psychosocial characteristics and statistical methods. The primary aim was to assess the effect of preoperative psychosocial factors on postoperative pain, function or satisfaction. Therefore the reviewers recorded relevant figures (e.g. significance levels, correlation coefficients, effect sizes, odds ratios, etc.) and level of dissatisfaction where possible.

2.3 Results

2.3.1 Literature search

After the removal of duplicates, 357 articles were identified (Figure 2.1). Following title and abstract screening, 210 articles were excluded. The remaining articles were subjected to a full-text review where 119 articles were excluded for the following reasons: outcome not related to systematic review criteria (n = 24); not original study (n = 21); no preoperative psychosocial factor (n = 29); content not related to systematic review criteria (n = 19); not in English (n = 5); cannot isolate TKR data (n = 11); follow-up < 3 months (n = 10). Following the full text-review, 28 articles met the inclusion criteria and four articles were identified by manual search of reference lists. In

total, 32 articles were included in the review (an increase of 11 studies since the Khatib et al. 2015 review).

2.3.2 Study characteristics

In the 32 included articles, there was a total of 18,866 participants with a mean age of 68.76 years (range 62- 72.5 years). Sample sizes ranged from 43 to 4234 and the percentage of female participants ranged from 45% to 97% (median = 60%). Length of follow-up ranged from 3 to 60 months. Nineteen studies were conducted in the USA or Canada, six were in the United Kingdom and the remaining studies were conducted in Spain, Greece, the Netherlands, Korea, Sweden, Switzerland, and Belgium. We identified 29 prospective cohort studies, two cross-sectional surveys, and one case-control study. Study characteristics are summarised in Table 2.1.

All studies measured at least one psychosocial factor preoperatively and had a measure of pain, function and/or satisfaction postoperatively. Thirty studies found that psychosocial factors measured preoperatively were associated with postoperative outcomes. Two studies (Jones, Voaklander, & Suarez-Alma, 2003; Kim, Chang, Kang, Kim, & Seong, 2009), did not find any significant effect of baseline psychosocial factors on postoperative outcomes.

2.3.3 Patient satisfaction

Eight studies assessed patient satisfaction after TKR surgery (Table 2.3). Percentage of dissatisfied patients ranged from 7.5% - 28.6% (median 15%). There was considerable heterogeneity observed regarding the conceptualization and measure of satisfaction across studies.

Table 2.1: Summary of the studies included in this review

Study	Study design	Sample size	Female n (%)	Mean age (years)	Follow-up period (months)	Follow-up rate (%)	Power analysis (Y/N)
Ali et al (2017)	Cohort Study	186	120 (65)	72.5	48	93	Y
Ayers et al (2005)	Cohort Study	165	103 (62)	68	12	100	N
Blackburn et al (2012)	Cohort Study	116	64 (55)	72	6	NS	N
Brander et al (2003)	Cohort Study	116	64 (55)	66	12	NS	N
Brander et al (2007)	Cohort Study	83	46(55)	66	60	72	N
Cooper et al (2017)	Case-control	317	173 (54)	62.3	6	79	N
Cremeans-Smith (2015)	Cohort Study	110	75 (68)	69.2	3	NS	Y
Duivenvoorden et al 2013	Cohort Study	128	72 (56.3)	66.2	12	70	Y
Edwards et al (2009)	Cohort Study	43	25 (58)	71.7	12	74	N
Ellis et al (2012)	Cohort Study	154	110 (71)	62	12	82	N
Engel et al (2004)	Cohort Study	117	60 (51)	67	6	NS	N
Escobar et al (2007)	Cross-sectional	640	471 (73.6)	71.8	6	75	N
Gandhi et al (2008)	Cross-sectional	1720	1005 (58)	70	12	75	N
Hanusch et al (2014)	Cohort Study	100	45 (45)	71	12	87	N
Heck et al (1998)	Cohort Study	291	182 (63)	70	24	92	N
Hirschmann et al (2013)	Cohort Study	104	58 (53)	70	12	95	Y
Jones et al (2003)	Cohort Study	276	162 (59)	69	6	79.5	N
Judge et al (2012)	Cohort Study	1991	1214 (61)	71	6	55.2	N
Kim et al (2009)	Cohort Study	270	261 (97)	68	12	69.7	N
Lingard & Riddle (2007)	Cohort Study	952	574 (60)	71	24	69.2	N
Lopez-Olivo et al (2011)	Cohort Study	241	163 (65)	65	6	66.6	Y
Neuprez et al (2016)	Cohort Study	58	35 (60)	68	12	74.5	N
Noiseux et al (2014)	Cohort Study	215	125 (58)	61.7	6	90	N
Papakostidou et al (2012)	Cohort Study	204	162 (79)	69	12	90	N
Riddle et al (2010)	Cohort Study	140	111 (79)	64	6	89.2	Y

Table 2.1 continued

Study	Study design	Sample size	Female n (%)	Mean age (years)	Follow-up period (months)	Follow-up rate (%)	Power analysis (Y/N)
Scott et al (2010)	Cohort Study	1141	698 (61)	70	12	94	Y
Singh et al (2013)	Cohort Study	4234	2329 (55)	68	60	57	Y
Singh et al (2014)	Cohort Study	4234	2329 (55)	68	60	57	Y
Smith & Zautra (2004)	Cohort Study	64	37 (58)	67	6	88.9	N
Sullivan et al (2011)	Cohort Study	120	79 (61)	67	12	NS	N
Wylde et al (2012)	Cohort Study	220	137 (62)	70	12	88	N
Yakobov et al (2014)	Cohort Study	116	71 (61)	67	12	NS	N

Y =Yes, N= no, NS= not specified.

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Four studies defined satisfaction as overall satisfaction with their replacement knee surgery (Ali et al., 2017; Heck et al., 1998; Judge et al., 2012; Kim et al., 2009) which was assessed using a single-item. Gandhi et al. (2008) assessed dimensions of satisfaction such as satisfaction with care, pain relief, ability to perform daily activities and ability to perform recreational activities. Similarly, two studies looked at patient satisfaction as a measure of pain relief and ability to perform daily activities, while also including a measure of overall satisfaction with surgery (Duivenvoorden et al., 2013; Scott et al., 2010). Neuprez et al. (2016) defined satisfaction as a measure of fulfilled expectations. In all studies, responses were dichotomised into 'satisfied' or 'dissatisfied'. Response options for satisfaction items across studies consisted of a variation of 'very satisfied', 'satisfied', 'unsure'/ 'neutral', and/ or 'dissatisfied'. Participants were classified as 'dissatisfied' if they responded 'dissatisfied' or 'neutral', and 'satisfied' if they responded either 'satisfied' or 'very satisfied'. For one study, where satisfaction was measured on a visual analogue scale (0-100), a response of 50 and above was deemed as satisfied (Judge et al., 2012).

General mental health was found to be a significant predictor of postoperative satisfaction in four studies (Ali et al. 2017; Gandhi et al., 2008; Heck et al., 1998; Scott et al., 2010). The presence of anxious or depressive symptoms was a significant predictor of postoperative dissatisfaction in two studies (Duivenvoorden et al., 2013; Judge et al., 2012). Neuprez et al. (2016) found that preoperative expectations predicted satisfaction postoperatively. The remaining study did not find any significant relationship between baseline psychosocial factors and postoperative satisfaction (Kim et al., 2009). With regard to postoperative improvement in pain intensity and functional restriction, two studies found that there were no significant differences between the 'satisfied' and 'dissatisfied' groups (Ali et al., 2016; Gandhi, et al., 2008).

In these studies, both groups showed significant improvements in pain one-year after surgery and function four-years after surgery. In one study with the longest follow-up, Brander et al. (2007) reported that five years after TKR, nearly all patients were satisfied (sample size = 83; "satisfied" patients = 80).

2.3.4 Postoperative function

Twenty-one studies assessed the influence of preoperative psychosocial factors on self-rated postoperative function (Table 2.3). The association of preoperative mental health with postoperative function was assessed in 14 studies (Ayers, Franklin, Ploutz-Snyder, & Boisvert, 2005; Blackburn, Qureshi, Amirfeyz, & Bannister, 2012; Brander et al., 2007; Cooper et al., 2017; Duivenvoorden et al., 2013; Escobar et al., 2007; Hanusch, O'Connor, Ions, Scott, & Gregg, 2014; Heck et al., 1998; Hirschmann et al., 2013; Jones et al., 2003; Judge et al., 2012; Lingard & Riddle, 2007; Lopez-Olivo et al., 2011; Wylde et al., 2012). Eleven studies found significant associations between preoperative mental health and postoperative function (Ayers et al., 2005; Blackburn et al., 2012; Brander et al., 2007; Cooper et al., 2017; Duivenvoorden et al., 2013; Escobar et al., 2007; Hanusch et al., 2014; Heck et al., 1998; Hirschmann et al., 2013; Lopez-Olivo et al., 2011; Wylde et al., 2012). Two other studies investigated the impact of psychopathology on functional outcomes after TKR (Ellis, Howard, Khaleel, & Bucholz, 2012; Singh & Lewallen, 2014). Singh and Lewallen (2014) found that depression was a significant predictor of functional outcomes five years after surgery however, a study conducted by Ellis et al. (2012) showed that while scores for preoperative function differed between those with psychopathology and those without, there was no significant difference in their improvement.

Table 2.2: Summary of quality assessment

Study	Addressed a focused issue	Acceptable recruitment procedure	Minimal bias for exposure	Minimal bias for outcome	Confounding factors considered	Follow-up complete enough	Results: precisely reported	Results: believable	Results: fitting with other evidence	Applicable to local population	Implications of study in practice	CASP Score*
Ali et al (2017)	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	9
Ayers et al (2005)	Yes	Unclear	Yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	7
Blackburn et al (2012)	Yes	Unclear	Yes	Yes	Unclear	Yes	No	Unclear	Yes	Yes	No	6
Brander et al (2003)	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	9
Brander et al (2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	9
Cooper et al (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	9
Cremeans-Smith (2015)	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Unclear	7
Duivenvoorden et al 2013	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	Unclear	Unclear	Unclear	6
Edwards et al (2009)	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Unclear	Unclear	7
Ellis et al (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	10
Engel et al (2004)	Yes	Yes	No	Yes	Unclear	Yes	Unclear	Yes	Yes	Unclear	Unclear	6
Escobar et al (2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	9
Gandhi et al (2008)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	9
Hanusch et al (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	10
Heck et al (1998)	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	7
Hirschmann et al (2013)	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	No	8

Table 2.2 continued

Study	Addressed a focused issue	Acceptable recruitment procedure	Minimal bias for exposure	Minimal bias for outcome	Confounding factors considered	Follow-up complete enough	Results: precisely reported	Results: believable	Results: fitting with other evidence	Applicable to local population	Implications of study in practice	CASP Score*
Jones et al (2003)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	10
Judge et al (2012)	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	8
Kim et al (2009)	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	7
Lingard & Riddle (2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	9
Lopez-Olivo et al (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Neuprez et al (2016)	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	8
Noiseux et al (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	9
Papakostidou et al (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	10
Riddle et al (2010)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	10
Scott et al (2010)	Yes	Yes	Yes	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	Yes	Unclear	5
Singh et al (2013)	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	8
Singh et al (2014)	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	8
Smith & Zautra (2004)	Yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Unclear	Unclear	6
Sullivan et al (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	9
Wylde et al (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	10
Yakobov et al (2014)	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	Unclear	8

* Quality of methodology and evidence was assessed using the Critical Appraisal Skills Programme (CASP) checklist for cohort studies

Other constructs that were investigated as potential predictors of postoperative function were catastrophizing (Sullivan et al., 2011; Yakobov et al., 2014), self-efficacy (Engel, Hamilton, Potter, & Zautra, 2004; Wylde et al., 2012), purpose in life (Smith & Zautra, 2004), and perceived injustice (Yakobov et al., 2014). In these studies, each construct significantly predicted functional ability 6-months to one-year after TKR, with the exception of perceived injustice.

The remaining four articles reported no significant association between preoperative mental health and postoperative outcomes (Jones et al., 2003; Judge et al., 2012; Lingard & Riddle, 2007; Riddle et al., 2010). Lingard and Riddle (2007) did not find any significant difference in postoperative improvements between 'distressed' and 'non-distressed' patients.

2.3.5 Postoperative pain

The impact of preoperative psychosocial factors on postoperative pain was assessed in 20 studies (Table 2.3). Of these, 15 investigated the association of preoperative mental health on postoperative pain intensity (Brander et al., 2003, Brander et al., 2007; Duivenvoorden et al., 2013; Edwards, Haythornthwaite, Smith, Klick, & Katz, 2009; Ellis et al., 2012; Escobar et al., 2007; Hirschmann et al., 2013; Judge et al., 2012; Kim et al., 2009; Lingard & Riddle, 2007; Lopez-Olivo et al., 2011; Noiseux et al., 2014; Papakostidou et al., 2012; Singh & Lewallen, 2013; Wylde et al., 2012). Of these studies, four reported a significant association between preoperative anxiety and heightened postoperative pain 6-months, 1-year, and 2-years after surgery (Brander et al., 2003; Noiseux et al., 2014; Singh & Lewallen, 2013; Wylde et al., 2012); two studies found that preoperative depression was predictive of heightened pain postoperatively measured at 6-months and 1-year (Duivenvoorden et al., 2013; Edwards et al., 2009); two studies reported a significant correlation between preoperative

depression scores and postoperative pain, however, they did not assess the predictive validity of this construct on postoperative outcomes (Hirschmann et al., 2013; Papakostidou et al., 2012). Three studies assessed general mental health as their baseline predictor and found that it was predictive of postoperative pain intensity 6-months and 1-year after surgery (Edwards et al., 2009; Escobar et al., 2007; Judge et al., 2012).

Other constructs such as post-traumatic stress (PTS) risk (Cremeans-Smith et al., 2015), perceived injustice (Yakobov et al., 2014), purpose in life (Smith & Zautra, 2004), coping efficacy (Engel et al., 2004; Lopez-Olivo et al., 2011) and pain catastrophizing (Edwards et al., 2009; Riddle et al., 2010; Sullivan et al., 2011; Yakobov et al., 2014) were investigated for their associations with postoperative outcomes. Catastrophizing, PTS risk factors, and coping efficacy measured preoperatively were significant predictors of postoperative pain intensity. Purpose in life and perceived injustice measured preoperatively were not significantly associated with postoperative pain intensity (Smith & Zautra, 2004; Yakobov et al., 2014).

Studies that calculated the change in pain scores across time reported significant improvements for all participants (Ali et al., 2017; Brander et al., 2003; Brander et al., 2007; Edwards et al., 2009; Engel et al., 2004; Escobar et al., 2007; Hirschmann et al., 2013; Kim et al., 2009; Lingard & Riddle, 2007; Lopez-Olivo et al., 2011; Noiseux et al., 2014; Papakostidou et al., 2012; Smith & Zautra, 2004; Wylde et al., 2012). In two studies where the effect of baseline mental health on pain was investigated, no significant difference was found between patients with and without psychological distress regarding change in pain scores across time (Ellis et al., 2012; Lingard & Riddle, 2007). Kim et al. (2009) found that although significant improvements in pain

were experienced in all patients, dissatisfied patients had significantly worse pain scores than satisfied patients.

2.3.6 Measures employed

There was considerable heterogeneity regarding the measures employed to assess psychosocial predictors and TKR outcomes (Table 2.3). Of the 25 studies that assessed aspects of mental health preoperatively, 10 different measures were employed. The most commonly used measures were the mental health component of the short-form 36 (SF-36 MCS) (Ware, 2000), the hospital anxiety and depression scale (HADS) (Zigmond & Snaith, 1983) and the state-trait anxiety index (STAI) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Different knee assessment tools were used to assess pain and function. A measure of pain and/or function was taken in 30 studies (Table 2.3). The most commonly used knee tool was the Western Ontario & McMaster Universities Arthritis Index (WOMAC) (Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988) which was employed in 18 studies. The Oxford Knee Score (OKS) (Murray et al., 2007), the Knee Society Score (KSS) (Noble et al., 2012), the Knee Injury and Osteoarthritis Outcomes Score (KOOS) (Roos, 1998) and the SF-36 physical component scale (SF-36 PCS) (Ware, 2000) were also used to assess knee pain and function (Table 2.3). The use of different measures limits the comparison and interpretation of results across studies.

Table 2.3: Summary of the main findings of the studies in this review

Study	Knee tool	Psychosocial tool	Psychosocial factor associated with outcome?	Dissatisfaction (rate)	Pain	Function
Ali et al (2017)	VAS, KOOS	HADS	Y	Y (14.5%)	NS	NS
Ayers et al (2005)	WOMAC	SF-36 MCS	Y	NM	NM	Y
Blackburn et al (2012)	OKS	HADS	Y	NM	NS	Y
Brander et al (2003)	KSS, WOMAC	BDI, STAI	Y	NM	Y	NS
Brander et al (2007)	KSS	BDI, STAI	Y	NM	N	Y
Cooper et al (2017)	KOOS	STAI, GDS	Y	NM	NS	Y
Cremeans-Smith (2015)	WOMAC	PTS risk	Y	NM	Y	NM
Duivenvoorden et al 2013	KOOS	HADS	Y	Y (28.6%)	Y	Y
Edwards et al (2009)	VAS	CSQ, CES-D	Y	NM	Y	NM
Ellis et al (2012)	WOMAC, KSS	PHQ	Y	NM	Y	Y
Engel et al (2004)	WOMAC	Coping Efficacy	Y	NM	Y	Y
Escobar et al (2007)	WOMAC	SF-36 MCS	Y	NM	Y	Y
Gandhi et al (2008)	WOMAC	SF-36 MCS	Y	Y (25%)	NS	NS
Hanusch et al (2014)	OKS	HADS	Y	NM	NM	Y
Heck et al (1998)	SF-36 PCS	SF-36 MCS	Y	NS (12%)	NS	Y
Hirschmann et al (2013)	WOMAC	BDI, STAI	Y	NM	Y	Y
Jones et al (2003)	WOMAC	SF-36 MCS	N	NM	NM	N
Judge et al (2012)	OKS	EQ5D	Y	NS (28.3%)	Y	N
Kim et al (2009)	WOMAC	SF-36 MCS	N	N (7.5%)	NS	NS
Lingard & Riddle (2007)	WOMAC	SF-36 MCS	Y	NM	Y	N
Lopez-Olivo et al (2011)	WOMAC	DASS, COPE	Y	NM	Y	Y
Neuprez et al (2016)	NS	HSS-KRES	Y	Y (15%)	NM	NM
Noiseux et al (2014)	NRS (pain)	STAI	Y	NM	Y	NM
Papakostidou et al (2012)	WOMAC	CES-D	Y	NM	Y	NS
Riddle et al (2010)	WOMAC	PCS	Y	NM	Y	N
Scott et al (2010)	OKS	SF-12 MCS	Y	Y (18.6%)	NS	NS

Table 2.3 continued

Study	Knee tool	Psychosocial tool	Psychosocial factor associated with outcome?	Dissatisfaction (rate)	Pain	Function
Singh et al (2013)	Pain (Likert)	Deyo-Charlson Index (psychological comorbidities)	Y	NM	Y	NM
Singh et al (2014)	Self-reported knee function (Likert scale)	Deyo-Charlson Index (psychological comorbidities)	Y	NM	NM	Y
Smith & Zautra (2004)	WOMAC	PIL	Y	NM	N	Y
Sullivan et al (2011)	WOMAC	PCS	Y	NM	Y	Y
Wylde et al (2012)	WOMAC	SES, HADS	Y	NM	Y	Y
Yakobov et al (2014)	WOMAC	IEQ-chr, PCS	Y	NM	Y	Y

Y = yes, the authors in each study examined the effect of baseline psychological factors and found that they did have an effect on postoperative outcomes related to pain, function and satisfaction; N = no, the authors in each study examined the effect of baseline psychological factors and found that they did not have an effect on postoperative outcomes related to pain, function and satisfaction; NS = not specified; NM = not measured, MCS = Mental Component Score; OKS = Oxford Knee Score; HADS = Hospital Anxiety and Depression Scale; KSS = The Knee Society Score; WOMAC = Western Ontario & McMaster Universities Arthritis Index; BDI = Beck Depression Index; STAI = State-Trait Anxiety Index; PHQ = Patient Health Questionnaire; EQ5D = European Quality of Life-5 Dimensions; CES-D = Centre for Epidemiological Studies Depression Scale; PCS = Pain Catastrophizing Scale; PIL = Purpose in Life; SES = Self-efficacy Scale; IEQ-chr = Injustice Experiences Questionnaire; NRS= Numeric Rating Scale; DASS = Depression Anxiety Stress Scales; COPE = The Cope Inventory; MHLC= Multidimensional Health Locus of Control; HSS-KRES= The Hospital for Special Patient Expectations Survey

2.4 Discussion

Since Khatib et al. published their review in 2015, 11 new studies (meeting the review inclusion criteria) investigating the effect of various psychosocial factors on outcomes following TKR have been published. The aim of this systematic review was to update the Khatib et al. (2015) review in light of more recent evidence. Overall, this review found that while TKR is largely successful at reducing pain and improving functional ability, there is strong evidence to suggest that preoperative psychosocial factors are significantly influential on these outcomes. Of the studies included in this review, 30 provided evidence for the association of preoperative psychosocial factors on TKR outcomes, defined as pain, function and patient satisfaction. While it has been well documented in the literature that less improvement in function and residual pain contribute to dissatisfaction (Baker et al., 2007; Bourne et al., 2010; Jacobs & Christensen, 2014; Matsuda, Kawahara, Okazaki, Tashiro, & Iwamoto, 2013; Venkataramanan et al., 2013), recent literature has highlighted the discrepancies between surgeon-rated and patient-rated outcomes after TKR (Harris et al., 2013; Janse et al., 2004). Patients can be less satisfied with their outcomes than surgeon's expect (Choi & Ra, 2016). Due to this, patient satisfaction is acknowledged as an important indicator of surgical success after TKR. In this review, the rate of dissatisfaction after surgery ranged from 7.5%-28.6%. Postoperative dissatisfaction was partially explained by baseline mental health in four studies (Ali. et al., 2017; Duivenvoorden et al., 2013; Gandhi et al., 2008; Scott et al., 2010) providing some evidence for the role of this construct in predicting patient satisfaction. Neuprez et al. (2016) found that expectations measured preoperatively predicted patient satisfaction after TKR. While this is the only study that fits our review criteria which investigates the effect of expectations on TKR outcomes, this construct has been investigated elsewhere (Bourne et al., 2010; Choi & Ra, 2016; Dunbar, Richardson, & Robertsson, 2013; Lau et al., 2012; Thambiah,

Nathan, Seow, Liang, & Lingaraj, 2015). These reports suggest that patient expectations met were significantly associated with postoperative satisfaction (Bourne et al., 2010; Thambiah et al., 2015); and that patient expectations are an important component of ensuring patient satisfaction (Choi & Ra, 2016; Lau et al., 2012).

Strong evidence is provided in this review for the influence of baseline mental health on postoperative pain and function. Nineteen included studies reported significant associations between baseline mental health and postoperative pain and/or function. This is consistent with and strengthens the findings of the Khatib et al. (2015) review which identified 16 studies that found significant associations between preoperative mental health and TKR outcomes. Other constructs have also emerged as important predictors of pain and function outcomes. A review by Burns et al. (2015) concluded there is moderate-level evidence for pain catastrophizing as a risk factor of poor TKR outcomes. In this current review it has also been identified as a consistent predictor in four of the included studies (Edwards et al., 2009; Riddle et al., 2010; Sullivan et al., 2011; Yakobov et al., 2014). Purpose in life, perceived injustice and PTS risk have each been identified as significant predictors each in one study. These concepts have been newly investigated as predictors since the publication of the Khatib et al. (2015) review and have potential explain further variance in postoperative TKR outcomes, however further investigation is needed to determine their predictive validity.

There are several limitations to be considered in this review. The most apparent limitation is with regard to the heterogeneity of the data across studies which makes a meta-analyses unfeasible. Six measures of knee function, five measures of knee pain and four measures of patient satisfaction were identified. The heterogeneity of measures poses an obstacle in the interpretation and comparison of results across studies. In addition, established confounders such as age, sex, BMI and comorbidities were not

consistently reported or considered in analyses. It is also important to consider these factors in any analyses to not inflate the impact of psychosocial factors. All of the studies included in this review were of acceptable quality (Table 2.1) however, only nine studies justified their sample size with a power analyses and some studies reported a large attrition rate across time points. The aim of the review was to investigate preoperative risk factors for chronic pain, function and patient satisfaction (persisting for ≥ three months) therefore, our search was limited to studies with a follow-up of at least three months. However as improvements after TKR can be seen up to two-years postoperatively (Haanstra et al., 2012), patients in the included studies may not have realised their full improvements at the time of follow-up which could exaggerate results.

Anxiety, depression and pain catastrophizing have been shown to be consistent predictors of poor TKR outcomes. However, it is important to note that the self-reported measures were employed to assess anxious and depressive symptoms rather than a formal diagnosis. Furthermore, pain catastrophizing is related to elements of anxiety and depression and it is unclear which psychological construct explains more of the variance in postoperative improvements (Burns et al., 2015).

Patient satisfaction is an important outcome of TKR. This review shows that patient dissatisfaction can be as high as 28.6%. It is clear that recovery from TKR is multi-dimensional and that many factors must be considered to optimise improvements. From this review, it is apparent that baseline mental health has a role to play in postoperative outcomes and warrants the attention of the multidisciplinary staff in orthopaedic surgeries. This finding is consistent with the review published by Khatib et al. (2015) and has many clinical implications. Preoperative psychological screening could highlight those at risk of poor outcomes. It could also provide an opportunity for further education, to discuss expectations and to refer patients for psychological

treatment before undergoing TKR. This could ultimately improve outcomes and reduce the rate of dissatisfied patients. Many preoperative factors have been identified as potential predictors of TKR outcomes in single studies. Future research should aim to pinpoint which psychological constructs have the greatest impact as well as investigate the benefits of preoperative psychological screening and support before TKR surgery. Overall, this review has strengthened the evidence of the predictive validity of preoperative mental health and pain catastrophising on pain intensity, functional ability and patient satisfaction after TKR. It has also added to the evidence base by identifying additional predictors such as Purpose in life, perceived injustice and PTS risk which have the potential to further explain the variance in TKR outcomes.

Chapter 3: Methodology

3.1 Research Design

The current study adopted a prospective cohort longitudinal design. Patient reported data were collected at two time points: two to six weeks before surgery (Time 1); and six months postoperatively (Time 2). Clinician rated data were collected during inpatient physiotherapy.

3.2 Setting

Participants were recruited from the Orthopaedic Department of Our Lady's Hospital, Navan (OLHN). The Orthopaedic unit provides orthopaedic services for the entire North East Region consisting of Meath, Louth, Dublin (North), Cavan and Monaghan and offers a wide range of services for patients undergoing elective orthopaedic surgery. Patients undergoing knee replacement surgery first attend their pre-surgical assessment two to six weeks before surgery; they are also offered an educational class to inform them of what their surgery and rehabilitation will entail. After their surgery, they attend inpatient physiotherapy before being discharged. The typical inpatient stay for TKR patients is three to five days. Physiotherapists review patients daily until discharge for approximately 30 minutes; if they require more input, they are reviewed and treated twice daily. Patients also are expected to perform their physiotherapy exercises three times daily for an average of 20 minutes per session. These exercises include a combination of bed exercises and walking. TKR patients are discharged when they meet the following discharge criteria: safe and independent walking with an aid: the ability to flex their knee to 90 degrees; and the ability to perform a straight leg raise. They are all referred for outpatient physiotherapy follow up at their local hospital.

3.3 Recruitment procedure

Consecutive patients undergoing primary knee replacement surgery under the care of three orthopaedic surgeons between November 2016 and January 2018 were considered for recruitment. Patients scheduled to undergo replacement knee surgery were sent an information sheet (see Appendix B) and a consent form (see Appendix C) by a member of the administrative staff. The information sheet provided details of the study and informed the patient that the researcher would be present on the day of their pre-surgical assessment. The researcher met with each potential participant after their pre-surgical assessment to discuss the study with them and go through the information sheet in further detail. Patients were given the opportunity to ask any questions about the research before deciding whether to take part. Patients who agreed to participate were asked to sign a consent form. They were given the option to complete the Time 1 questionnaire at that time or to take the questionnaire home for completion and return using a pre-paid envelope.

Rehabilitation engagement was rated by treating physiotherapists in OLHN during the participant's inpatient stay. Participants were sent the follow-up questionnaire six months after their TKR surgery via post. Participants completed and returned the questionnaire using the pre-paid envelope provided. Two attempts were made to contact participants by telephone if the questionnaire was not returned within two weeks.

3.3.1 Inclusion and exclusion criteria

Inclusion criteria

Patients were eligible to take part in the study if they were:

1. Undergoing elective primary total knee replacement

2. Aged 18 and over
3. Fluent in English (to meet the demands of the study)

Exclusion criteria

Patients who did not have enough English to meet the demands of the study were excluded from participation at pre-assessment.

3.3.2 Participant recruitment

Over 13 months 100 patients met the inclusion criteria. Eighteen declined to take part (18%). The remaining 82 patients agreed to take part in the study and completed the questionnaire at Time 1. Out of the 82 participants, three completed the questionnaire at home and returned it to the researcher via post. The other 78 participants completed the Time 1 questionnaire on the day of their pre-assessment appointment.

Follow-up questionnaires were sent to participants six-months after their knee replacement surgery. Eleven participants did not undergo their knee replacement surgery within the timeframe of the study. Twenty-two participants did not return the questionnaire after two attempts to be contacted. Three questionnaires were sent back with more than 50% missing data and therefore were excluded in the analyses. The remaining 46 questionnaires were included in the longitudinal analyses (65% of participants who converted to surgery).

3.3.3 Sample characteristics

Sociodemographic characteristics of the sample at each time point are displayed in Table 3.1. The current sample is broadly comparable to The Irish LongituDinal Study on Ageing (TILDA), which provides a detailed description of the characteristics of 1,042 Irish adults living with OA (French et al., 2015). The majority of their sample were female (73.6%), married (64.01%), retired/ unemployed (76.58%) and between the

ages of 61 and 80 (63.37%) (French et al., 2015). The current sample are mostly female (55%), married (68%), retired (61%) with a mean age of 65.68 years (range: 39-89, SD = 9.47).

3.4 Ethical considerations

This project received ethical approval from the Health Service Executive North East Area Research Ethics Committee and from the Ethics Committee of Maynooth University (see Appendix D). Full consideration had been given to the ethical implications of this study.

3.4.1 Informed consent

Potential participants were made aware of the study by the administration staff approximately two weeks prior to meeting with the researcher. On meeting the researcher participants were fully briefed regarding the aims of the research and what participation involved. They were provided with an information sheet and given the opportunity to ask questions about the study. They were assured that their treatment would not be affected regardless of their participation. Those who agreed to participate were asked to sign a written consent form. Participants were assured of the confidentiality of their data and were informed of the ongoing option to withdraw.

3.4.2 Data protection

Access to the data was restricted to the researcher and the supervisory team. Informed consent documents and completed surveys were initially retained by the researcher in separate sealed envelopes in Our Lady's Hospital Navan and later transferred to the Department of Psychology in Maynooth University. Hard copies of patient details and completed surveys were stored in a locked filing cabinet. Data were coded and recorded in SPSS for analyses. All electronic data were password protected

and keys to decode the data were held only by the researcher and their academic supervisor.

Table 3.1: Sociodemographic characteristics of the sample at each time point

Variable	***Time 1 (N=82)*** ***N (%)***	***Time 2 (N =46)*** ***N (%)***
Sex		
Male	37 (45)	20 (43.5)
Female	45 (55)	26 (56.5)
Ethnicity		
White	82 (100)	46 (100)
Marital Status		
Married	56 (68)	30 (65.2)
Separated	4 (5)	2 (4.3)
Divorced	2 (2.5)	0 (0)
Widowed	11 (13.5)	6 (13)
Single	9 (11)	8 (17.4)
Employment		
Retired	50 (61)	27 (59)
Employed	23 (28)	13 (28)
Unemployed	2 (2.5)	1 (2)
Homemaker	7 (8.5)	5 (11)
Education		
Primary	34 (42)	18 (38.3)
Secondary	43 (53.1)	27 (57.5)
Third level	4 (4.9)	2 (4.2)
Age		
Range	39-83	39-83
Mean (SD)	65.68 (9.47)	64.22 (9.39)

3.5 Measures

The following provides a description of the variables assessed and measures used in the study questionnaire (see Appendix E). Questionnaires were completed by each participant preoperatively and approximately 6 months postoperatively. Table 3.2 summarises the measures used.

3.5.1 Patient reported measures

3.5.1.1 Pain intensity and functional restriction

Pain intensity and functional restriction of the knee was assessed using the Western Ontario & McMaster University Osteoarthritis Index (WOMAC) (Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988). The WOMAC is used to assess patient's perceptions of the current pain, stiffness and function in their knee (Bellamy, Campbell, Hill, & Band, 2002). It is one of the most widely used patient reported outcome measures for people with lower limb osteoarthritis (Giesinger, Hamilton, Jost, Behrend, & Giesinger, 2015; Terwee, Roorda, Knol, De Boer, & De Vet, 2009; Wolfe & Kong, 1999). The WOMAC consists of 24 items; 5 items assess pain intensity during daily activities, 2 items assess stiffness and 17 items assess functional restriction. All items are scored from 0 to 4 (0= 'none', 1= 'mild', 2= 'moderate', 3= 'severe', 4= 'extreme'). The total raw score ranges from 0-96 and each subscale can be scored individually (pain ranges from 0-20; stiffness ranges from 0-8; function ranges from 0-68) (Bellamy, 2002). Raw scores are then transformed to a 0-100 scale (0= best, 100=worst). Higher scores on the 'pain' subscale indicates greater pain intensity; higher scores on the 'stiffness' subscale indicates greater stiffness and higher scores on the 'function' subscale indicates greater functional restriction. The measure takes about 10 minutes to complete and its psychometric properties have been thoroughly investigated (Giesinger et al., 2015; Roos, Roos, & Lohmander, 1999; Wolfe & Kong, 1999). The WOMAC has demonstrated adequate internal consistency and test-retest reliability for pain, stiffness and function (Cronbach's α = .78, .79, .92; ICC = .88, .89, .91, respectively) (Xie et al., 2008).

Table 3.2: Summary of measures administered at each time point

Patient Reported Measures			
Domain	*Assessment*	*Pre-op*	*Post-op (6months)*
Pain intensity and functional restriction	Western Ontario & McMaster University Osteoarthritis Index	✓	✓
Participation restriction	Measure of Activity and Participation	✓	✓
Physical health	Short-Form 12	✓	✓
Mental health	Short-Form 12	✓	✓
Catastrophizing	Pain Catastrophizing Scale	✓	✓
Self-efficacy	Arthritis Self-Efficacy Scale	✓	✓
Patient activation	Patient Activation Measure	✓	-
Expectations	Knee Society Score Expectations subscale	✓	✓
Satisfaction with knee condition	Knee Society Score Satisfaction subscale	✓	✓
Global satisfaction	Single-item measure	-	✓
Clinician Rated Measures			
Domain	*Assessment*	*Pre-op*	*Post-op (6months)*
Engagement in rehabilitation	Hopkins Rehabilitation Engagement Rating Scale	-	✓†

† Engagement in rehabilitation was rated during inpatient physiotherapy

Participation restriction was assessed using the Participation section of the Measure of Activity and Participation (MAP) (O'Donovan et al., 2009). Items assessed the level of restriction experienced in 13 life areas. These areas include education, employment, family life, socialising, other activities of daily living and participation. Responses are on a scale of 0-4 (0 = 'not at all', 1= 'mildly restricted', 2= 'moderately restricted', 3 = 'severely restricted', and 4 = 'completely restricted'). Responses were then dichotomised into 'no restriction' and 'some restriction' (0 = 'no restriction', responses 1-4 were transformed into 'some restriction').

General physical health was measured using the Physical Component Subscale (PCS) of Short-Form 12 (SF-12) (Ware, Kosinski, & Keller, 1996). The SF-12 is one of

the most widely used general health/quality of health questionnaires (Dunbar, Robertsson, Ryd, & Lidgren, 2001). The PCS assesses four domains: physical functioning, role-physical, bodily pain, and general health.(Gandhi et al., 2001; Ware et al., 1996). Raw scores and percentage scores for each domain were generated using the QualityMetric Health Outcomes Scoring Software that is made available to the licence holder. It also generates scores for each domain based on norm scores. The total PCS score is reported and interpreted based on norm scores (e.g. 'Well Below', 'Below', 'Same or Better'). Psychometric properties of the PCS component of the SF-12 have been evaluated in osteoarthritis (OA) and has it demonstrated adequate validity and reliability (Gandhi et al, 2001). Cronbach's $\alpha = 0.85$, ICC = 0.72 (Hayes, Bhandari, Kathe, & Payakachat, 2017).

3.5.1.2 Psychosocial measures

General mental health was measured using the Mental Component Subscale (MCS) of Short-Form 12 (SF-12) (Ware et al., 1996). Ware (2000) defines general mental health as a measure of psychological distress and disability of daily life roles due to emotional difficulties. The MCS assess four domains; vitality, social functioning, role-emotional; and mental health. Raw scores and percentage scores for each domain were generated using the QualityMetric Health Outcomes Scoring Software. The total MCS score is reported and interpreted based on norm scores (e.g. 'Well Below', 'Below', 'Same or Better'). Psychometric properties of the MCS component of the SF-12 have been evaluated in osteoarthritis (OA) and has demonstrated adequate validity and reliability (Cronbach's $\alpha = 0.84$, ICC = .62) (Hayes et al, 2017).

Catastrophizing was measured using the Pain Catastrophizing Scale (PCS) (Sullivan et al., 1995). The 13 items of the PCS assess three subcategories of catastrophizing: rumination (4 items); magnification (3 items); and helplessness (6

items). All items are scored on 0-4 scales which correspond to the degree to which the participant has these thoughts or feelings while experiencing pain (0= 'not at all', 1= 'to a slight degree', 2= 'to a moderate degree', 3= 'to a great degree', 4= 'all the time'). The total PCS score is the sum of all 13 items and ranges from 0-52. Higher scores indicate higher levels of catastrophizing. The user manual describes norms and cut off scores (Sullivan et al., 2009); a total score of 30 or higher indicates a clinically relevant level of catastrophizing The PCS takes about five minutes to complete (Sullivan et al., 1995) and has demonstrated good internal consistency for the total scale (Cronbach's α = 0.95) (Osman et al., 2000).

Self-efficacy was measured using the 8-item Arthritis Self-Efficacy Scale (ASES-8) which is a self-report measure that takes less than five minutes to complete (Lorig, 1989). The domains assessed are in relation to pain management (2 items), pain and fatigue interference with daily activities (2 items) and other symptoms (4 items). Responses are on scale of 1-10 (1= no self-efficacy, 10= highest level of self-efficacy). The total score is calculated using the sum of responses for all items. The mean of the total score is used for analysis. Higher scores indicate greater self-efficacy (range 1-10). The English version of the ASES-8 was evaluated by Wilcox and colleagues as an independent assessment of arthritis self-efficacy, and displayed adequate reliability and validity (Cronbach's α = .95) (Wilcox, Schoffman, Dowda, & Sharpe, 2014).

Patient activation was measured using the 13-item Patient Activation Measure (PAM-13) (Hibbard, Mahoney, Stockard, & Tusler, 2005). The PAM-13 was developed to comprehensively assess the concept of 'activation' which refers to the belief in the importance of one's role in managing their own health condition as well as direct engagement in their healthcare (Hibbard et al., 2004). The PAM-13 assesses 4 domains: the belief that taking an active role in one's own healthcare is important (2 items);

confidence and knowledge to take action (6 items); taking action (3 items); and staying on track even during times of stress (2 items) (Hibbard et al, 2005). Responses range from 0-4 (1= 'strongly disagree', 2= 'disagree', 3= 'agree', 4= 'strongly agree', 0= 'not applicable'). Activation scores are computed using PAM software (range 0-100, with higher scores indicating higher activation (Skolasky et al., 2011)). The PAM-13 has demonstrated high internal consistency (Cronbach's α = .87) (Skolasky et al., 2011).

Patient expectations were measured using the Expectations subscale of the Knee Society Score (KSS) (Noble et al., 2012). Expectations were assessed both pre- and postoperatively. Preoperatively, expectations refer to the patient's expectations of their recovery after surgery. Items include: 'Do you expect your knee joint replacement will relieve you of your knee pain?'; 'Do you expect your surgery will help you carry out your normal activities of daily living?' and; 'Do you expect you surgery will help you perform leisure, recreational or sports activities?'. Items are scored on a scale of 1-5 (1= 'no, not at all', 2= 'yes, a little bit', 3= 'yes, somewhat', 4= 'yes, a moderate amount', 5= 'yes, a lot') with higher scores indicating higher expectations (range 5-15). Postoperatively, the measure assesses whether the patient's preoperative expectations of recovery were met. Items include: 'My expectations of pain relief were…'; 'My expectations for being able to do my normal activities of daily living were…' and 'My expectations for being able to do my leisure, recreational or sports activities were…'. Items are scored on a scale of 1-5 (1= 'Too high- I'm a lot worse than I thought', 2= 'Too high- I'm somewhat worse than I thought', 3= 'Just right- My expectations were met', 4= 'Too low- I'm somewhat better than I thought', 5= 'Too low- I'm a lot better than I thought') with higher scores indicating better fulfilment of expectations (range 5-15). This subscale has demonstrated high internal consistency and reliability (Cronbach's α = .93, ICC= .79) (Dinjens, Senden, Heyligers, & Grimm, 2014).

Patient satisfaction was measured using the satisfaction subscale of the KSS (Noble et al., 2012). Satisfaction refers to how satisfied the patient is with the current level of pain and functional ability of their knee. The satisfaction subscale of the KSS consists of five items (Noble et al, 2012). The measure assesses the participant's satisfaction with the pain level and functional ability of their knee when performing different activities e.g.: "Currently, how satisfied are you with the pain level of your knee while sitting?"; "Currently how satisfied are you with your knee function while performing light household duties?" Each item is scored on a scale of 0-8; (0= 'very dissatisfied', 2= 'dissatisfied', 4= 'neutral', 6= 'satisfied', 8= 'very satisfied'). Responses are summed to generate a total score (range 0-40) with lower scores indicating greater dissatisfaction. Psychometric properties of the Satisfaction subscale have been investigated and show adequate reliability (Cronbach's $\alpha = .94$, ICC= .85) (Dinjens et al., 2014).

Global satisfaction was measured using a single-item: 'Overall, how satisfied are you with your replacement knee surgery'. Reponses range from 0-4 (0 = 'very dissatisfied', 1= 'dissatisfied', 2= 'neutral', 3= 'satisfied', 4= 'very satisfied'). Reponses were dichotomised into 'satisfied' and 'dissatisfied'. Reponses 3-4 were transformed into 'satisfied' and responses 0-2 were transformed into 'dissatisfied' (Ali et al., 2017; Bourne et al., 2010; Kim et al., 2009). Global satisfaction was used to determine the percentage of dissatisfied participants.

3.5.2 Clinician rated measures

Engagement in rehabilitation was measured using Hopkins Rehabilitation Engagement Rating Scale (HRERS) (Kortte, et al., 2007). The HRERS is a 5-item measure, rated by physiotherapists after a patient has completed a rehabilitation programme. The measure assesses attendance to, attitude towards, and participation in

the rehabilitation programme. Each item is scored on a scale of 1-6 (item two is reverse scored) with higher scores indicating greater engagement in rehabilitation. All items are summed to generate a total rehabilitation engagement score. The HRERS has high internal consistency when completed by physiotherapists with a Cronbach's α of .92 and a satisfactory interrater reliability score of .73 (Kortte et al, 2007).

3.6 Statistical analyses

All statistical analyses were conducted using SPSS version 22 (IBM, 2013) and guided by Pallant (2010) and Tabachnick and Fidell (2007).

3.6.1 Missing data, outliers, and distribution

Data were initially screened for missing values and accuracy of input using descriptive statistics and frequencies. Unless otherwise stated by the scoring manuals of the measures, mean values were calculated where possible, when 20% of the data or less was missing. When more than 20% of the data were missing, they were excluded from any analysis using that scale. Outliers were examined using box plots and by comparing the mean to the 5% trimmed mean. No extreme outliers were identified therefore all responses were included in the analyses. Normality was assessed using skewness, kurtosis, the results of the Kolmogorov-Smirnov statistic and by examining histograms and normal Q-Q plots.

Normality, linearity, multicollinearity and homoscedasticity were examined in the multiple regression outputs. Normal P-P plots, scatterplots and histograms were examined and showed none of the above assumptions were violated. The outputs were not affected by outliers. Therefore, all data were retained in the analyses.

3.6.2 Preliminary analyses

Descriptive statistics were calculated at each time point. Continuous variables are displayed as means and standard deviations and categorical variables are displayed as percentages. Before analyses, marital status was dichotomised into 0= married, 1= not married/separated and employment was dichotomised into 0= working, 1= not working. Independent t-tests were employed to compare characteristics of those who participated at Time 1 only with those who participated at both Time 1 and Time 2. There were no significant differences with regard to age, sex, employment or marital status (all p's > .3). There were significant differences in preoperative mental health scores and patient activation scores. Participants included at both Time 1 and Time 2 had significantly lower mental health scores (M = 50.03, SD = 12.49) and patient activation scores (M= 72.52, SD = 14.66) preoperatively when compared to participants included in Time 1 analyses only (M = 55.36, SD = 8.53; p = .004; M= 77.01, SD = 19.10; p= 0.005).

3.6.3 Cross-sectional analyses

Pearson correlations were employed to examine the relationship between predictor and outcome variables at Time 1. Bonferroni correction was applied to the alpha level to reduce the risk of type 1 error. The adjusted alpha level is noted in Table 4.4. Standard multiple regression analyses were used to determine the amount of variance explained by preoperative psychosocial predictors regarding pain intensity and functional restriction (Nathans, Oswald, & Nimon, 2012). All regression analyses were conducted using the 10:1 ratio whereby for each predictor entered into a multiple regression, there should be 10 participants (Harrell, 2015; Peduzzi, Concato, Feinstein, & Holford', 1995; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996; Vittinghoff & McCulloch, 2007). For example, three predictors would require 30 participants for

the regression to be adequately powered. Using this rule, all psychosocial predictors were entered into the regressions to predict pain intensity and functional restriction at Time 1 (n = 82). Demographic variables (age, sex) were controlled for in the analyses. Hierarchical multiple regression was used to assess the ability of psychosocial variables and pain intensity and functional restriction to predict levels of patient satisfaction. Age, sex, pain intensity and functional restriction were controlled for in the model. The psychosocial variables with the strongest relationships with satisfaction were then entered into the regression model maintaining the 10:1 ratio. This was determined by the correlation coefficients. The significance is set at $p \leq .05$ unless otherwise specified.

3.6.4 Longitudinal analyses

A series of paired-sample t-tests were employed to investigate any significant changes in psychosocial variables and physical variables across Time 1 and Time 2. Means and standard deviations were calculated for both time points. Bonferroni corrections were applied to reduce the chance of Type 1 error. Percentages and z-values were calculated to determine whether there was a significant change in the proportion of the current sample experiencing restriction in the 13 life areas (defined by the MAP) at Time 1 and Time 2. Z-values were calculated using a z-test software (EpiTools) (Sergeant, 2018). Z-tests can determine the difference in sample proportion at two time points. Correlational analyses were conducted to investigate the relationship between psychosocial variables measured at Time 1, expectations measured at Time 2 (the degree to which patient's expectations of surgery are fulfilled) and outcome variables measured at Time 2. Multiple regression analyses were performed to investigate the influence of patient-reported psychosocial variables on pain intensity and functional restriction measured at Time 2 (Nathans et al., 2012). Hierarchical regression was performed to determine the influence of patient-reported psychosocial variables on patient satisfaction

measured at Time 2. Logistic regression was employed to determine the effect of Time 1 psychosocial variables on global satisfaction. In the hierarchical regression, and logistic regression, change in pain intensity and change in functional restriction from Time 1 to Time 2 were controlled for in the model. Age was not significantly associated with pain intensity, functional restriction or patient satisfaction at Time 1 or Time 2. It also was not predictive of pain intensity, functional restriction or patient satisfaction in the Time 1 regression models and therefore not included in the regression models at Time 2.

3.6.5 Power analyses

Using the G*Power 3.1 programme (Faul, Erdfelder, Lang, & Buchner, 2007) both an a priori analyses of power and a post-hoc analyses of power were conducted. G*Power analyses determined that a sample of 92 would be required to detect significant interactions in a multiple regression with five predictors. Given a sample size of 82, a significance level of 0.05, and a medium effect size ($f^2 = 0.15$), the power of this study at Time 1 is 0.75. Given a sample size of 46, a significance level of 0.05, and a medium effect size ($f^2 = 0.15$), the power of this study at Time 2 is 0.48. This indicates that the study is underpowered as the sample size did not meet the specified criteria. The achieved sample size and high attrition rate in this study was mainly due to the limited time frame for participant recruitment and follow-up, and a number of participants who did not convert to surgery within the time frame of the study (n = 11).

The study attempted to account for the small sample size throughout the statistical analyses. Multiple comparisons were Bonferroni corrected to reduce the chance of Type I error. As well as this, the number of predictors entered into each regression model was restricted at Time 2, entering only four predictors into each regression. Specific predictors were chosen by examining the strength of associations of psychosocial variables and outcomes variables (pain intensity, functional restriction,

patient satisfaction and global satisfaction). Stronger effect sizes increase power in statistical analyses (Cohen, 1992) therefore, the psychosocial variables with the strongest association to the dependent variable (largest effect size) were chosen as predictors for regression models at Time 2. Restricting the predictor variables entered into the regression was chosen to decrease the chance of Type II error in an underpowered sample.

Chapter 4: Results

4.1 Results of Objective 1

Objective 1: To describe the characteristics of the current sample and to investigate the associations between demographic variables (age, sex, education, employment and marital status) and patient-reported variables (psychosocial variables and outcome variables (pain intensity, functional restriction, satisfaction)) at Time 1.

Descriptive statistics for patient-reported variables are displayed in Table 4.1. One-way ANOVAs, Pearson correlations and a series of independent t-tests were performed to investigate the associations between sociodemographic variables (education, age, sex, employment and marital status) and psychosocial variables at Time 1. There were no significant associations between age, education and any of the psychosocial variables. The descriptive statistics including means and standard deviations for the independent t-tests performed are displayed in Table 4.2.

The results of the independent t-tests showed a significant difference in the scores of males and females in mental health and satisfaction (see Table 4.2 and Table 4.3). Females scored significantly lower than males in mental health (lower scores indicate worse mental health) and satisfaction (lower scores indicate greater dissatisfaction). There were no significant associations between the employment groups (working/not working) or the marital status groups (married/not married or separated) with any of the psychosocial variables.

Table 4.1: Descriptive statistics for patient reported variables at Time 1

Variable	***Possible Range***	***Valid N***	***Minimum***	***Maximum***	***Mean (SD)***
Psychosocial variables					
Pain catastrophizing	0-52	82	0	52	18.56 (15.36)
Expectations	3-15	82	5	15	13.72 (1.81)
Self-efficacy	1-10	78	1	10	5.70 (2.10)
Patient activation	0-100	79	43.70	100	74.45 (16.75)
Physical health	0-100	81	21.79	54.28	34.52 (7.79)
Mental health	0-100	81	26.50	70.22	52.27 (11.25)
Outcome variables					
Pain intensity	0-100	82	10	100	61.34 (19.47)
Stiffness	0-100	82	12.5	100	65.39 (21.45)
Functional restriction	0-100	82	13.24	100	58.69 (19.15)
Satisfaction	0-40	82	0	34	15.51 (7.28)

Table 4.2: Descriptive statistics for sex, employment, and marital status with patient reported variables at Time 1

Variable	***Sex***		***Employment***		***Marital Status***	
	Male	***Female***	***Working***	***Not Working***	***Married***	***Not Married/ Separated***
	M (SD)	***M (SD)***	***M (SD)***	***M (SD)***	***M (SD)***	***M (SD)***
Pain Catastrophizing	14.38 (15.10)	22.00 (14.87)	19.35 (14.42)	18.25 (15.82)	17.98 (16.02)	19.87 (14.04)
Expectations	13.59 (1.80)	13.82 (1.83)	13.74 (1.42)	13.63 (2.02)	13.57 (2.05)	13.88 (1.33)
Self-efficacy	6.30 (2.07)	5.35 (2.22)	5.74 (2.18)	5.79 (2.21)	5.74 (2.20)	5.85 (2.23)
Physical health	36.26 (8.46)	33.52 (7.12)	34.26 (7.69)	34.98 (7.69)	35.26 (8.55)	33.68 (5.94)
Mental health	56.22 (9.93)	49.11 (11.36)**	51.87 (11.33)	52.68 (11.21)	53.32 (11.14)	50.49 (11.26)
Patient activation	78.35(18.70)	71.19 (14.36)	70.52 (14.97)	75.87 (17.25)	74.65 (16.93)	74.03 (16.70)
Pain intensity	54.43 (21.45)	66.54 (16.87)	61.09 (19.36)	61.02 (20.31)	60.56 (20.42)	62.08 (19.10)
Stiffness	62.50 (21.22)	68.75 (21.78)	70.65 (21.19)	63.89 (21.67)	67.69 (21.01)	61.97 (22.86)
Functional restriction	53.07 (20.15)	63.54 (18.09)	58.12 (19.99)	59.06 (19.67)	58.17 (20.91)	60.12 (16.83)
Satisfaction	18.81 (7.49)	12.80 (5.91)***	14.96 (6.17)	15.78 (7.96)	16.00 (7.75)	14.50 (6.76)

Note ** $p \leq$ Bonferroni corrected p-value (.006), ***p≤ .001

Table 4.3: Associations between demographic variables and psychosocial variables at Time 1

Variable	***Education***	***Age***	***Sex***		***Employment***		***Marital status***	
	F (df)	*r*	*t*	*Cohen's d*	*t*	*Cohen's d*	*t*	*Cohen's d*
Pain Catastrophizing	.44 (2,78)	-.15	-2.29	-.50	.29	.07	-.50	-.12
Expectations	2.59 (2,78)	.04	-.56	-.13	.24	.06	-.67	-.17
Self-efficacy	.70 (2,74)	.04	1.90	.44	-.09	-.02	-.21	-.04
Physical health	.25 (2,78)	.11	1.54	.35	-.37	-.09	-.93	.21
Mental health	.10 (2,78)	.28	2.96**	.67	-.29	-.24	1.03	.25
Patient activation	.66 (5,75)	.22	1.92	.43	-1.26	.33	.15	.04
Pain intensity	.24 (2,78)	-.29	-2.77	-.62	.01	.00	-.31	-.07
Stiffness	.19 (2,78)	-.28	-1.27	-.29	1.26	.32	1.07	.26
Functional restriction	.63 (2,78)	-.21	-2.40	-.55	-.19	-.05	-.40	-.10
Satisfaction	.13 (2,78)	-.27	4.06***	.89	-.44	-.12	.82	.20

Note ** $p \leq$ Bonferroni corrected p-value (.006), ***p≤ .001

4.2 Results of Objective 2

Objective 2: To investigate whether psychosocial variables measured at Time 1 are associated with pain intensity, functional restriction and satisfaction at Time 1 and rehabilitation engagement.

4.2.1 Bivariate Correlations

Pearson's correlational analyses were conducted to investigate the relationship between psychosocial variables and outcome variables (pain, function and satisfaction). As multiple correlations were performed, Bonferroni adjustment was applied to the alpha level to reduce the chance of Type I error. The results are displayed in Table 4.4.

Pain catastrophizing was significantly positively correlated with pain intensity and functional restriction, indicating that those had higher pain catastrophizing scores were more likely to report greater pain intensity and functional restriction. In addition, pain catastrophizing was significantly negatively correlated with satisfaction, indicating that higher levels of pain catastrophizing are related to lower levels of satisfaction.

General mental health scores were significantly negatively correlated with functional restriction and with pain intensity and significantly positively correlated with satisfaction at Time 1. Patient activation was significantly negatively correlated with functional restriction and significantly positively correlated with satisfaction.

Pain intensity, stiffness and functional restriction scores were all significantly negatively correlated with satisfaction. This suggests that those who reported greater pain intensity, stiffness and functional restriction reported greater dissatisfaction with the status of their knee. There were no significant correlations observed between patient-reported variables measured at Time 1 and rehabilitation engagement measured during inpatient physiotherapy.

Table 4.4: Correlational analyses for psychosocial variables at Time 1

	Variable	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
1	Pain Catastrophizing	-									
2	Expectations	.04	-								
3	Self-efficacy	-.31	.17	-							
4	Physical health	-.13	-.05	-.04	-						
5	Mental health	-.43***	.15	.41***	-.02	-					
6	Patient activation	-.31	.10	.26	.11	.32	-				
7	Pain intensity	.49***	.21	-.07	-.35	-.37***	-.17	-			
8	Stiffness	.29	.09	-.05	-.28	-.26	-.14	61***	-		
9	Functional restriction	.48***	.14	-.03	-.38***	-.36***	-.36***	.64***	.54***	-	
10	Satisfaction	-.54***	-.24	.16	.28	.38***	.35***	-.65***	-.49***	-.56***	-
11	Rehabilitation Engagement	.17	.14	.07	-.10	.01	.10	.16	.22	.11	-.09

Note *** $p \leq$ Bonferroni corrected p-value (.001)

4.2.2 Regression analyses at Time 1

A standard multiple regression analysis was employed to assess the ability of the patient-reported psychosocial variables to predict functional restriction at Time 1 (Table 4.5). Demographic variables (age, sex) were controlled for in the model. Psychosocial variables (pain catastrophizing, patient activation, mental health, preoperative expectations and self-efficacy) were entered into the model. The model was statistically significant ($p \leq .001$) and explained 38% of the variance of functional restriction. Neither of the demographic variables were significant predictors. Catastrophizing and patient activation were significant independent predictors of functional restriction indicating that higher pain catastrophizing scores and lower patient activation scores are predictive of worse functional restriction reported preoperatively.

A standard regression was also employed to assess the ability of psychosocial variables to predict pain intensity at Time 1 (see Table 4.6). Demographic variables (age, sex) were controlled for in the model. Psychosocial variables (pain catastrophizing, patient activation, mental health, preoperative expectations and self-efficacy) were entered into the model. The model was statistically significant ($p \leq .001$) and explained 39% of the variance of pain intensity. Pain catastrophizing and expectations were significant independent predictors of pain intensity at Time 1, indicating that worse pain catastrophizing scores and greater expectations of surgery predicts worse pain intensity reported preoperatively.

Table 4.5: Multiple regression model for variables predicting functional restriction at Time 1

	R^2	Adjusted R^2	B	SE	β	CI 95% (B)
Model	**.38*** **	**.31*** **				
Age			-.12	.21	-.06	-.54/.30
Sex			4.37	3.96	.11	-3.59/12.32
Catastrophizing			.44	.14	.35**	.16/.72
Patient activation			-.25	.12	-.22*	-.50/-.01
Mental health			-.33	.21	-.19	-.74/-.08
Expectations			1.41	1.01	.13	-7.1/3.52
Self-efficacy			1.89	.96	.22	-.04/3.81

*Note. *p ≤.05, **p ≤ .01, ***p≤ .001*

Table 4.6: Multiple regression model for variables predicting pain intensity at Time 1

	R^2	Adjusted R^2	B	SE	β	CI 95% (B)
Model	**.39*** **	**.32*** **				
Age			-.40	.21	-.20	-.82/.02
Sex			5.83	4.01	.15	-2.18/13.84
Catastrophizing			.49	.14	.39***	.21/.77
Patient activation			.04	.12	.04	-.21/.29
Mental health			-.32	.21	-.19	-.74/.09
Expectations			2.18	1.07	.20*	.06/4.3
Self-efficacy			1.06	.97	.12	-.88/3.00

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

A hierarchical multiple regression was used to assess the predictive validity of patient-rated psychosocial variables, pain intensity and functional restriction on levels of satisfaction (see Table 4.7). To control for demographic variables (age, sex), these were entered into the regression at step 1. The model at step 1 explained 23% of the variance of satisfaction both age and sex presenting as significant predictors. Pain catastrophizing, patient activation, mental health and expectations had the strongest association with satisfaction in the correlational analyses (Table 4.4) and were entered into the model at step 2. At step 2, factors explained an additional 25% of the variance.

In this step, sex, pain catastrophizing and expectations presented as significant predictors. Pain intensity and functional restriction were entered into the regression at step 3. The additional variables explained a further 11% of the variance of patient satisfaction. The model as a whole explained 59% of the variance. In the final model, sex and pain intensity were significant predictors of patient satisfaction.

Table 4.7: Summary of hierarchical regression model for variables predicting satisfaction at Time 1

	B	***SE***	***β***	***R^2***	***Adjusted R^2***	**ΔR^2**
Step 1				**.23*** **	**.21*** **	**.23*** **
Age	.19	.08	.24*			
Sex	-5.79	1.51	-.40***			
Step 2				**.48*** **	**.43*** **	**.25*** **
Age	.11	.07	.15			
Sex	-3.45	1.34	-.24*			
Catastrophizing	-.17	.05	-.36***			
Patient activation	.07	.04	.15			
Mental health	.06	.07	.10			
Expectations	-.99	.35	-.25**			
Step 3				**.59*** **	**.54*** **	**.11** **
Age	.05	.0	.07			
Sex	-2.57	1.23	-.18*			
Catastrophizing	-.09	.05	-.19			
Patient activation	.06	.04	.14			
Mental health	.02	.06	.03			
Expectations	-.62	.33	-.15			
Pain intensity	-.12	.04	-.33**			
Functional restriction	-.05	.04	-.14			

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

A standard multiple regression was employed to assess the ability of Time 1 psychosocial variables to predict participants' engagement in rehabilitation which was

measured by a clinician during participant's inpatient physiotherapy (see Table 4.8). Demographic variables (age, sex) were controlled for in the model. Overall, the model was not significant, explaining 14% of the variance of rehabilitation engagement. None of the predictors entered into the model reached statistical significance.

Table 4.8: Summary of regression model for variables predicting rehabilitation engagement †

	R^2	*Adjusted* R^2	*B*	*SE*	*β*	*CI 95% (B)*
Model	**.14**	**.03**				
Age			-.07	.06	-.17	-.19/.04
Sex			-1.70	1.04	-.21	-3.78/.39
Catastrophizing			.07	.04	.26	-.01/.15
Patient activation			.03	.03	.14	-.03/.10
Mental health			.01	.06	.03	-.11/.12
Expectations			.28	.29	.13	-.31/.87
Self-efficacy			.09	.27	.05	-.44/.63

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001; † N = 66

5.1 Descriptive statistics for Time 2

Descriptive statistics were calculated for psychosocial variables and outcome variables at Time 2 (see Appendix F). Global satisfaction was used to determine the percentage of dissatisfied participants, 21.7% of participants were classified as dissatisfied with their knee replacement surgery. Potential predictors of dissatisfaction are investigated in section 5.3.

One-way ANOVAs, Pearson's correlations and a series of independent t-tests were performed to investigate the associations between sociodemographic variables (education, age, sex, employment and marital status) and psychosocial variables at Time 2 (see Appendix F). Bonferroni correction was applied to reduce the chance of Type 1 error (adjusted alpha = .004). The results of the t-tests show a significant difference between 'working' participants and 'not working' participants with regard to knee stiffness. This suggests that working participants are more likely to report worse knee stiffness than 'not working' participants (t = 3.27, Cohen's d = 1.18) six-months after surgery.

Table 5.1: Descriptive statistics for psychosocial variables and outcome variables at Time 2

Variable	***Possible Range***	***Valid N***	***Min***	***Max***	***Mean (SD)***
Psychosocial Variables					
Pain Catastrophizing	0-52	46	0	52	7.12 (11.27)
Expectations	3-15	46	3	15	10.15 (3.10)
Self-efficacy	1-10	44	3	10	7.12 (2.10)
Physical health	0-100	46	28.70	58.38	44.62 (6.64)
Mental health	0-100	46	32.84	64.46	51.60 (9.77)

Table 5.1 continued

Variable	***Possible Range***	***Valid N***	***Min***	***Max***	***Mean (SD)***
Outcomes Variables					
Pain intensity	0-100	46	10	100	22.55 (19.20)
Stiffness	0-100	46	12.5	100	30.16 (20.17)
Functional restriction	0-100	46	13.24	100	23.63 (18.10)
Patient satisfaction	0-40	46	4	40	28.96 (8.00)
Global satisfaction			***Satisfied***	***Dissatisfied***	
N (%)		46	36 (78.3)	10 (21.7)	

5.2 Results for Objective 3

Objective 3: To investigate any significant changes in both psychosocial variables and outcome variables across Time 1 and Time 2.

5.2.1 Paired samples t-tests to investigate the changes in variables from Time 1 to Time 2

A series of paired-samples t-tests were employed to investigate any changes in variables assessed at Time 1 and Time 2 (Table 5.2). Bonferroni corrections were applied to reduce the chance of Type 1 error (adjusted alpha = .025). Cohen's d was calculated using a within-subjects design (means and standard deviations at both time points, and correlation coefficients were used to calculate within-subjects Cohen's d).

5.2.1.1 Changes in psychosocial variables from Time 1 to Time 2

Significant changes in scores for psychosocial variables from Time 1 to Time 2 are indicated in Table 5.2. Participants' general mental health scores (normed from 0-100) did not significantly change across time points i.e. on average mental health remained stable over time. There was a significant decrease in pain catastrophizing scores (range 0-52) from Time 1 to Time 2. Self-efficacy scores significantly increased

across time points suggesting that participants' belief in their ability to cope with their arthritis increased significantly six-months postoperatively.

Table 5.2: Changes in variables from Time 1 to Time 2

Variable	***Time 1 Mean (SD)***	***Time 2 Mean (SD)***	***t***	***Cohen's d***
Mental health	49.97 (12.62)	51.60 (9.77)	-.86	-.13
Catastrophizing	20.28 (15.42)	7.12 (11.27)	5.57	.84***
Self-efficacy	5.85 (2.32)	7.16 (2.03)	-3.52	-.55***
Physical health	34.73 (6.57)	44.62 (6.64)	-7.65	-1.13***
Pain intensity	65.33 (18.27)	22.55 (19.20)	11.97	1.76***
Stiffness	65.50 (22.00)	30.16 (20.17)	8.47	1.25***
Functional restriction	60.22 (18.10)	23.63 (18.10)	10.57	1.55***

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

5.2.1.2 Changes in pain intensity, stiffness, functional restriction and physical health from Time 1 to Time 2

Significant changes in scores for pain intensity, stiffness, functional restriction and physical health from Time 1 to Time 2 are indicated in Table 5.2. Trends in scores are presented in Figure 5.1. Pain intensity, stiffness and functional restriction significantly decreased across time points (lower scores indicate less pain, stiffness and functional restriction). Physical health scores significantly increased from Time 1 to Time 2 (scores normed at 50). This indicates that participants experienced significant improvements in their pain levels, physical health and functional ability from before surgery to six months post-surgery.

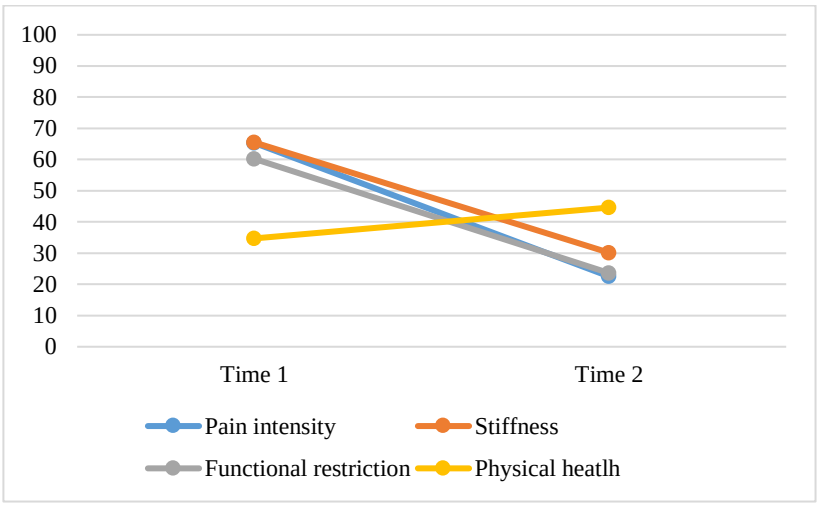

Figure 5.1: Changes in pain intensity, stiffness, functional restriction and physical health from Time 1 to Time 2

5.2.1.3 Changes in participation restriction from Time 1 to Time 2

Participants documented the level of restriction they experience in 13 life areas: education and training; employment or job seeking; community life; family life; socialising; shopping; living with dignity; leisure/ cultural activities; sports or physical recreation; religion; hospital services; mental health services; and community-based services. Scores were dichotomised into 'no restriction' and 'some restriction'. Figure 5.2 shows the percentage of people reported experiencing restriction in different life areas at Time 1 and Time 2. Z-values were calculated to determine whether there was a significant change in the proportion of the current sample experiencing restriction in the 13 life areas at Time 1 and Time 2 (Table 5.3) using a z-test software (EpiTools) (Sergeant, 2018). There was a significant decrease in the percentage of people experiencing restriction in 'socialising' (with friends or relatives), 'shopping' and 'leisure/ cultural activities' across time points. This indicates that six-months after TKR, people are less likely to experience restriction in these areas.

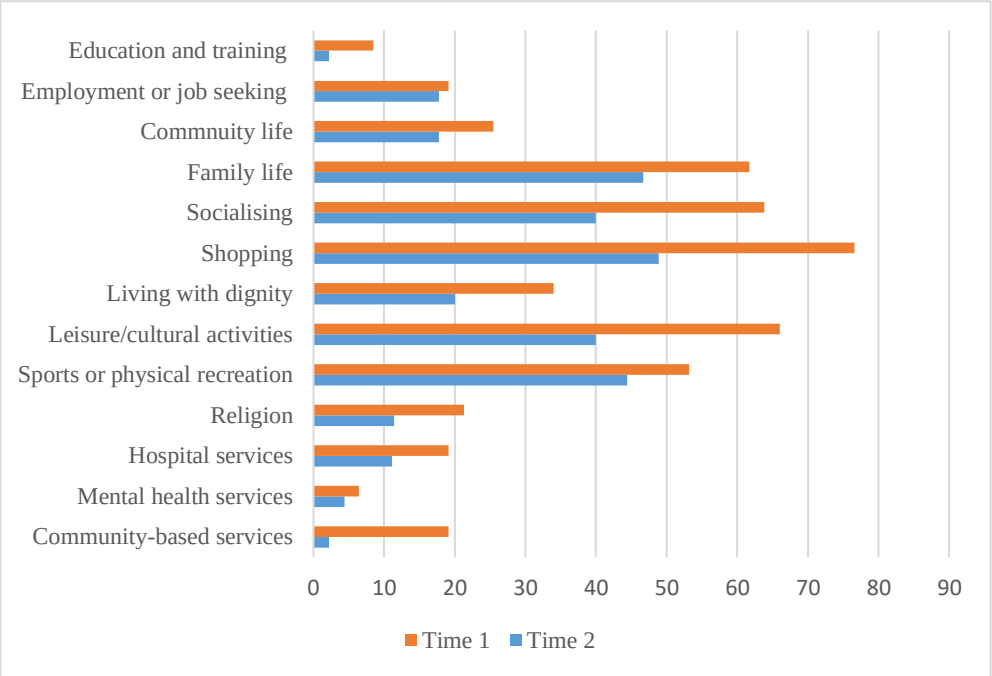

Figure 5.1: Percentages of participants experiencing restriction at Time 1 and Time 2 (n=46)

Table 5.3: Percentage of participants experiencing restriction areas defined by the MAP at Time 1 and Time 2 (based on complete data: n = 46).

	Time 1	***Time 2***	
Areas of participation restriction	***Restricted %***	***Restricted %***	***z-value***
Education and training	8.5	2.2	1.3
Employment or job seeking	19.1	17.8	.2
Community life	25.5	17.8	.9
Family life	61.7	46.7	1.4
Socialising	63.8	40	2.3*
Shopping	76.6	48.9	2.7**
Living with dignity	34	20.0	1.5
Leisure/cultural activities	66	40.0	2.7*
Sports or physical recreation	53.2	44.4	.8
Religion	21.3	11.4	1.3
Hospital services	19.1	11.1	1.1
Mental health services	6.4	4.4	0.4
Community-based services	19.1	2.2	2.6**

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

5.3 Results of Objective 4

Objective 4: To investigate whether pain intensity, functional restriction and satisfaction at Time 2 are predicted by psychosocial variables at Time 1 and fulfilment of expectations (measured at Time 2).

5.3.1 Bivariate correlations at Time 2

Pearson's correlational analyses were conducted to investigate the relationship between psychosocial variables at Time 1, expectations at Time 2 and outcome variables (pain, function and satisfaction) at Time 2. Expectations measured at Time 2 refer to the degree to which participants' expectations of surgery were fulfilled. As multiple correlations were performed, Bonferroni adjustment was applied to the alpha level to reduce the chance of Type I error (adjusted alpha = .001). The results are displayed in Table 5.4. None of the psychosocial variables measured at Time 1 were significantly correlated with the outcome variables measured at Time 2 using the Bonferroni adjusted alpha level.

5.3.2 Regression analyses to predict outcome variables at Time 2

5.3.2.1 Regression model predicting functional restriction at Time 2

A standard multiple regression analysis was employed to assess the ability of the psychosocial variables to predict functional restriction at Time 2 (Table 5.5). Sex and preoperative function were controlled for in the model. The psychosocial variables with the strongest relationship to functional restriction at Time 2 were mental health (measured at Time 1) and expectations (measured at Time 2) (r = -.36 and -.32, respectively) (see Table 5.4) and therefore, were included in the regression. The model was significant (p = .04) explaining 21% of the variance of functional restriction. However, none of the variables entered into the model presented as significant independent predictors of functional restriction.

5.3.2.2 Regression model predicting pain intensity at Time 2

A standard multiple regression analysis was employed to assess the ability of the patient-reported psychosocial variables to predict pain intensity at Time 2 (Table 5.6). Sex and preoperative pain intensity were controlled for in the model. The psychosocial variables with the strongest relationship to pain intensity at Time 2 were mental health (measured at Time 1) and expectations (measured at Time 2) (r = -.33 and -.32, respectively) (see Table 5.4) and therefore, were included in the regression. The model was significant (p = .045) explaining 20% of the variance of pain intensity. Expectations measured at Time 2 emerged as a significant predictor of postoperative pain intensity. The results suggest that greater fulfilment of surgical expectations is associated with lower pain intensity reported six-months after surgery.

Table 5.4: Associations between demographics, psychosocial variables at Time 1, expectations Time 2 and outcome variables Time 2

	Variable	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***
1	Age	-											
2	Sex	-.06	-										
3	Pain Catastrophizing (T1)	-.15	.25	-									
4	Expectations (T1)	.04	.06	.04	-								
5	Self-efficacy (T1)	.04	.21	-.31	.17	-							
6	Mental health (T1)	.28	-.32	-.43*	.15	.41*	-						
7	Expectations (T2)	-.09	-.19	-.05	-.15	.04	.09	-					
8	Physical health (T2)	.22	-.07	-.02	.17	.20	.26	.35	-				
9	Pain intensity (T2)	-.33	.17	.01	-.05	-.21	-.33	-.32	-.66*	-			
10	Stiffness (T2)	-.29	-.00	-.14	-.21	-.19	-.30	-.25	-.43	.69*	-		
11	Functional restriction (T2)	-.24	.20	-.01	-.18	-.35	-.35	-.32	-.65*	.79*	.64*	-	
12	Satisfaction (T2)	.21	-.23	-.15	.21	.34	.39	.26	.60*	.79*	-.64*	-.74*	-
13	Global satisfaction (T2)	.09	-.09	.07	.20	.18	.30	.22	.38	-.48	-.49	-.51*	.65*

Note * $p \leq$ Bonferroni corrected p-value (.0004)

Table 5.5: Summary of regression model predicting functional restriction at Time 2

	R^2	Adjusted R^2	B	SE	β	CI 95% (B)
Model	**.21***	**.13***				
Sex			1.69	5.42	.05	-9.24/12.61
Mental health (T1)			-.49	.24	-.30	-.90/.01
Expectations (T2)			-1.68	.84	-.27	-3.38/.02
Functional restriction (T1)			.01	.14	.01	-.28/.30

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

Table 5.6: Summery of regression model predicting pain intensity at Time 2

	R^2	Adjusted R^2	B	SE	β	CI 95% (B)
Model	**.20****	**.13****				
Sex			.23	5.77	.01	11.41/11.86
Mental health (T1)			-.45	.26	-.27	-1.00/0.7
Expectations (T2)			-1.94	.89	-.31*	-3.73-.15
Pain intensity (T1)			.09	.15	-.09	-.22/.39

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

5.3.2.3 Regression model predicting patient satisfaction at Time 2

A hierarchical multiple regression was used assess the variables that predicted satisfaction (defined as satisfaction with current level of pain and functional ability of their knee) measured at Time 2 (Table 5.7). Sex was entered into the regression at step 1. At this step, the model was not significant explaining 5% of the variance of patient satisfaction. The changes in pain intensity ('change in pain') and functional restriction ('change in function') from Time 1 to Time 2 were controlled for in the model and were entered into the regression at step 2. Change in pain' and 'change in function' explained an additional 26% of the variance with 'change in function' emerging as a significant independent predictor. The model at this step was significant explaining 36% of the variance of patient satisfaction. 'Mental health measured at Time 1 had the greatest association with satisfaction in the correlational analyses (r = .40, see Table 5.4) and was entered into the model at step 3. Mental health measured at Time 1 explained an

additional 14% of the variance and was a significant independent predictor of postoperative patient satisfaction. The model as a whole was significant explaining 52% of the variance. The results of the regression model indicate that better preoperative mental health scores and a greater decrease in functional restriction predict greater satisfaction six-months after surgery.

Table 5.7: Summary of regression model predicting satisfaction at Time 2

	B	***SE***	***β***	R^2	***Adjusted*** R^2	ΔR^2
Step 1				**.05**	**.03**	**-**
Sex	-3.64	2.30	-.23			
Step 2				**.36*** **	**.31*** **	**.31*** **
Sex	-3.89	1.95	-.25			
Change in pain	-.07	.06	-.22			
Change in function	-.12	.06	-.38*			
Step 3				**.52*** **	**.47*** **	**.16*** **
Sex	-1.79	1.81	-.11			
Change in pain (T1- T2)	-.06	.05	-.19			
Change in function (T1- T2)	-.14	.05	-.45**			
Mental health (T1)	.30	.08	.42***			

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

5.3.2.4 Logistic regression analyses predicting global satisfaction

A logistic regression was performed to assess the impact of psychosocial factors (measured at Time 1) on global satisfaction defined as overall satisfaction with replacement knee surgery (measured at Time 2) (Table 5.8). The model controlled for sex, change in pain intensity from Time 1 to Time 2 and change in functional restriction from Time 1 to Time 2. The psychosocial variable most strongly correlated with global satisfaction was mental health (r = .40; see Table 5.4) and was therefore entered into the

model as a potential predictor. The model as a whole explained between 24.6% (Cox and Snell R^2) 37.1% (Nagelkerke R^2) of the variance of global satisfaction. Change in function from Time 1 to Time 2 made a significant contribution to the model (OR = .95) and presented as a significant independent predictor of global satisfaction. This indicates that with every unit decrease in functional restriction, global satisfaction increases by 1.05.

Table 5.8: Summary of logistic regression model predicting global satisfaction

Model			**R^2 = 24.6%- 37.1%**		**χ^2= 10.86****
Variable	***B***	***SE***	***OR***	***CI (95%)***	***p-value***
Sex	-.29	.94	.76	.23/4.70	.76
Change in pain (T1-T2)	.01	.02	1.01	.96/ 1.01	.76
Change in function (T1- T2)	-.05	.24	.95	.91/1.00	.04*
Mental health (T1)	.07	.05	1.08	.98/1.18	.11

Note. *p ≤.05 **p ≤ .01, ***p ≤ .001

Chapter 6: Discussion

6.1 Review of aims, objectives and rationale of the current study

The demand for TKR in Ireland is increasing due to an ageing population resulting in a higher proportion of people suffering with OA. Patients are scheduled for TKR only when the pain and functional restriction associated with OA has not responded to conventional medication. TKR has shown to be effective in improving symptoms associated with OA and the rate of unsuccessful surgeries is less than 5% (Wylde et al., 2007). However, reports have shown that up to 28% of patients are dissatisfied with their surgery (Khatib et al., 2015). Recent reviews have highlighted the impact of psychosocial factors on recovery from TKR (Gunaratne et al., 2017; Khatib et al., 2015; Vissers et al., 2012). The aim of the current study was to investigate the impact of preoperative psychosocial factors on postoperative pain intensity, functional restriction, and patient satisfaction outcomes. This study adopted a prospective cohort design; participants were assessed two to six weeks preoperatively and six-months postoperatively. Psychosocial factors including pain catastrophizing, patient expectations, mental health, self-efficacy and patient activation were assessed preoperatively as potential predictors of pain intensity, functional restriction, and patient satisfaction.

6.2 Findings of the current study

Significant associations were found between numerous psychosocial variables and outcome variables (pain intensity, functional restriction and patient satisfaction) at Time 1. Pain catastrophizing and mental health were most strongly associated with pain intensity, functional restriction and satisfaction. Pain catastrophizing and patient activation contributed significantly to the variance in functional restriction at Time 1. This indicates that those with higher pain catastrophizing scores and lower patient

activation are more likely to report worse functional restriction scores before surgery. Pain catastrophizing and expectations of surgery contributed significantly to the variance in pain intensity at Time 1; greater pain catastrophizing and higher preoperative expectations are associated with higher pain intensity preoperatively.

The current study found no significant association between psychosocial variables measured at Time 1 and rehabilitation engagement. This finding is similar to previous studies that investigated this construct (Kortte, Veiel, Batten, & Wegener, 2009; Ramanathan-Elion, McWhorter, Wegener, & Bechtold, 2016). These studies found that psychological factors such as hope, emotional functioning and depressive symptoms did not significantly explain any of the variance of rehabilitation engagement. One study, found that depressive symptoms explained 15% of the variance of rehabilitation participation (Lenze et al., 2004) however, this study defined rehabilitation participation as a measure of attendance only, while the HRERs assesses attendance, attitudes expressed, need for prompts to engage, active participation and acknowledgement of need for rehabilitation (Kortte, Falk, Castillo, Johnson-Greene, & Wegener, 2007). A possible explanation for the lack of significant associations, is that rehabilitation engagement has been previously measured during acute inpatient rehabilitation (mean length of stay range 13.3- 20.6 days) (Kortte et al., 2009; Ramanathan-Elion et al., 2016). During this acute stage, patients may be highly motivated for their symptoms to improve, take part in the rehabilitation exercises and ultimately return home after their surgery. At this time, patients also have the supports of physiotherapists and nurses, who are likely to encourage patients to engage in rehabilitation. However, motivation is likely to decrease with time, as patients return home and access to immediate supports is limited. Future research could investigate the impact of preoperative psychosocial factors on longer term rehabilitation engagement.

Global satisfaction, which was used to determine the percentage of dissatisfied participants, showed that 21.7% of participants of the current study were dissatisfied with their knee replacement surgery six-months post-operatively. The dissatisfaction rate of the current study is similar to that of other studies which assess patient satisfaction six-months postoperatively (Judge et al., 2012; Scott et al., 2010). However, while improvements after TKR can be seen up to two-years postoperatively (Haanstra et al., 2012), the dissatisfaction rate of the current sample is also similar to the dissatisfaction rate of studies that report outcomes one-year, two-years and four-years postoperatively (Duivenvoorden et al., 2013; Gandhi et al., 2008; Kim et al., 2009).

Preoperative mental health did not significantly predict global satisfaction defined as overall satisfaction with surgery. The results of the logistic regression indicate that change in functional restriction from Time 1 to Time 2 was the only significant independent predictor of global satisfaction (for every unit decrease in functional restriction, global satisfaction increased by 1.05). The results of both regression analyses found that different interpretations of postoperative satisfaction were associated with different significant predictors. While preoperative mental health was a significant predictor of patient satisfaction, it was not a significant predictor of global satisfaction. One explanation for this may be the use of a single-item measure to assess global satisfaction. Single-item measures can potentially increase measurement error (Spector, 1992) which can decrease reliability of the scale. It can also decrease the effect size which in turn decreases power suggesting that a larger sample size would be needed to detect significance (Cohen, 1992) The underpowered sample of the current study potentially increases the chance of Type II error.

As seen in the regression analysis, preoperative mental health and change in function from Time 1 to Time 2 were significant predictors of patient satisfaction

(defined as satisfaction with pain relief and functional ability). Change in function from Time 1 to Time 2 explained 20% of the variance and preoperative mental health explained 17% of the variance in patient satisfaction. These findings indicate that decrease in functional restriction as well as better preoperative mental health predict greater postoperative patient satisfaction. The MCS subscale of the SF-12, used in the current study, includes items assessing depressive symptoms which have been previously negatively associated with dissatisfaction after TKR (Ali et al., 2017; Duivenvoorden et al., 2013). The measure of depressive symptoms in the MCS subscale of the SF-12 could potentially explain the significant impact of preoperative mental health on postoperative patient satisfaction found in the current study (Escobar et al., 2007). This finding is supported by recent systematic reviews of the current literature which provides some evidence for the impact of preoperative mental health on postoperative satisfaction (Khatib et al., 2015; Vissers et al., 2012).

The discrepancies in significant predictors of postoperative global satisfaction and patient satisfaction found in this study echoes the conclusions of recent systematic reviews that identify the need to reach a consensus regarding the conceptualisation of postoperative satisfaction (Gunaratne et al., 2017; Khatib et al., 2015).

Pain intensity, knee stiffness and functional restriction all significantly decreased six-months after surgery when compared to preoperative scores which is an unsurprising finding considering the aim of TKR surgery is to decrease symptoms associated with severe OA. Self-efficacy and physical health significantly increased from Time 1 to Time 2 which is consistent with existing literature (Clement, MacDonald, Patton, & Burnett, 2014; Escobar et al., 2007; Lopez-Olivo et al., 2011; Orbell et al., 2001; Qi et al., 2016; van den Akker-Scheek et al., 2007). However, research investigating changes in pain catastrophizing from pre- to post-surgery is

inconsistent. There is evidence to support the idea that pain catastrophizing is a trait-like construct that remains constant over time (Edwards et al., 2009; Forsythe et al., 2008). However, in the current study pain catastrophizing decreased from Time 1 (preoperatively) to Time 2 (six-months postoperatively). This is consistent with recent research which suggests that pain catastrophizing is a dynamic, rather than trait-like construct (Høvik et al., 2016; Wade et al., 2012; Wylde et al., 2012). Wade et al. (2012) provided preliminary evidence for idea that pain catastrophizing is a dynamic construct, suggesting that pain catastrophizing decreases along with pain intensity. These findings are consistent with other studies in which pain catastrophizing significantly decreases over time (Høvik et al., 2016; Wylde et al., 2012). The findings of the current study add to this literature and supports the notion that pain catastrophizing is dynamic and susceptible to change.

The current sample reported high levels of participation restriction prior to surgery. In Ireland, patients must be presenting with high levels of pain and functional restriction to be eligible for TKR surgery provided by the public healthcare system. According to HIQA, the waiting list for TKR is substantial, with 49.3% of orthopaedic referrals waiting more than six-months for their first appointment (Health Information and Quality Authority, 2014). This level of restriction and isolation from important life areas could have long-term effects on the quality of life of orthopaedic patients. This is particularly relevant for the current cohort which is mainly comprised of older adults who may already be susceptible to social isolation (Nicholson, 2012). However, the results of the current study show that significantly less people felt some restriction at Time 2 when compared to Time 1, in the areas of socialising, shopping, leisure activities and community-based services (as measured by the MAP). These findings suggest that despite considerable wait times for orthopaedic intervention, high levels of

pain and functional restriction which previously impacted on levels of participation, and the potential for social isolation, participants returned to low levels of participation restriction after TKR surgery.

The results of this study highlight the importance of unfulfilled expectations in recovery from TKR surgery. In the current study, unfulfilled expectations accounted for 11% of the variance in postoperative pain intensity. Unfilled expectations have previously been significantly associated with TKR outcomes such as health-related quality of life (Gonzalez Saenz de Tejada et al., 2010; Odell et al., 2017). However, limited evidence exists for the impact of unfulfilled expectations on postoperative pain intensity. The strong association between postoperative patient expectations and pain intensity could be explained by the nature of the postoperative expectations scale employed. The current study used the postoperative expectations subscale of the KSS (Noble et al., 2012) which asks to what degree patient expectations were met in relation to pain relief and functional ability. Patients with greater pain relief are more likely to report fulfilment of expectations in this area.

The current study found no significant associations between preoperative pain catastrophizing and postoperative pain intensity, functional ability or satisfaction. The non-significant association between preoperative pain catastrophizing and postoperative pain is a somewhat surprising finding considering the growing evidence for preoperative pain catastrophizing as a consistent predictor of postoperative pain intensity. A recent systematic review provided moderate level evidence for the impact of preoperative pain catastrophizing on postoperative pain intensity (Burns et al., 2015). An important consideration however, as discussed by Burns et al. (2015), is that other psychological constructs such as anxious and depressive symptoms are related to pain catastrophizing scores. In line with this, two prospective cohort studies found that when

preoperative anxiety was included as a predictor of postoperative pain, pain catastrophizing did not present as a significant predictor (Høvik et al., 2016; Masselin-Dubois et al., 2013). The current study controlled for baseline mental health using the MCS subscale of the SF-12 which assesses mental health, social functioning, vitality and emotional difficulties (depressive and anxious symptoms). The lack of significant association between preoperative pain catastrophizing and postoperative pain could potentially be explained by the inclusion of a measure of mental health. Future studies would need to investigate anxiety and depression as potential confounders for pain catastrophizing.

6.3 Limitations

The current sample is broadly representative of a typical Irish OA population when compared to the results of the TILDA study. This is reflected in the ratio of males to females, mean age, marital status and employment status. The use of a prospective cohort design eliminates the potential of recall bias that must be considered in retrospective studies. This can also increase the validity of results. However, several limitations must be considered when interpreting the findings of the current study. The sample size obtained at both time points should be considered when interpreting results from the regression analyses, particularly at six-month follow-up. While strong associations have been found between the predictor variables and outcomes variables in the regression analyses, further research should be conducted to examine the strength of the associations in a larger sample.

Sample attrition from Time 1 to Time 2 can impact the reliability of the results and should be taken into consideration when interpreting findings. In the current study, the sample size decreased from 82 participants at Time 1 to 46 participants at Time 2 (56% of the original sample or 65% of the sample who converted to TKR surgery).

While this attrition rate is not grossly different the attrition rates previously observed in longitudinal studies, it is still important to note it is somewhat higher than previous studies with TKR patients of a similar sample size (Brander et al., 2007; Duivenvoorden et al., 2013; Smith & Zautra, 2004). It should also be noted that participants who responded at Time 2 had significantly lower preoperative mental health and patient activation scores when compared to participants who were included in Time 1 analyses only. As lower preoperative mental health was found to be a significant predictor of postoperative patient satisfaction in this study, this could potentially skew the results and should be considered during interpretation.

Due to the limited time frame of the study, the maximum time for follow-up that could be allowed was six months after surgery. This means that the current sample may not have realised their full improvements at the time of follow-up which may influence findings. This should be considered when interpreting the results. Future studies with longer follow-up and multiple time points is needed to determine the trend in TKR recovery as well as the preoperative factors that may influence longer term outcomes of TKR.

Another limitation of the current study is the reliance on subjective measures to assess study variables. Self-report measures were employed to assess both psychosocial and physical factors at both time points. One consideration that should be taken into account is that of common method variance or measurement bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Spector, 2006). This is the idea that the variance observed can be attributed to the method rather than the constructs actually being measured. This can contribute to both Type I and Type II errors. Another consideration is that of socially desirable responding which may influence results. In line with this, participants completed Time 2 questionnaires in their home and may have been

influenced by family members or friends. However, self-report measures give the researcher insight into constructs such as psychological distress and patient satisfaction that are not easily objectively measured. In relation to this, a study conducted by Berliner et al. (2017) found that pre-operative PROMs are associated with clinically meaningful improvements after TKR. In addition, self-report measures can be easily administered in busy orthopaedic surgeries for screening purposes ensuring that preoperative screening is a realistic goal.

Inconsistencies regarding the interpretation and assessment of patient expectations is apparent in the current literature. Haanstra et al. (2012) highlighted the need to reach a consensus for a theoretical framework of patient expectations. Zywiel et al. (2013) also highlighted the need for valid and reliable measurements that are consistently used when investigating patient expectations. Another recent systematic review provided evidence for the association of unfulfilled expectations on outcomes following joint replacement (Dyck et al., 2014). They concluded that fulfilment of expectations is associated with greater clinical improvement in joint surgery. However, this review, similar to the review by Zywiel et al. (2013), identified many expectation assessment measurements. While this study utilised a validated measure of patient expectations (both preoperatively and postoperatively) which can be seen as a strength of the current study, the inconsistencies noted in the literature could potentially affect the comparison of results across studies.

6.4 Future Research

The current study found no significant association between preoperative self-efficacy and postoperative pain intensity, functional restriction or patient satisfaction. This finding is consistent with reports elsewhere (Hartley et al., 2008; Lopez-Olivo et al., 2011; Orbell et al., 2001; Riddle et al., 2010). A systematic review by Magklara et

al. (2014) concluded that preoperative self-efficacy was the least consistent predictor of functional outcomes after TKR. Rather, short-term postoperative self-efficacy has been proposed as a more reliable predictor of long-term functional outcomes after TKR (Magklara et al., 2014). Future research could investigate short-term postoperative self-efficacy as a possible predictor of long-term postoperative TKR outcomes.

Also related to self-efficacy is the potential for confusion regarding the similarities between self-efficacy and patient activation. While having belief in your own ability is an important component in patient activation (and similar to self-efficacy), it is has to include direct action and engagement which differs from self-efficacy. Furthermore, self-efficacy and patient activation scores were not significantly correlated at Time 1 (see Table 4.4) indicating that they were measuring different constructs. However, similar to how anxious and depressive symptoms may be related to pain catastrophizing, the similarities between self-efficacy warrant investigation to see whether one of the constructs could be made redundant.

The current study found that unfulfilled expectations contributed significantly to the variance of postoperative pain intensity. However, while unfulfilled expectations have been shown to contribute to the variance in patient satisfaction (Culliton et al., 2012), little research looks at the association of unfulfilled expectations on disease-specific outcomes after TKR surgery (e.g. pain relief and functional restriction). Dyck et al. (2014) provided some evidence for the association between unfulfilled expectations and outcomes after joint replacement surgery, however their systematic review included samples of both TKR and THR as well as a wide range of outcomes (e.g. satisfaction, health-related quality of life, and general health). Differences have been shown in the rate of recovery for both TKR and THR with TKR patients experiencing worse pain and functional recovery (Hall, Aarons, Hall, Hughes, & Salmon, 1996; O'Brien, Bennett,

Doran, & Beverland, 2009; Salmon, 2001; Wylde et al., 2009). Therefore, the effect of unfulfilled expectations on TKR outcomes warrants further attention.

It should also be noted that there are many different ways in which patient expectations can be operationalised. For example, unmet expectations could be positive (e.g. outcome was better than expected). While there is little research to date that looks at unmet expectations as both positive or negative, future research could investigate the impact that the different variations of expectations has on TKR outcomes.

6.5 Clinical Implications

Recovery from TKR is almost solely focused on physical improvements. Clinical outcomes such as range of motion of the knee, radiographic results and joint alignment and stability are routinely documented as indicators of surgical success after knee replacement surgery. However, the results of the current study, as well as recent systematic reviews, show that up to 28% of patients are dissatisfied with their outcomes even with no physical indicators of poor recovery (Khatib et al., 2015). Eligibility for TKR surgery in Ireland is dependent on chronic pain and considerable functional restriction. As well as this, patients are likely to wait greater than six-months for an orthopaedic appointment (Health Information and Quality Authority, 2014). Wait times of greater than six-months for people suffering from chronic pain have been shown to have a negative effect on patients' quality of life and psychological well-being (Lynch et al., 2008) which can impact patients' mental health. The results of the current study along with previous research, highlight the importance of preoperative mental health in relation to patient satisfaction after TKR, and indicate that lower preoperative mental health can negatively impact on postoperative satisfaction.

It is essential for orthopaedic surgeons to be aware of patients' mental health as well as their physical health. Preoperative psychological screening in orthopaedic

surgeries could identify those more likely to be dissatisfied after their surgery. The routine administration of a measure of mental health such as the SF-12 during patients' preoperative assessment would add very little burden to both patients and staff while helping to identify those who may benefit from psychological intervention before undergoing TKR, which in turn could ultimately improve satisfaction rates and overall surgical experience.

The results of the current study also suggest that it would be beneficial to orthopaedic surgeons to monitor patient expectations both preoperatively and throughout recovery. Preoperative education regarding expected outcomes of knee replacement surgery, as well as regular discussions between patient and surgeon, could help patients form and maintain realistic expectations and may influence patient outcomes.

6.6 Conclusions

The current study provides evidence for the impact of preoperative psychosocial factors on recovery from TKR surgery. Preoperative mental health, as well as unmet expectations, are significant risk factors for poor outcomes six-months after surgery. The findings contribute to the current literature which acknowledges the impact of preoperative factors on long-term outcomes after TKR. The study also supports calls for consensus on the conceptualisation and measurement of postoperative satisfaction in TKR research. Preoperative screening could help to identify patients at risk of poor outcomes after TKR and could offer opportunities for interventions to increase patient satisfaction.

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Appendix A: Search Strategy for Systematic Review

Embase search string

No.	Query
#1	'knee arthroplasty'/exp
#2	'knee prosthesis'/exp
#3	'knee'/exp
#4	'arthroplasty'/exp
#5	arthroplast* OR replac* OR prosthe*
#6	#3 AND (#4 OR #5)
#7	knee* NEAR/3 (arthroplast* OR replac* OR prosthe*)
#8	#1 OR #2 OR #6 OR #7
#9	'prediction and forecasting'
#10	prognos* OR predict*
#11	'risk assessment'/exp
#12	#9 OR #10 OR #11
#13	'psychological aspect'/exp
#14	'psychological test'/exp
#15	'psychology'/exp
#16	psycholog*
#17	'catastrophizing'/exp
#18	catastrophiz*
#19	#13 OR #14 OR #15 OR #16 OR #17 OR #18
#20	#8 AND #12 AND #19

Appendix B: Participant Information Sheet

Participant Information Leaflet

Study title: SPARKS: Social and Psychosocial factors in Knee Replacement Surgery.

Researcher Name: **Joanne Brennan**

Research Supervisor Name(s): **Dr. Deirdre Desmond**
Lecturer, Department of Psychology
Maynooth University

Mr. Aaron Glynn
Consultant Orthopaedic Surgeon,
Department of Orthopaedics,
Our Lady's Hospital, Navan

Introduction

You are being invited to take part in a research study. Before you decide to take part or not,
It is important that you understand why the study is being done and what it will involve.
You should read the information provided below carefully.

You should clearly understand the risks and benefits of taking part in this study so that you can make a decision that is right for you. This process is known as 'Informed Consent'.

You don't have to take part in this study and a decision not to take part will not effect on your future treatment.

You can change your mind about taking part in the study any time you like. Even if the study has started, you can still opt out. You don't have to give us a reason. If you do opt out, rest assured it won't affect the quality of treatment you get in the future.

Why is this study being done?

We want to find out why people experience different outcomes after having Total Knee Replacement surgery and why it goes better for some people more than others. We are particularly interested in finding out whether any factors before your surgery can influence your outcome after surgery. The outcomes we will be looking at include pain and function in the knee after surgery.

Who is organising and funding this study?

I (Joanne Brennan) am a student of Maynooth University and this study is part of a PhD in psychological research. I am carrying out this research with my supervisors; Dr Deirdre Desmond, a Lecturer in the Department of Psychology in Maynooth University, and Mr. Aaron Glynn, a Consultant Orthopaedic Surgeon of the Department of Orthopaedics in Our Lady's Hospital Navan.

Why am I being asked to take part?

You are being invited to take part in this study as you are currently on the waiting list for Total Knee Replacement surgery.

How will the study be carried out?

The study will be carried out in Our Lady's Hospital, Navan. The study involves completing a questionnaire before your knee surgery and 6 months, 12 months and 2 years after your knee surgery.

What will happen to me if I agree to take part – what is involved?

Before your knee replacement surgery, you will be asked to complete a questionnaire which will take 30-45 minutes to complete. With your permission, the Clinical Specialist Physiotherapist and Orthopaedic Consultant will provide us with information on your diagnosis and rehabilitation plan discussed with you. You will then be contacted 6 months, 12 months and two years after your surgery to complete follow-up questionnaires. Your completed questionnaires will help us to understand how some factors before your surgery may have influenced your outcomes after surgery. The outcomes we will be looking at are pain and function in the knee after surgery and satisfaction. Also with your permission, we will be accessing your health care records to see the history of your knee pain and its treatment. At no point will we have access to any information in your health care records that is not directly relevant to this research.

What other treatments are available to me?

Your medical treatment will not be affected in any way by whether or not you decide to take part in this study. You do not have to be part of this study to be treated.

What are the benefits?

There are no direct benefits from taking part in this study. Your participation will help us to understand the why people experience different outcomes after undergoing knee replacement surgery.

What are the risks?

There are no known risks associated with taking part in this study.

Is the study confidential?

If you agree to take part, the information collected from the questionnaire and your Health Care Record will be kept confidential. Any information that will identify you will be removed. The procedures for handling, processing, storage and destruction of your data will be compliant with the Data Protection Acts 1998 and 2003.

All information will be stored on secure hard-drives and in locked filing cabinets in the Department of Psychology at Maynooth University. Any personal information that could identify you will be permanently destroyed at the end of the study. The information from everybody who takes part will be put together in a report and/or publications. No individual results or identifiable features will be reported. The findings will be used to develop possible treatment approaches to help people who undergo knee replacement surgery to experience the best possible outcomes for them. Data, with all identifying information removed, will be kept for 10 years and may be reanalysed as part of similar studies.

Compensation – what are my rights?

Participation in this study will in no way affect your legal rights.

Voluntary participation - Do I have to take part?

No, it is completely up to you whether you take part or not. If you decide to take part, you will be given a copy of this information sheet for you to keep, and asked to sign a consent form to show you have agreed to take part. You are free to decide not to take part or to withdraw from the study any time without having to give a reason.

Where can I get further information?

If you have any further questions about the study or if you want to opt out of the study, you can rest assured it won't affect the quality of treatment you get in the future.

If you need any further information now or at any time in the future, please contact: Joanne Brennan or Dr. Deirdre Desmond on 087-4308566 or speak with your Consultant. If you have any specific health concerns please discuss this with your Consultant Orthopaedic Surgeon, Physiotherapist or Family Doctor.

You will be given a copy of the Information sheet and a signed consent form to keep.
Thank you for taking time to read this sheet.

Appendix C: Consent Form

Consent Form

Title of Study: **SPARKS: Social and Psychosocial factors in Knee Replacement Surgery.**

Please read the following statements and tick each box:

1. I confirm that I have read, or had read to me, the information sheet. I have had an opportunity to ask questions and all my questions have been answered to my satisfaction. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. ☐

3. I agree to be contacted again by the researchers 6 months, 12 months and 2 years after my surgery. ☐

4. I give permission for the researchers to access my Health Care Record. ☐

5. I understand that I will not be named in any presentations or publications that result from this research. ☐

6. I have been given a copy of the Information Leaflet and this completed consent form for my records. ☐

7. I agree to take part in the above study. ☐

8. I give permission for the researchers to securely store the information I give so that it may be used for research purposes and where appropriate re-analysed by other researchers. I understand that no identifying information about me will be stored with my answers. ☐

_____	_____	_____
Name of Participant	Date	Signature

Statement of person taking consent: I have explained the nature, purpose, benefits, and risks to this research study. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

_____	_____	_____
Name of person taking consent	Date	Signature

Appendix D: Letters of Ethical Approval

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Regional Manager Consumer Affairs
HSE Dublin North East

Bective Street, Kells
Co. Meath

Tel: +353 (0) 46 9251264
Fax: +353 (0) 46 9251774

Loughlee Business Park
Drumalee, Cavan

Tel: +353 (0) 49 4377343
Fax: +353 (0) 49 4377379
Email: consumeraffairs.hsedne@hse.ie

23rd August 2016

Ms Joanne Brennan
Postgraduate Research Student
Department of Psychology
Maynooth University
Maynooth
Co Kildare

Re/ **Research Study Proposal:**
"Psychosocial factors in knee replacement outcomes"

Dear Ms Brennan

I refer to your email correspondence of 03/08/16 in response to issues raised by the HSE North East Area Research Ethics Committee (REC) in connection with the above study. I wish to advise that Ms Rosie Quinn has had an opportunity to review same.

I can confirm that you have met all the conditions of the Committee and you may commence the above study.

This will be formally noted at the next REC meeting.

Yours sincerely,

Brendan Mac Mahon

Dr Brendan MacMahon
Chairperson
HSE North East Area -
Research Ethics Committee

Copied to/ **Mr Ken Fitzgibbon, General Manager, Our Lady's Hospital, Navan, Co Meath**
Dr Zubovic, Lead Clinician Orthopaedics, Our Lady's Hospital, Navan, Co Meath
Ms.Deirdre Desmond, Lecturer, Department of Psychology, Maynooth University, Maynooth, Co Kildare

MAYNOOTH UNIVERSITY RESEARCH ETHICS COMMITTEE
MAYNOOTH UNIVERSITY,
MAYNOOTH, CO. KILDARE, IRELAND

Maynooth University
National University of Ireland Maynooth

Dr Carol Barrett
Secretary to Maynooth University Research Ethics Committee

14 September 2016

Ms Joanne Brennan
Department of Psychology
Maynooth University

RE: Application for Ethical Approval for a project entitled: **Psychosocial factors in Knee replacements outcome**

Dear Joanne,

The above project has been evaluated under Tier 2 process, Expedited review and we would like to inform you that ethical approval has been granted.

Any deviations from the project details submitted to the ethics committee will require further evaluation. This ethical approval will expire on 30 September 2018.

Kind Regards,

Dr Carol Barrett
Secretary,
Maynooth University Research Ethics Committee

C.c Dr Deirdre Desmond, Department of Psychology, Maynooth University

Reference Number
SREC-2016-066

Appendix E: Time 1 and Time 2 Questionnaires

Time 1 Questionnaire

Section A

Instructions

The following survey asks for some general information about you. Please fill out the survey using the instructions provided for each question.

Today's Date _____ /_____ / _____
DD MM YYYY

Demographic Information

1. Date of Birth _____ /_____ / _____ **2. Contact No.:_____**
DD MM YYYY

3. Address

_____

_____

_____

4. Sex (please tick)

○ Male ○ Female

5. Height (ft' in'') **6. Weight (St lbs)**

7. Ethnicity (Please tick)

○ White ○ Black or Black Irish ○ Asian or Asian Irish

○ Other (please specify)

8. Do you smoke tobacco? (please tick)

○ Yes

○ No

9. Marital Status (please tick)

○ Married (not separated)
○ Married (separated)
○ Divorced
○ Single
○ Widowed

10. Highest Level of Education (please tick)

○ Primary Education
○ Group Certificate/ Intermediate Certificate/ Junior Certificate
○ Leaving Certificate
○ Further Education and Training/ Post Leaving Certificate Courses
○ Third Level Education (undergraduate)
○ Third Level Education (postgraduate)

11. Employment (please tick)

○ Retired (normative retirement)
○ Retired due to knee problems
○ Retired due to health problems unrelated to the knee
○ Full-time or Part-time employment
○ Unemployed
○ Homemaker

12. Reason for knee replacement

○ Osteoarthritis
○ Rheumatoid arthritis
○ Trauma
○ Other (Please specify)

_____

Section B

Instructions
This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. **Answer each question by ticking just one answer**.

1. In general, would you say your health is:

1. Excellent ☐ 2. Very good ☐ 3. Good ☐ 4. Fair ☐ 5. Poor ☐

The following questions are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
2. Moderate activities such as moving a table, pushing a vacuum cleaner or playing golf.	☐	☐	☐
3. Climbing several flights of stairs	☐	☐	☐

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities **because of your physical health?**

	All of the time	*Most of the time*	*Some of the time*	*A little of the time*	*None of the time*
4. Accomplished less than you would like.	☐	☐	☐	☐	☐
5. Were limited in the **kind** of work or other activities.	☐	☐	☐	☐	☐

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities **because of any emotional problems** (such as feeling depressed or anxious)?

	All of the time	*Most of the time*	*Some of the time*	*A little of the time*	*None of the time*
6. Accomplished less than you would like.	☐	☐	☐	☐	☐
7. Did work or activities less carefully than usual.	☐	☐	☐	☐	☐

8. **During the past 4 weeks,** how much did pain interfere with your normal work (including work outside the home and housework)?

1. Not at all ☐ 2. A little bit ☐ 3. Moderately ☐ 4. Quite a bit ☐ 5. Extremely ☐

These questions are about how you have been feeling during the <u>past 4 weeks.</u>

For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the <u>past 4 weeks</u>…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
9. Have you felt calm and peaceful?	☐	☐	☐	☐	☐
10. Did you have a lot of energy?	☐	☐	☐	☐	☐
11. Have you felt down-hearted and blue?	☐	☐	☐	☐	☐

12. **During the past 4 weeks,** how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

1. All of the time ☐
2. Most of the time ☐
3. Some of the time ☐
4. Little of the time ☐
5. None of the time ☐

Section C

Instructions: The following questions ask how you feel about your knee and how well you are able to carry out your usual daily activities. **Please tick only one box** underneath the response that best suits you.

Symptoms

1. Do you have swelling in your knee?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

2. Do you feel grinding, hear clicking or any other type of noise when your knee moves?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

3. Does your knee catch or hang up when moving?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

4. Can you straighten your knee fully?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

5. Can you bend your knee fully?

Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

Stiffness

1. How severe is your knee joint stiffness after first awakening in the morning?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

2. How severe is your knee stiffness after sitting, lying or resting later in the day?

None	Mild	Moderate	Severe	Extreme
☐	☐	☐	☐	☐

Pain

1. How often do you experience knee pain?

Never ☐ Monthly ☐ Weekly ☐ Daily ☐ Always ☐

What amount of knee pain have you experienced the last week during the following activities?

2. Twisting/ pivoting on your knee

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

3. Straightening knee fully

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

4. Bending knee fully

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

5. Walking on a flat surface

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

6. Going up or down the stairs

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

7. At night while in bed

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

8. Sitting or Lying

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

9. Standing upright

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

Function, daily living

The following questions concern your physical function and how well you can perform your daily activities. Please indicate the degree of difficulty you have experienced in the last week due to your knee.

1. Descending stairs

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

2. Ascending stairs

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

3. Rising from sitting

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

4. Standing

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

5. Bending to the floor/ picking up an object from the floor

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

6. Walking on a flat surface

None Mild Moderate Severe Extreme

7. Getting in/out of the car

None Mild Moderate Severe Extreme

8. Going shopping

None Mild Moderate Severe Extreme

9. Putting on socks

None Mild Moderate Severe Extreme

10. Rising from bed

None Mild Moderate Severe Extreme

11. Taking off socks

None Mild Moderate Severe Extreme

12. Lying in bed (turning over, maintaining knee position)

None Mild Moderate Severe Extreme

13. Getting in/out of the bath

None Mild Moderate Severe Extreme

14. Sitting

None Mild Moderate Severe Extreme

☐ ☐ ☐ ☐ ☐

15. Getting on/off of the toilet

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

16. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc.)

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

17. Light domestic duties (cooking, dusting, etc.)

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

Section D

Instructions:
We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, **please indicate the degree** to which you have these thoughts and feelings when you are experiencing pain.

RATING	0	1	2	3	4
MEANING	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time

When I'm in pain …

Number	Statement	Rating
1	I worry all the time about whether the pain will end.	
2	I feel I can't go on.	
3	It's terrible and I think it's never going to get any better.	
4	It's awful and I feel that it overwhelms me.	
5	I feel I can't stand it anymore.	
6	I become afraid that the pain will get worse.	
7	I keep thinking of other painful events.	
8	I anxiously want the pain to go away.	
9	I can't seem to keep it out of my mind.	
10	I keep thinking about how much it hurts.	
11	I keep thinking about how badly I want the pain to stop.	
12	There's nothing I can do to reduce the intensity of the pain.	
13	I wonder whether something serious may happen.	

Section E

Instructions: We are interested to know how you feel about managing your own health care. Please **circle one response** which best indicates how much you agree with the following statements.

		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1	When all is said, and done, I am the person who is responsible for managing my own health condition.	1	2	3	4	5
2	Taking an active role in my own healthcare is the most important factor in determining my health and ability to function.	1	2	3	4	5
3	I am confident that I can take actions that will help prevent or minimize some symptoms or problems associated with my health condition.	1	2	3	4	5
4	I know what each of my prescribed medication does.	1	2	3	4	5
5	I am confident that I can tell when I need to get medical care and when I can handle a health problem myself.	1	2	3	4	5
6	I am confident I can tell my health care provider concerns I have even when he or she does not ask.	1	2	3	4	5
7	I am confident that I can follow through on medical treatments I need to do at home.	1	2	3	4	5
8	I understand the nature and causes of my health condition(s).	1	2	3	4	5
9	I know the different medical treatment options available for my health condition.	1	2	3	4	5

		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
10	I have been able to maintain (keep up with) lifestyle changes, like eating right or exercising	1	2	3	4	5
11	I know how to prevent problems with my health	1	2	3	4	5
12	I am confident I can figure out solutions when new problems arise with my health	1	2	3	4	5
13	I am confident that I can maintain lifestyle changes, like eating right and exercising, even during times of stress	1	2	3	4	5

Section F

Instructions
This survey asks you about how satisfied you are with the **current level** of pain and function in your knee.
Please **tick one response** for each question.

1- Currently, how satisfied are you with the pain level of your knee while sitting?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

2- Currently, how satisfied are you with the pain level of your knee while lying in bed?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

3- Currently, how satisfied are you with your knee function while getting out of bed?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

4- Currently, how satisfied are you with your knee function while performing light household duties?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

5- Currently, how satisfied are you with your knee function while performing leisure recreational activities?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

Section G

Instructions
We would like to know your views on what you expect from your knee replacement surgery.
Please **tick one response** for each question.

What do you expect to accomplish with your knee replacement:

1- Do you expect your knee joint replacement surgery will relieve your knee pain?

○ no, not at all
○ yes, a little bit
○ yes, somewhat
○ yes, a moderate amount
○ yes, a lot

2- Do you expect your surgery will help you carry out your normal activities of daily living?

○ no, not at all
○ yes, a little bit
○ yes, somewhat
○ yes, a moderate amount
○ yes, a lot

3- Do you expect your surgery will help you perform leisure, recreational or sports activities?

○ no, not at all
○ yes, a little bit
○ yes, somewhat
○ yes, a moderate amount
○ yes, a lot

Section H

Instructions
Using the scale below (from 1-10), please circle the number which best indicates how uncertain/certain you are of the following statements.

1. How certain are you that you can decrease your pain quite a bit?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

2. How certain are you that you can keep your arthritis pain from interfering with your sleep?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

3. How certain are you that you can keep your arthritis pain from interfering with the things you want to do?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

4. How certain are you that you can regulate your activity so as to be active without aggravating your arthritis?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

5. How certain are you that you can keep the fatigue caused by your arthritis from interfering with the things you want to do?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

6. How certain are you that you can do something to help yourself feel better if you are feeling blue?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

7. As compared with other people with arthritis like yours, how certain are you that you can manage pain during your daily activities?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

8. How certain are you that you can deal with the frustration of arthritis?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

Section J Instructions: The following questions relate any restriction you may feel while participating in life roles.

To what extent has your participation been restricted in the following areas **over the last 12 months? (please tick)**

	Does not apply to me	Not at all restricted	Mildly restricted	Moderately restricted	Severely restricted	Completely restricted
Education and Training						
Employment or Job Seeking						
Community Life (e.g. volunteering, neighbourhood watch)						
Family Life						
Socialising (e.g. meeting friends)						
Shopping						
Living with Dignity						
Leisure /Cultural Activities						
Sports or Physical Recreation						
Religion						
Hospital Services						
Mental Health Services						
Community Based Health Services (e.g. GPs, nurses, dentists)						

END OF QUESTIONNAIRE.

Thank you for taking part in this study. The time and effort involved in filling out this questionnaire is really appreciated. Your contribution will help significantly in the completion of my postgraduate study.

I will be in touch again in 6 months to check your progress and see how you are getting on after your surgery.

Wishing you the best of luck going forward with your surgery and a full and smooth recovery.

Best wishes,

Joanne Brennan

PLEASE RETURN TO THE RESEARCHER.

If you are returning this questionnaire by post, please use the prepaid envelope and return to the address provided:

Joanne Brennan
Department of Psychology,
Maynooth University,
Maynooth,
Co. Kildare.

Time 2 Questionnaire

Section A

Instructions

The following survey asks for some general information about you. Please fill out the survey using the instructions provided for each question.

Today's Date _____ /_____ / _____
DD MM YYYY

Follow-up Information

1. Contact No.:_____

2. Height (ft' in'') **3. Weight (St lbs)**

4. Employment (please tick)

○ Retired (normative retirement)
○ Retired due to knee problem
○ Retired due to health problems unrelated to the knee
○ Full-time or Part-time employment
○ Unemployed
○ Homemaker

5. Reason for knee replacement
○ Osteoarthritis
○ Rheumatoid arthritis
○ Trauma
○ Other (Please specify)

_____

6. Length of stay from day of surgery to discharge (days)

_____

7. Did you experience any of the following complications during/after your knee replacement surgery (Please tick)?

○ Infection
○ Bleeding
○ Blood Clot
○ Damage to arteries/ nerves/ ligaments/ tendons
○ Numbness
○ Other (please specify)

_____

8. Did you experience any of the following life events in the last 6 months (please tick)?

○ Death of a loved one
○ Moving house
○ Divorce/ Separation
○ Losing a job (involuntarily unemployed)
○ Having/ adopting a child
○ Other (please specify)

_____

Section B

Instructions
This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. **Answer each question by ticking just one answer**.

1. In general, would you say your health is:

1. Excellent ☐ 2. Very good ☐ 3. Good ☐ 4. Fair ☐ 5. Poor ☐

The following questions are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
2. Moderate activities such as moving a table, pushing a vacuum cleaner or playing golf.	☐	☐	☐
3. Climbing several flights of stairs	☐	☐	☐

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities **because of your physical health?**

	All of the time	*Most of the time*	*Some of the time*	*A little of the time*	*None of the time*
4. Accomplished less than you would like.	☐	☐	☐	☐	☐
5. Were limited in the **kind** of work or other activities.	☐	☐	☐	☐	☐

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities **because of any emotional problems** (such as feeling depressed or anxious)?

	All of the time	*Most of the time*	*Some of the time*	*A little of the time*	*None of the time*
6. Accomplished less than you would like.	☐	☐	☐	☐	☐
7. Did work or activities less carefully than usual.	☐	☐	☐	☐	☐

8. **During the past 4 weeks,** how much did pain interfere with your normal work (including work outside the home and housework)?

1. Not at all ☐ 2. A little bit ☐ 3. Moderately ☐ 4. Quite a bit ☐ 5. Extremely ☐

These questions are about how you have been feeling during the <u>past 4 weeks.</u>

For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the <u>past 4 weeks</u>…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
9. Have you felt calm and peaceful?	☐	☐	☐	☐	☐
10. Did you have a lot of energy?	☐	☐	☐	☐	☐
11. Have you felt down-hearted and blue?	☐	☐	☐	☐	☐

12. **During the past 4 weeks,** how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

6. All of the time ☐
7. Most of the time ☐
8. Some of the time ☐
9. Little of the time ☐
10. None of the time ☐

Section C

Instructions: The following questions ask how you feel about your knee and how well you are able to carry out your usual daily activities. **Please tick only one box** underneath the response that best suits you.

Symptoms

1. Do you have swelling in your knee?

Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always ☐

2. Do you feel grinding, hear clicking or any other type of noise when your knee moves?

Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always ☐

3. Does your knee catch or hang up when moving?

Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always ☐

4. Can you straighten your knee fully?

Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always ☐

5. Can you bend your knee fully?

Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always ☐

Stiffness

6. How severe is your knee joint stiffness after first awakening in the morning?

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

7. How severe is your knee stiffness after sitting, lying or resting later in the day?

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

Pain

8. How often do you experience knee pain?

Never ☐ Monthly ☐ Weekly ☐ Daily ☐ Always ☐

What amount of knee pain have you experienced the last week during the following activities?

9. Twisting/ pivoting on your knee

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

10. Straightening knee fully

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

11. Bending knee fully

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

12. Walking on a flat surface

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

13. Going up or down the stairs

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

14. At night while in bed

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

15. Sitting or Lying

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

16. Standing upright

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

Function, daily living

The following questions concern your physical function and how well you can perform your daily activities. Please indicate the degree of difficulty you have experienced in the last week due to your knee.

17. Descending stairs

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

18. Ascending stairs

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

19. Rising from sitting

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

20. Standing

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

21. Bending to the floor/ picking up an object from the floor

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

22. Walking on a flat surface

None Mild Moderate Severe Extreme

23. Getting in/out of the car

None Mild Moderate Severe Extreme

24. Going shopping

None Mild Moderate Severe Extreme

25. Putting on socks

None Mild Moderate Severe Extreme

26. Rising from bed

None Mild Moderate Severe Extreme

27. Taking off socks

None Mild Moderate Severe Extreme

28. Lying in bed (turning over, maintaining knee position)

None Mild Moderate Severe Extreme

29. Getting in/out of the bath

None Mild Moderate Severe Extreme

30. Sitting

None Mild Moderate Severe Extreme

☐ ☐ ☐ ☐ ☐

31. Getting on/off of the toilet

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

32. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc.)

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

33. Light domestic duties (cooking, dusting, etc.)

None ☐ Mild ☐ Moderate ☐ Severe ☐ Extreme ☐

Section D

Instructions:
We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, **please indicate the degree** to which you have these thoughts and feelings when you are experiencing pain.

RATING	0	1	2	3	4
MEANING	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time

When I'm in pain …

Number	Statement	Rating
1	I worry all the time about whether the pain will end.	
2	I feel I can't go on.	
3	It's terrible and I think it's never going to get any better.	
4	It's awful and I feel that it overwhelms me.	
5	I feel I can't stand it anymore.	
6	I become afraid that the pain will get worse.	
7	I keep thinking of other painful events.	
8	I anxiously want the pain to go away.	
9	I can't seem to keep it out of my mind.	
10	I keep thinking about how much it hurts.	
11	I keep thinking about how badly I want the pain to stop.	
12	There's nothing I can do to reduce the intensity of the pain.	
13	I wonder whether something serious may happen.	

Section E

Instructions
This survey asks you about how satisfied you are with the **current level** of pain and function in your knee.
Please **tick one response** for each question.

1- Currently, how satisfied are you with the pain level of your knee while sitting?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

2- Currently, how satisfied are you with the pain level of your knee while lying in bed?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

3- Currently, how satisfied are you with your knee function while getting out of bed?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

4- Currently, how satisfied are you with your knee function while performing light household duties?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

5- Currently, how satisfied are you with your knee function while performing leisure recreational activities?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

6– Overall, How satisfied are you with your replacement knee sugery?

Very Satisfied ○	Satisfied ○	Neutral ○	Dissatisfied ○	Very Dissatisfied ○

Section F

Instructions

We would like to know what you think about the expectations you had before your surgery. Please **tick one response** for each question.

Compared to what you expected before your knee replacement:

1- My expectations of pain relief were…

- ○ Too high- "I'm a lot worse than I thought"
- ○ Too high- "I'm somewhat worse than I thought"
- ○ Just right- "My expectations were met"
- ○ Too low- "I'm somewhat better than I thought"
- ○ Too low- "I'm a lot better than I thought"

2- My Expectations for being able to do my normal activities of daily living were…

- ○ Too high- "I'm a lot worse than I thought"
- ○ Too high- "I'm somewhat worse than I thought"
- ○ Just right- "My expectations were met"
- ○ Too low- "I'm somewhat better than I thought"
- ○ Too low- "I'm a lot better than I thought"

3- My expectations for being able to do my leisure, recreational or sports activities were…

- ○ Too high- "I'm a lot worse than I thought"
- ○ Too high- "I'm somewhat worse than I thought"
- ○ Just right- "My expectations were met"
- ○ Too low- "I'm somewhat better than I thought"
- ○ Too low- "I'm a lot better than I thought"

Section G

Instructions
Using the scale below (from 1-10), please circle the number which best indicates how uncertain/certain you are of the following statements.

1. How certain are you that you can decrease your pain quite a bit?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

2. How certain are you that you can keep your arthritis pain from interfering with your sleep?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

3. How certain are you that you can keep your arthritis pain from interfering with the things you want to do?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

4. How certain are you that you can regulate your activity so as to be active without aggravating your arthritis?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

5. How certain are you that you can keep the fatigue caused by your arthritis from interfering with the things you want to do?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

6. How certain are you that you can do something to help yourself feel better if you are feeling blue?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

7. As compared with other people with arthritis like yours, how certain are you that you can manage pain during your daily activities?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

8. How certain are you that you can deal with the frustration of arthritis?

very uncertain 1 2 3 4 5 6 7 8 9 10 very certain

Section J Instructions: The following questions relate any restriction you may feel while participating in life roles.

To what extent has your participation been restricted in the following areas **over the last 12 months? (please tick)**

	Does not apply to me	Not at all restricted	Mildly restricted	Moderately restricted	Severely restricted	Completely restricted
Education and Training						
Employment or Job Seeking						
Community Life (e.g. volunteering, neighbourhood watch)						
Family Life						
Socialising (e.g. meeting friends)						
Shopping						
Living with Dignity						
Leisure /Cultural Activities						
Sports or Physical Recreation						
Religion						
Hospital Services						
Mental Health Services						
Community Based Health Services (e.g. GPs, nurses, dentists)						

END OF QUESTIONNAIRE.

Thank you so much again for taking part in the second part of this study. The time and effort involved in filling out this questionnaire is really appreciated. Your contribution will help significantly in the completion of my postgraduate study.

I will be in touch again in 6 months to check your progress and see how you are getting on 1 year after your surgery.

Wishing you the best of luck going forward with your recovery.

Best wishes,

Joanne Brennan

PLEASE RETURN TO THE RESEARCHER.

If you are returning this questionnaire by post, please use the prepaid envelope and return to the address provided:

Joanne Brennan
Department of Psychology,
Maynooth University,
Maynooth,
Co. Kildare.

Appendix F: Supplementary Tables

Descriptive statistics for sex, employment, and marital status with patient-rated variables at Time 2

	Male	***Female***	***Working***	***Not Working***	***Married***	***Not Married/ Separated***
Variable	***Sex***		***Employment***		***Marital Status***	
	M (SD)	***M (SD)***	***M (SD)***	***M (SD)***	***M (SD)***	***M (SD)***
Pain Catastrophizing	3.95 (6.20)	9.38 (13.64)	8.85 (11.20)	6.30 (11.39)	4.60 (5.81)	11.56 (16.81)
Expectations	10.85 (3.07)	9.62 (3.07)	10.00 (3.49)	10.21 (3.00)	10.37 (3.67)	9.75 (2.57)
Self-efficacy	7.50 (2.16)	6.84 (1.87)	6.42 (2.25)	7.41 (1.85)	6.93 (2.20)	7.45 (1.61)
Physical health	45.13 (8.04)	44.23 (5.46)	41.19 (7.00)	45.97 (6.10)	44.18 (6.71)	45.46 (6.63)
Mental health	54.92 (8.33)	49.05 (10.17)	51.44 (10.10)	51.66 (9.81)	51.53 (10.40)	51.73 (8.80)
Pain intensity	18.50 (17.93)	25.67 (19.89)	30.77 (16.69)	19.32 (19.38)	23.33 (19.36)	21.09 (19.43)
Stiffness	30.00 (20.44)	30.29 (20.36)	44.23 (12.09)	24.62 (20.12)	31.67 (22.20)	27.34 (15.95)
Functional restriction	18.97 (17.24)	27.21 (18.12)	32.24 (15.39)	20.23 (18.05)	25.07 (18.99)	20.91 (16.29)
Satisfaction	31.20 (7.82)	27.23 (7.84)	25.69 (6.52)	30.24 (8.24)	29.73 (7.73)	27.50 (8.53)

Associations between demographic variables and psychosocial variables at Time 2

Variable	***Education***	***Age***	***Sex***		***Employment***		***Marital status***	
	F (df)	*r*	*t*	*Cohen's d*	*t*	*Cohen's d*	*t*	*Cohen's d*
Pain Catastrophizing	2.06 (4,45)	-.09	-1.65	.51	.69	.23	-2.07	.55
Expectations	.96 (4,45)	-.08	1.35	.40	-.21	.06	.64	.20
Self-efficacy	1.01 (4,45)	.39	1.09	.33	-1.53	.48	-.82	.27
Physical health	.94 (4,45)	.23	.45	.13	-2.30	.73	-.62	.19
Mental health	1.77 (4,45)	.16	2.10	.63	-.07	.02	-.06	.02
Pain intensity	1.03 (4,45)	-.37	-1.27	.38	1.87	.63	.37	.12
Stiffness	1.25 (4,45)	-.34	-.05	.01	3.27**	1.18	.69	.22
Functional restriction	.56 (4,45)	-.32	-1.56	.47	2.11	.72	.74	.24
Satisfaction	1.04 (4,45)	.26	1.70	.51	-1.78	.61	.90	.27