

## ORIGINAL ARTICLE

# The quality of recovery on discharge from hospital, a comparison between patients undergoing hip and knee replacement – a European study

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**Aims and objectives.** To describe and compare the quality of recovery on discharge from hospital among patients undergoing elective hip or knee replacement. The study will also attempt to identify any predicting factors.

**Background.** Arthroplasty is commonly used for an increasing population of patients with osteoarthritis, and the recovery process starts directly after surgery. Today's shorter hospital stay may be a challenge for the patients during the early period of recovery. It is therefore important to identify factors associated with quality of recovery at discharge from hospital.

**Design.** A descriptive, comparative study including 12 hospitals in 5 European countries; Cyprus, Finland, Greece, Iceland and Sweden.

**Methods.** Consecutively included patients responded on: health-related quality of life, and emotions before surgery and at hospital discharge; quality of recovery, patient satisfaction and fulfilment of knowledge expectations. Related factors and associations were analysed separately for each kind of arthroplasty. In total, 865 patients were included (hip  $n = 413$ , knee  $n = 452$ ).

**Results.** In the dimension of pain, patients undergoing hip replacement had significantly better quality of recovery compared to those undergoing knee replacement. Both patient groups experienced negative emotions before surgery that were related to poorer quality of recovery. Fulfilment of knowledge expectations has a limited effect on quality of recovery. Greater satisfaction with care predicted better quality of recovery.

### What does this paper contribute to the wider global clinical community?

- Negative preoperative emotions were related to poorer QoR, which emphasises the need for clinical interventions that focus on the patient's emotional state.
- Greater satisfaction with care was associated with better QoR. The other predicting factors, e.g. despair or hopelessness, differed between the two kinds of arthroplasty. Person-centred care tailored to each kind of arthroplasty is therefore needed.

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**Conclusions.** Negative preoperative emotions were related to poorer quality of recovery. For both kinds of arthroplasty, greater satisfaction with care was associated with better quality of recovery.

**Relevance to clinical practice.** The result emphasises the need to detect patients in need of support in their preparation and recovery process, taking into account the perspective of their emotional state.

**Key words:** fulfilment of knowledge expectations, health-related quality of life, hip replacement, knee replacement, preoperative emotional state, quality of recovery, satisfaction with care

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## Introduction

For the increasing population of patients with osteoarthritis, hip and knee replacements are successful treatments and they constitute a large proportion of arthroplasty operations performed throughout Europe. The incidence rates per 100,000 inhabitants were 157 for patients undergoing hip replacement and 113 for patients undergoing knee replacement in the Organisation for Economic Co-operation and Development (OECD) countries during 2012. There are substantial differences in hip and knee replacement rates in the OECD countries, and there are also considerable differences between hospitals and regions in the same country. These variations may be due to differences in the healthcare system, different indication criteria or the population age structure (OECD 2014). The Nordic countries have similar public healthcare systems and similar incidence rates for hip and knee replacement, but differences in types of implant (Lohmander *et al.* 2006). Greece has a national public healthcare system, whereas Cyprus has comparably sized systems of public and private healthcare (WHO/Europe 2015). The incidence rates are smaller in Greece and Cyprus compared with the Nordic countries (OECD 2014).

Arthroplasty is followed by a period of postoperative recovery. The recovery includes both biomedical issues and personal experiences. During recent years, medical advances, new approaches to care and a policy to reduce costs have resulted in shorter hospital stays after hip and knee replacements, from 6–10 to 3–5 days (Anastase *et al.* 2014). Most of the recovery period is therefore spent in the patient's home environment, and patients are expected to be more responsible for their own recovery. This can be problematic, and the patients may need support to handle challenges during the early period of recovery. To be able to identify patients at risk of poor Quality of Recovery

(QoR), it is important to identify factors that are related to QoR, for each kind of arthroplasty.

## Background

For patients undergoing hip or knee replacement, the recovery process starts directly after surgery, and improvements occur during the whole recovery period, even after several years (Browne *et al.* 2013). Our study focuses on the early period of recovery, at discharge from hospital. And with today's ever shorter hospital stays, patients need to be more responsible for their recovery. A distinction between the personal and social approach to recovery has been made previously (Vandekinderen *et al.* 2012), supported by a qualitative study where it was shown that the recovery process after hip replacement could lead to changes in personal and social functioning that patients did not always anticipate (Grant *et al.* 2009). In our study QoR is described from a personal, self-perceived perspective, and is defined using five dimensions of health; comfort, emotions, physical independence, patient support and pain (Gornall *et al.* 2013).

Patients' satisfaction has been reported to be high after many types of surgery and there is a relationship between some of the dimensions of recovery and satisfaction. For example, a strong relationship between postoperative pain, nausea or other postoperative complications and patient dissatisfaction has been reported (Myles *et al.* 2000, Royse *et al.* 2013). Improved health is one of the goals of arthroplasty, and that better health has a positive effect on Health-Related Quality of Life (HRQoL) is well known (Rasanen *et al.* 2007, Shan *et al.* 2014). A poor QoR in hospital predicts a poor HRQoL after surgery (Berg *et al.* 2012). In these earlier studies, patients' satisfaction and HRQoL were measured as an outcome after surgery. The authors have not found any studies examining whether

patient satisfaction and HRQoL can predict QoR, and this study aims to remedy this.

Negative correlations between QoR and length of hospital stay have been found, and pain affects recovery negatively (Eriksson *et al.* 2013, Gornall *et al.* 2013). Women have been shown to recover faster directly after general anaesthesia, but their overall QoR, during the first three postoperative days, is poorer compared with males (Buchanan *et al.* 2011). Age does not seem to influence recovery after hip or knee replacement (Hamel *et al.* 2008). A reduction in preoperative anxiety, depressive symptoms and uncertainty has been shown to have a positive impact on postoperative recovery (Kagan & Bar-Tal 2008, Duivenvoorden *et al.* 2013).

At the European Union level, improving and supporting patient empowerment and patient-centred care has been emphasised (EU 2012). Empowering knowledge also emphasises the capacity and knowledge of the patients, and the definition is based on a multidimensional model including the bio-physiological, functional, experiential, ethical, social and financial dimensions (Valkeapää *et al.* 2014). The assumption is that if patients have their knowledge expectations fulfilled they will have the possibility to become empowered concerning their own health. Results from the project that this study is a part of show that patients undergoing hip or knee replacement expect a wide range of knowledge, and those expectations are not adequately met during the hospital stay (Ingadottir *et al.* 2014, Johansson Stark *et al.* 2014, Klemetti *et al.* 2014). Patients may therefore lack empowering knowledge, which can affect the recovery process.

Patient education has resulted in an increased level of knowledge, as well as a positive effect on postoperative daily activities. Patient education is closely linked to the recovery process and promotes early recovery (Murphy *et al.* 2011, Tay Swee Cheng *et al.* 2015). The relationship between unfulfilled knowledge expectations and QoR has not been studied before, and is relevant to study during the early period of recovery.

Previous, single-centre studies show that patients undergoing hip replacement improve better in postoperative function compared with those undergoing knee replacements (O'Brien *et al.* 2009, Choi *et al.* 2012). This difference has also been found in self-perceived recovery (de Beer *et al.* 2012). In our multicentre study we compare QoR between those two types of arthroplasty in a larger sample than previous single-centre studies have done. In addition, we have included several factors that together may explain differences in QoR.

This study aims to describe and compare the QoR on discharge from hospital between patients undergoing elective hip or knee replacement. The study will also attempt to identify any predicting factors.

Research questions:

What are the differences in QoR between patients undergoing hip or knee replacement?

Do patients' background factors, HRQoL, length of hospital stay, fulfilment of knowledge expectations, satisfaction with care and emotional state predict patients' QoR?

## Methods

### Design

This descriptive, comparative, multicentre study with data collected by questionnaires before surgery and at hospital discharge after hip or knee replacement is part of a European project (Valkeapää *et al.* 2014). The results are based on data from five countries, with approximately the same number of patients undergoing the two kinds of arthroplasty in each country. Data were collected during 2009–2012.

### Study population

The population consisted of patients with osteoarthritis on waiting lists for hip or knee replacement. Participants were recruited from 12 public nonrandom community and university hospitals in Cyprus (two hospitals), Finland (two hospitals), Greece (three hospitals), Iceland (three hospitals) and Sweden (two hospitals). Inclusion criteria were as follows: age  $\geq 18$  years, able to complete the questionnaires and able to understand one of the following languages: Finnish/Greek/Icelandic/Swedish. The total sample consisted of 1187 patients, and of these 865 (73%) were included in the analyses (hip;  $n = 413$ , knee;  $n = 452$ ). Of the 245 nonresponders, those undergoing hip replacement had a higher level of professional education ( $p = 0.025$ ) compared with the 1187 responders. No difference was found for those excluded due to missing data ( $n = 77$ ) compared with the 865 included patients (Fig. 1).

### Measurements

Health-related quality of life, knowledge expectations and emotional state were assessed before surgery, whereas QoR, satisfaction with care and received knowledge were assessed at discharge from hospital by using self-reported instruments.

#### *Health-related quality of life*

EQ-5D was used to measure HRQoL before surgery. It is a validated instrument that has been used in several European

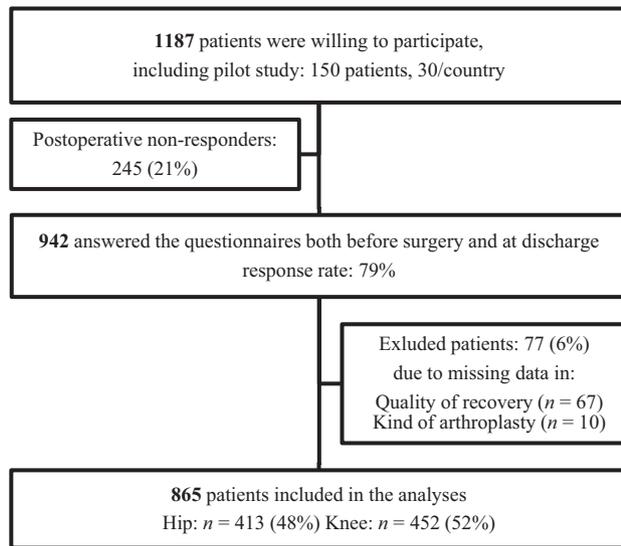


Figure 1 Flow chart of participant recruitment.

countries and is recommended for orthopaedic patients (Rabin & de Charro 2001, Goodwin *et al.* 2011). The instrument consists of two parts, the EQ visual analogue scale (EQ VAS) with a vertical scale ranging from 0 = worst imaginable health state, to 100 = best imaginable health state, and the EQ-5D descriptive system including five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has three levels: 1 = no problems, 2 = some problems and 3 = extreme problems. According to the user guide (Euro-Qol 2015), the EQ5D scores were converted into a single summary EQ-5D index quantifying health status. The index ranges from -0.595 to 1, and has 243 possible health outcomes. The higher the index score, the better the patient's perceived HRQoL. Nonresponders on any of the dimensions were treated as missing data.

#### Preoperative emotional state

The prevalence and frequency of nine emotions (hope, concern, impatience, uncertainty, anxiety, fear, depressive state, grief, despair or hopelessness) were measured. Response options were as follows: 1 = not at all, 2 = rarely, 3 = sometimes and 4 = very often. Response options  $\geq 2$  constituted the prevalence (Heikkinen *et al.* 2012).

#### Quality of recovery

Quality of recovery was assessed by the validated 40-item instrument, QoR-40 (Gornall *et al.* 2013), which includes five dimensions of health; comfort (12 items, e.g. breathe easy, good sleep, enjoy food, feeling restless), emotions (9 items, e.g. feeling comfortable, anxious, depressed),

physical independence (5 items, e.g. able to return to work or usual activities, have normal speech), patient support (7 items, e.g. able to communicate, support from doctors, nurses, family or friends, feeling confused) and pain (7 items e.g. pain, headache, sore throat). Response options for each item ranged from 1 = none of the time to 5 = all of the time. For negative items the scale was reversed before analysis. The global score ranged from 40 = extremely poor QoR to 200 = excellent QoR. In this study, Cronbach's alpha for the five dimensions ranged from 0.70–0.88, and 0.93 for the global score.

#### Patients' satisfaction with care

The Patient Satisfaction Scale (PSS) was used to measure satisfaction with care. This 11-item instrument includes: components of care needs (technical/scientific, information and interaction/support) and evaluative criteria (accessibility, ability/competency and conduciveness). The response options were as follows: 1 = very dissatisfied, 2 = dissatisfied, 3 = satisfied, 4 = very satisfied. Patient satisfaction was the mean score of the 11 items, and higher scores indicated more satisfaction with care. The instrument has been used in different European countries and has good psychometric properties (Suhonen *et al.* 2012), Cronbach's alphas coefficient range from 0.84–0.86. In our study, the Cronbach's alpha of the scale was 0.96.

#### Empowering knowledge

The structured instruments, Knowledge Expectations of hospital patients (KE<sub>hp</sub>) and Received Knowledge of hospital patients (RK<sub>hp</sub>), are two 40-item scales with parallel questions which measure empowering knowledge defined as six dimensional (Leino-Kilpi *et al.* 2005). In our study, the total scale is reported. Response options for each item were categorised from 1 = fully disagree to 4 = fully agree and 0 = not applicable. The score of the total scale was the mean of all 40 items. High scores indicated high knowledge expectations or a high level of received knowledge. Differences were calculated by subtracting expected knowledge from received knowledge. The possible range was from -3 to 3. A negative difference meant that patients had higher knowledge expectations than perceptions of received knowledge, and were defined as unfulfilled knowledge expectations. Patients with no or a positive difference were defined as experiencing fulfilled knowledge expectations. The instruments have been tested for content validity (Leino-Kilpi *et al.* 2005, Heikkinen *et al.* 2007) and reliability (Klemetti *et al.* 2014, Valkeapää *et al.* 2014). In our study, the Cronbach's alpha was 0.98 for the KE<sub>hp</sub> and RK<sub>hp</sub> scales.

### Background data

Data were collected on patients' characteristics: age, sex, educational level, employment status, whether the patients were undergoing hip or knee replacement and whether it was their first or second arthroplasty. The patients were also asked for other background data: the length of their present hospital stay and if their hospital stay had been as expected or not.

### Procedures

A translation procedure, including back-translation, was performed for instruments that were not already translated into all required languages. Questionnaires were piloted in each country in a corresponding group of 30 patients per country (Fig. 1) and were shown to be understandable and easy to complete. No changes were required after piloting. The procedure is presented in more detail in Klemetti *et al.* (2014) and Valkeapää *et al.* (2014).

Before surgery, all patients received written information about the study, and signed informed consent forms. The first questionnaire was sent to the patients' homes or given to patients on admission to hospital. After surgery and before discharge, the questionnaire was distributed to all patients who had answered the first questionnaire. The participants returned the completed questionnaires to mailboxes on the wards or sent them back by prepaid envelope to a member of the research group within a few days.

### Ethical considerations

All relevant permissions and ethical approval were obtained (Valkeapää *et al.* 2014) and good ethical research praxis, according to the Helsinki Declaration, was followed. All participants were informed of the purpose of the study, about the principles of voluntary participation and confidentiality, and they provided their written informed consent.

### Statistical analysis

Descriptive statistics were used to describe the sample. The normality of the global score of QoR was tested visually, and by Shapiro–Wilks test (0.937, *df* 839,  $p < 0.001$ ). The data were negatively skewed and were normalised by using a log transformation. The results were similar when comparing the ordinary, and the normalised scale which resulted in the decision to use the ordinary scale and parametric tests. For the scales, internal consistency was tested with Cronbach's alpha.

Differences between patients undergoing hip or knee replacement were calculated with a *t*-test for independent samples or Chi-square when appropriate. The differences between received and expected knowledge (empowering knowledge) were calculated with a paired sample *t*-test ( $RK_{hp} - KE_{hp}$ ).

The relations between QoR and participants' characteristics, background data or other related factors were tested separately for patients undergoing hip or knee replacement by one-way ANOVA followed by *post hoc* Bonferroni, by *t*-test for independent samples or by Pearson's correlation coefficient, when appropriate.

To compare patients undergoing hip or knee replacement, linear regression analysis, with the global score of QoR as a dependent variable, was carried out separately for those two kinds of arthroplasty. Dummy variables were created for the countries, and adjustments were made with Sweden as the reference category. Variables related to QoR were chosen as independent variables. In the first step, sex, professional education, length of hospital stay, whether hospital stay was experienced as expected, satisfaction with care, EQ-5D index and EQ VAS before surgery and fulfilment of knowledge expectations were used. A second step was added in combination with the other independent variables. In this step the prevalence of concern, impatience, uncertainty, anxiety, fear, depressive state, grief, despair or hopelessness before surgery was added. Multicollinearity was assessed with the Variance Inflation Factor (VIF). To illustrate the model development, adjusted  $R^2$  change was used.

Internal missing data ranged between 0–10%. For QoR, questionnaires with four or more missing items were excluded from the analyses; for the remaining questionnaires with 1–3 missing items, imputations were carried out. Approximately 1% of each item was missing and was replaced with the median value of remaining items in the same dimension. The level of statistical significance was set at  $p < 0.05$ . Data were analysed using IBM SPSS® statistics for Windows, version 22, Armonk, NY: IBM Corp.

## Results

### Characteristics of the sample

Patients' characteristics and factors related to QoR are presented in Table 1. Females constituted the majority for both kinds of arthroplasty. Patients undergoing hip replacement were younger and a higher proportion of them were employed compared with patients undergoing knee replacement. Hip replacement patients also had a higher level of education.

**Table 1** Sample characteristics, and related factors,  $n = 865$ 

|   | Hip replacement<br>$n = 413$ (48%) | Knee replacement<br>$n = 452$ (52%) | $p$ -Value        |
|---|------------------------------------|-------------------------------------|-------------------|
| Age in years  |                                    |                                     |                   |
| Mean ( $\pm$ SD)                                    | 65 ( $\pm$ 12)                     | 67 ( $\pm$ 9)                       | <b>0.002*</b>     |
| (min-max)   | (28-91)                            | (35-90)                             |                   |
| Sex $n$ (%)   |                                    |                                     |                   |
| Female  | 220 (53)                           | 273 (61)                            | <b>0.028†</b>     |
| Professional education $n$ (%)                      |                                    |                                     |                   |
| None  | 155 (42)                           | 214 (53)                            | <b>0.005†</b>     |
| Secondary level                                     | 86 (23)                            | 93 (23)                             |                   |
| College level                                       | 79 (21)                            | 57 (14)                             |                   |
| Academic level                                      | 53 (14)                            | 43 (11)                             |                   |
| Employment status $n$ (%)                           |                                    |                                     |                   |
| Employed  | 154 (39)                           | 109 (26)                            | <b>&lt;0.001†</b> |
| Retired   | 210 (54)                           | 252 (60)                            |                   |
| Stay at home  | 20 (5)                             | 53 (12)                             |                   |
| Unemployed/job applicant                            | 6 (2)                              | 9 (2)                               |                   |
| History of employment in social/health care $n$ (%) |                                    |                                     |                   |
| Yes   | 80 (20)                            | 73 (17)                             | 0.206†            |
| Earlier arthroplasty $n$ (%)                        |                                    |                                     |                   |
| First arthroplasty                                  | 311 (76)                           | 321 (72)                            | 0.233†            |
| Second or more arthroplasty                         | 98 (24)                            | 122 (28)                            |                   |
| Health-related quality of life mean ( $\pm$ SD)     |                                    |                                     |                   |
| EQ-5D index, before surgery                         | 0.58 ( $\pm$ 0.19)                 | 0.59 ( $\pm$ 0.21)                  | 0.511*            |
| EQ visual analogue scale, before surgery            | 56 ( $\pm$ 21)                     | 60 ( $\pm$ 20)                      | <b>0.014*</b>     |
| Emotions, prevalence before surgery‡ $n$ (%)        |                                    |                                     |                   |
| Hope  | 387 (97)                           | 416 (98)                            | 0.327†            |
| Concern   | 348 (86)                           | 385 (87)                            | 0.557†            |
| Impatience  | 318 (80)                           | 357 (82)                            | 0.385†            |
| Uncertainty   | 289 (73)                           | 282 (66)                            | <b>0.050†</b>     |
| Anxiety   | 277 (70)                           | 314 (72)                            | 0.541†            |
| Fear  | 280 (70)                           | 294 (67)                            | 0.371†            |
| Depressive state                                    | 226 (57)                           | 210 (49)                            | <b>0.025†</b>     |
| Grief   | 215 (54)                           | 240 (55)                            | 0.709†            |
| Despair or hopelessness                             | 205 (51)                           | 218 (50)                            | 0.715†            |
| Hospital stay in days                               |                                    |                                     |                   |
| Mean ( $\pm$ SD)                                    | 8 ( $\pm$ 6)                       | 8 ( $\pm$ 6)                        | 0.839*            |
| Hospital stay as expected $n$ (%)                   |                                    |                                     |                   |
| Yes   | 370 (91)                           | 407 (92)                            | 0.702†            |
| Satisfaction with care mean ( $\pm$ SD)             | 3.35 ( $\pm$ 0.64)                 | 3.37 ( $\pm$ 0.66)                  | 0.736*            |
| Fulfilment of knowledge expectations $n$ (%)        |                                    |                                     |                   |
| Fulfilled expectations                              | 102 (27)                           | 138 (33)                            | 0.055†            |
| Unfulfilled expectations                            | 272 (73)                           | 277 (67)                            |                   |

\* $t$ -test for independent samples.

†Chi-square test.

‡Prevalence = Score  $\geq 2$ , 1 = not at all, 2 = rarely, 3 = sometimes, 4 = very often.Bold values are significant  $p$ -values.

### Quality of recovery

When comparing QoR among the countries, patients in Cyprus had significantly poorer QoR ( $p = <0.001$ ) compared with the other countries; mean differences for hip replacement ranged from  $-26.3$  (Sweden) to  $-37.2$  (Iceland), whereas mean differences for knee replacement

ranged from  $-17.7$  (Sweden) to  $-28.2$  (Iceland). Iceland had significantly higher QoR compared with Sweden; the mean difference for hip replacement was  $10.8$  ( $p = <0.001$ ), whereas for knee replacement it was  $10.5$  ( $p = 0.005$ ).

The global score of QoR is presented in Table 2. Greek patients undergoing hip replacement had significantly higher QoR compared with those undergoing knee replacement.

**Table 2** Quality of Recovery (QoR), global score, comparisons between patients undergoing hip ( $n = 413$ ) or knee ( $n = 452$ ) replacement per country

| QoR, global score<br>min–max score, 40–200 | Hip<br>$n$ (%) | Knee<br>$n$ (%) | Hip<br>mean ( $\pm$ SD) | Knee<br>mean ( $\pm$ SD) | $p$ -Value*  |
|--|----------------|-----------------|-------------------------|--------------------------|--------------|
| Cyprus                                     | 60 (41)        | 85 (59)         | 139.3 (23.2)            | 146.6 (26.7)             | 0.080        |
| Finland                                    | 80 (53)        | 70 (47)         | 172.5 (20.2)            | 168.1 (19.9)             | 0.182        |
| Greece                                     | 65 (37)        | 110 (63)        | 173.7 (14.3)            | 168.1 (19.1)             | <b>0.030</b> |
| Iceland                                    | 90 (48)        | 97 (52)         | 176.5 (16.2)            | 174.8 (15.7)             | 0.481        |
| Sweden                                     | 118 (57)       | 90 (43)         | 165.6 (19.4)            | 164.3 (19.8)             | 0.635        |

\* $t$ -test for independent samples.

In the dimension of pain, patients undergoing hip replacement had significantly better QoR compared to patients undergoing knee replacements (Table 3). Negative correlations between QoR (global score) and length of hospital stay were found for both kinds of arthroplasty; hip;  $-0.352$ , knee;  $-0.374$  ( $p = 0.01$ ). QoR was better for patients who experienced the hospital stay as expected (Table 4).

### Factors related to quality of recovery

#### Patients' satisfaction with care

There were no differences in satisfaction with care between patients undergoing hip or knee replacement, for the total scale (Table 1). In addition, positive correlations between satisfaction with care and QoR were found for hip and knee replacement, with scores of 0.441 and 0.342 ( $p = 0.01$ ), respectively.

#### Emotional state

Most of the patients experienced hope (97%), and between 49–87% experienced different kinds of negative emotions before surgery. Patients undergoing hip replacement were

more depressed and uncertain compared with patients undergoing knee replacement (Table 1). For both kinds of arthroplasty; patients experiencing negative emotions had poorer QoR compared with those not experiencing negative emotions before surgery (Table 4).

#### Health-related quality of life

Patients undergoing hip replacement had lower EQ VAS compared with patients undergoing knee replacement, whereas no significant differences were found regarding EQ-5D index (Table 1). Positive correlations between QoR and EQ-5D index (hip: 0.302, knee: 0.362) as well as EQ VAS (hip: 0.177, knee: 0.243) were found ( $p = 0.01$ ).

#### Fulfilment of knowledge expectations

The majority of patients had unfulfilled knowledge expectations. No difference between patients undergoing hip or knee replacement was found (Table 1). Patients with fulfilled knowledge expectations and undergoing knee replacement had higher QoR compared with those having unfulfilled expectations (Table 4).

### Factors explaining the variance in quality of recovery

For patients undergoing hip replacement, factors explaining the variance in QoR in the first model were as follows: satisfaction with care, whether the hospital stay was realised as expected and length of hospital stay (adj.  $R^2$  hip = 0.491). In the second model, when preoperative emotions were added, these three factors remained and despair or hopelessness was added as an explaining factor (adj.  $R^2 = 0.522$ ). The change in explained variance was 3.1%. For patients undergoing knee replacement, the first model resulted in satisfaction with care and length of hospital stay. In the second model, the only remaining factor explaining the variance in QoR was satisfaction with care (adj.  $R^2 = 0.439$ ). The change in explained variance was 4.4% (Table 5). No multicollinearity was found for any of

**Table 3** Differences in Quality of Recovery (QoR) between patients undergoing hip or knee replacement

| QoR-40<br>Dimensions     | Min–Max<br>score | Hip<br>replacement<br>mean ( $\pm$ SD) | Knee<br>replacement<br>mean ( $\pm$ SD) | $p$ -Value*  |
|--------------------------|------------------|--|---|--------------|
| Comfort                  | 12–60            | 50.6 (7.2)                             | 49.9 (7.6)                              | 0.166        |
| Emotions                 | 9–45             | 37.3 (6.1)                             | 36.8 (6.4)                              | 0.184        |
| Physical<br>independence | 5–25             | 19.0 (4.5)                             | 19.0 (4.8)                              | 0.973        |
| Patient<br>support       | 7–35             | 30.8 (5.5)                             | 30.7 (5.4)                              | 0.818        |
| Pain                     | 7–35             | 29.0 (4.3)                             | 28.3 (4.4)                              | <b>0.025</b> |
| Global score             | 40–200           | 166.8 (22.3)                           | 164.7 (22.4)                            | 0.187        |

\* $t$ -test for independent samples.

**Table 4** Background factors and emotional state related to Quality of Recovery (QoR) for patients undergoing hip (*n* = 413) or knee (*n* = 452) replacement (only significant results are reported in the table)

|                                      | QoR global score*<br>mean (±SD)<br>Hip | <i>p</i> -Value     | QoR global score*<br>mean (±SD)<br>Knee | <i>p</i> -Value     |
|--------------------------------------|--|---------------------|---|---------------------|
| Sex                                  |  | 0.723 <sup>†</sup>  |   | 0.006 <sup>†</sup>  |
| Female vs.                           | 166.4 (20.4)                           |                     | 162.5 (22.0)                            |                     |
| Male                                 | 167.2 (24.3)                           |                     | 168.4 (22.7)                            |                     |
| Professional education‡              |  | 0.007 <sup>§</sup>  |   | 0.098 <sup>§</sup>  |
| None vs.                             | 162.4 (24.1)                           |                     | 163.1 (23.4)                            |                     |
| College level                        | 173.1 (17.4)                           | 0.003 <sup>¶</sup>  | 170.8 (19.0)                            | 0.125 <sup>¶</sup>  |
| Fulfilment of knowledge expectations |  | 0.279 <sup>†</sup>  |   | 0.012 <sup>†</sup>  |
| Fulfilled expectations vs.           | 169.3 (25.2)                           |                     | 168.9 (23.9)                            |                     |
| Unfulfilled expectations             | 166.2 (21.2)                           |                     | 163.0 (21.8)                            |                     |
| Hospital stay as expected            |  | <0.001 <sup>†</sup> |   | 0.004 <sup>†</sup>  |
| Yes vs.                              | 168.1 (21.8)                           |                     | 165.7 (22.1)                            |                     |
| No                                   | 153.7 (23.3)                           |                     | 154.3 (22.7)                            |                     |
| Emotions, before surgery**           |  |                     |   |                     |
| Concern                              |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 164.7 (±22.6)                          |                     | 162.4 (±22.8)                           |                     |
| No                                   | 177.8 (±17.1)                          |                     | 178.9 (±13.6)                           |                     |
| Impatience                           |  | <0.001 <sup>†</sup> |   | 0.021 <sup>†</sup>  |
| Yes vs.                              | 164.1 (±22.5)                          |                     | 163.3 (±22.7)                           |                     |
| No                                   | 175.0 (±19.8)                          |                     | 169.8 (±20.2)                           |                     |
| Uncertainty                          |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 163.1 (±22.2)                          |                     | 160.9 (±23.2)                           |                     |
| No                                   | 174.6 (±20.2)                          |                     | 171.1 (±19.4)                           |                     |
| Anxiety                              |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 162.5 (22.6)                           |                     | 161.6 (22.6)                            |                     |
| No                                   | 175.1 (19.4)                           |                     | 171.2 (20.3)                            |                     |
| Fear                                 |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 161.5 (±22.7)                          |                     | 160.1 (±22.3)                           |                     |
| No                                   | 177.8 (±16.8)                          |                     | 173.5 (±19.6)                           |                     |
| Depressive state                     |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 158.9 (±22.9)                          |                     | 156.8 (±23.3)                           |                     |
| No                                   | 175.8 (±17.6)                          |                     | 171.4 (±19.3)                           |                     |
| Grief                                |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 158.3 (±23.9)                          |                     | 157.8 (±22.8)                           |                     |
| No                                   | 175.4 (±16.3)                          |                     | 172.6 (±18.9)                           |                     |
| Despair or hopelessness              |  | <0.001 <sup>†</sup> |   | <0.001 <sup>†</sup> |
| Yes vs.                              | 157.7 (±23.6)                          |                     | 157.9 (±23.3)                           |                     |
| No                                   | 175.4 (±16.6)                          |                     | 170.8 (±19.1)                           |                     |

\*Possible range 40–200.

<sup>†</sup>*t*-test for independent samples.

<sup>‡</sup>Only significant results of the response options: none, secondary, college or academic level are reported.

<sup>§</sup>One-way ANOVA.

<sup>¶</sup>*post hoc* Bonferroni.

\*\*No = 1, Yes = Score ≥2 (1 = not at all, 2 = rarely, 3 = sometimes, 4 = very often).

the variables, the mean VIF was hip = 1.6 (range; 1.1–2.3) and knee = 1.6 (1.1–2.2).

## Discussion

In our study, despite a worse preoperative health state, patients undergoing hip replacement showed better QoR in

the dimension of pain, compared to those undergoing knee replacements. This finding, however, is different compared with earlier studies, which have shown greater overall improvements for patients undergoing hip replacement compared with those undergoing knee replacements, also in the early period of recovery (O'Brien *et al.* 2009, de Beer *et al.* 2012, Choi *et al.* 2012). Further research is needed to

**Table 5** Variables predicting for the Quality of Recovery (global score) for patients undergoing hip or knee replacement with adjustment for country

|  | Model I       |                  | Model II       |                  |
|--|---------------|------------------|----------------|------------------|
|  | B (SE)        | p-Value          | B (SE)         | p-Value          |
| <i>Hip replacement</i>                             |               |                  |                |                  |
| Constant (Sweden)                                  | 116.69 (1.20) | <0.001           | 139.32 (8.82)  | <0.001           |
| Cyprus   | -20.57 (3.58) | <0.001           | -21.85 (3.80)  | <0.001           |
| Finland  | 6.58 (2.90)   | 0.024            | 1.94 (3.31)    | 0.558            |
| Greece   | 6.23 (3.67)   | 0.090            | 1.84 (4.09)    | 0.652            |
| Iceland  | 12.04 (2.93)  | <0.001           | 8.81 (3.20)    | 0.006            |
| Sex*   | 1.05 (2.04)   | 0.609            | 0.36 (2.16)    | 0.867            |
| Professional education <sup>†</sup>                | 0.68 (0.94)   | 0.468            | 0.22 (0.98)    | 0.822            |
| Length of hospital stay <sup>‡</sup>               | -0.44 (0.17)  | <b>0.010</b>     | -0.34 (0.17)   | <b>0.041</b>     |
| Hospital stay realised as expected <sup>§</sup>    | 10.31 (3.61)  | <b>0.005</b>     | 9.79 (3.65)    | <b>0.008</b>     |
| Satisfaction with care <sup>¶</sup>                | 9.16 (1.65)   | <b>&lt;0.001</b> | 7.78 (1.72)    | <b>&lt;0.001</b> |
| EQ visual analogue scale (VAS), before surgery**   | 0.09 (0.05)   | 0.086            | 0.03 (0.05)    | 0.558            |
| EQ-5D index, before surgery <sup>††</sup>          | 8.84 (6.02)   | 0.143            | 1.52 (6.25)    | 0.808            |
| Fulfilment of knowledge expectations <sup>‡‡</sup> | 1.66 (2.28)   | 0.467            | 1.06 (2.32)    | 0.649            |
| Concern <sup>§§</sup>                              |               |                  | -1.06 (3.65)   | 0.772            |
| Impatience <sup>§§</sup>                           |               |                  | 0.60 (2.84)    | 0.833            |
| Uncertainty <sup>§§</sup>                          |               |                  | 0.72 (2.92)    | 0.807            |
| Anxiety <sup>§§</sup>                              |               |                  | -0.55 (2.92)   | 0.851            |
| Fear <sup>§§</sup>                                 |               |                  | -2.19 (2.96)   | 0.461            |
| Depressive state <sup>§§</sup>                     |               |                  | -5.29 (3.02)   | 0.081            |
| Grief <sup>§§</sup>                                |               |                  | 0.58 (2.76)    | 0.834            |
| Despair or hopelessness <sup>§§</sup>              |               |                  | -7.23 (2.81)   | <b>0.011</b>     |
| Adjusted R <sup>2</sup>                            | 0.491         |                  | 0.522          |                  |
| Adjusted R <sup>2</sup> change                     |               |                  | 0.031          |                  |
| <i>Knee replacement</i>                            |               |                  |                |                  |
| Constant (Sweden)                                  | 106.55 (8.78) | <0.001           | 133.73 (10.67) | <0.001           |
| Cyprus   | -4.18 (4.21)  | 0.322            | -14.35 (4.98)  | 0.004            |
| Finland  | 5.64 (3.31)   | 0.090            | 3.84 (3.66)    | 0.295            |
| Greece   | 10.90 (3.73)  | 0.004            | 7.37 (4.23)    | 0.082            |
| Iceland  | 15.07 (3.27)  | <0.001           | 11.94 (3.64)   | 0.001            |
| Sex*   | 1.39 (2.16)   | 0.117            | 2.71 (2.25)    | 0.231            |
| Professional education <sup>†</sup>                | 0.64 (1.07)   | 0.548            | 0.93 (1.10)    | 0.398            |
| Length of hospital stay <sup>‡</sup>               | -0.64 (0.21)  | <b>0.003</b>     | -0.39 (0.22)   | 0.074            |
| Hospital stay realised as expected <sup>§</sup>    | 5.75 (4.25)   | 0.177            | 1.84 (4.39)    | 0.675            |
| Satisfaction with care <sup>¶</sup>                | 10.64 (1.84)  | <b>&lt;0.001</b> | 9.56 (1.93)    | <b>&lt;0.001</b> |
| EQ VAS, before surgery**                           | 0.10 (0.06)   | 0.070            | 0.06 (0.06)    | 0.322            |
| EQ-5D index, before surgery <sup>††</sup>          | 13.04 (6.37)  | <b>0.041</b>     | 1.17 (6.94)    | 0.866            |
| Fulfilment of knowledge expectations <sup>‡‡</sup> | 0.75 (2.27)   | 0.742            | 0.51 (2.41)    | 0.832            |
| Concern <sup>§§</sup>                              |               |                  | -6.61 (3.86)   | 0.089            |
| Impatience <sup>§§</sup>                           |               |                  | 0.64 (2.89)    | 0.824            |
| Uncertainty <sup>§§</sup>                          |               |                  | -2.85 (2.76)   | 0.302            |
| Anxiety <sup>§§</sup>                              |               |                  | 2.23 (3.17)    | 0.482            |
| Fear <sup>§§</sup>                                 |               |                  | -0.69 (2.94)   | 0.815            |
| Depressive state <sup>§§</sup>                     |               |                  | -4.32 (2.86)   | 0.131            |

find out why these differences in QoR are smaller between hip and knee arthroplasty patients in our multicentre study compared with earlier single-centre studies. It has been concluded that analgesic needs are higher for patients undergoing knee replacement than those undergoing hip replacement. This means that patients undergoing hip

replacement have less postoperative pain (Anastase *et al.* 2014). It is possible that the smaller differences in our study are related to less pain, as new analgesia methods and operative techniques aimed at early mobilisation and shorter hospital stay have been developed during recent years (Anastase *et al.* 2014).

Table 5 (continued)

|                                | Model I |         | Model II     |         |
|--------------------------------|---------|---------|--------------|---------|
|                                | B (SE)  | p-Value | B (SE)       | p-Value |
| Grief§§                        |         |         | 0.27 (3.06)  | 0.929   |
| Despair or hopelessness§§      |         |         | -2.43 (2.87) | 0.398   |
| Adjusted R <sup>2</sup>        | 0.395   |         | 0.439        |         |
| Adjusted R <sup>2</sup> change |         |         | 0.044        |         |

\*0 = female, 1 = male.

†0 = none, 1 = Secondary, 2 = college level, 3 = academic level.

‡In days, range from 1–77.

§0 = No, 1 = Yes.

¶Range from 1 = very dissatisfied to 4 = very satisfied.

\*\*Range from 0 = worst imaginable health state to 100 = best imaginable health state.

††Range from 0–1, higher scores indicate better Health-Related Quality of Life.

‡‡0 = unfulfilled knowledge expectations, 1 = fulfilled knowledge expectations.

§§0 = not at all, 1 = rarely, sometimes, very often.

The relevance of emotional state has also been highlighted as a predictor of postoperative pain after hip or knee replacement as preoperative optimism has been found to be the main predictor of postoperative pain intensity (Pinto *et al.* 2013). A qualitative study of day surgery patients has shown that a positive attitude together with confidence in the situation favoured the recovery (Berg *et al.* 2013), and patients without depression, and undergoing knee replacements, have been shown to have better functional outcome (Caracciolo & Giaquinto 2005). In our study, one of the factors related to QoR, for both kinds of arthroplasty, was preoperative emotions. Patients experiencing feelings such as preoperative despair or hopelessness, concern or depressive state, had poorer QoR at discharge compared with those not experiencing such negative emotions. In addition, despair or hopelessness could explain the variance in QoR, but only for patients undergoing hip replacement. This result supports the view that a reduction in preoperative despair or hopelessness could have a positive impact on QoR. The present findings suggest that patients may improve their QoR by preoperative interventions promoting a more positive emotional state.

Another factor related to QoR was fulfilment of knowledge expectations. Patients undergoing knee replacement, and experiencing fulfilled knowledge expectations had better QoR, but this was not the case for patients undergoing hip replacement. On the other hand, fulfilment of knowledge expectations did not predict QoR for any of the two kinds of arthroplasty. Variables predicting for QoR differed between the two arthroplasty groups but there were also similarities. For example, patients' satisfaction with care explained the variance in QoR for both arthroplasty groups. Patients undergoing hip or knee replacement are

often treated together, and our results highlight the necessity to develop care that is customised to meet patients' personal needs, regardless of operative intervention. Patient-centred care is important for all groups of patients (de Boer *et al.* 2013). The results from our study may help nurses to identify factors related to recovery among the patients, where fulfilment of patients' knowledge expectations seems to have a limited effect on QoR. In contrast, if patients' satisfaction with care can be improved by person-centred care, tailored to each kind of arthroplasty, it may be possible to improve the early period of recovery in the patient's home environment.

As in other studies (Eriksson *et al.* 2013, Gornall *et al.* 2013), negative correlations between QoR and length of hospital stay was found in our study. Despite this result, short hospital stay may be a problem for the patients, as there are efforts to reduce costs of care nowadays e.g. with early discharge from hospital. One consequence of shorter hospital stay is that patients may need support from their family after discharge. A greater involvement of family care has been reported in southern, compared with northern Europe (Lamura *et al.* 2008, Sapountzi-Krepia *et al.* 2008), and there are more nurses per population in the Nordic countries compared with southern Europe (OECD 2014). Low female employment together with family traditions and shortage of nursing care staff are some reasons why the families are more involved during the early recovery process at hospitals in southern Europe (Lamura *et al.* 2008, Sapountzi-Krepia *et al.* 2008). Anyway, the countries included in our study represent countries with differences not only in family involvement but also in healthcare systems. In addition, regional differences within the included countries (Mäkelä *et al.* 2011) or influences of socioeco-

nomic factors and ethnicity (Krupic *et al.* 2013) as well as other differences between the countries may have had an effect on patients' QoR. For example, the operation can be performed at different stages of symptom appearance due to differences in economic conditions between included countries. But also differences in the population age structures in the regions from which patients were recruited can affect patients' QoR (OECD 2014). It is also possible that patients of different ethnicity have different perceptions of the QoR. Therefore, the results should be interpreted with caution even though adjustments were made for country.

The main purpose of this study was to identify factors that can predict patients' QoR, e.g. fulfilment of knowledge expectations. Results from the main European project show that fulfilment of patients' knowledge expectations can improve HRQoL (Koekenbier *et al.* 2015), and we were interested in finding out if the same relationship applies regarding QoR. Our results could not support any such relationship. Further studies, comparing QoR between the countries as well as analysing the relationships between patients' QoR and their HRQoL, can gain valuable knowledge that might improve QoR.

The nonrandom choice of hospitals is another reason that the results should be interpreted with caution, except for Iceland and Cyprus where all hospitals performing hip or knee replacement were included. The multicentre design increases the number of patients and minimises the bias that can occur in single-centre studies. One of the strengths of the study is the large sample size, which was one of the reasons to choose parametric tests.

Low internal missing data and the result of the pilot study indicated that the respondents found the questionnaires relevant and easy to understand. For the scales, the reliability, tested by using Cronbach's alphas, indicated good internal consistency,  $>0.80$ , except for the dimension of pain in QoR  $>0.70$ . The choice of using the ordinary scale of QoR even though it was skewed allows international comparisons of the results. QoR-40 is a widely used, validated instrument and has been advised to be used on short-term postoperative recovery (Gornall *et al.* 2013). To examine whether missing data had any bias, dropout analyses were performed which showed that nonresponders undergoing hip replacement had a higher level of professional education. As QoR was better for patients with a higher level of professional education undergoing hip replacement, this may have influenced the result. If those patients with a higher level of education had remained in the study, it might have strengthened the differences in QoR between the two arthroplasty groups.

## Conclusion

In the dimension of pain, patients undergoing hip replacement had significantly better QoR compared to those undergoing knee replacements. Preoperative despair or hopelessness could predict QoR, but only for patients undergoing hip replacement. For both kinds of arthroplasty; negative preoperative emotions were related to poorer QoR, whereas greater satisfaction with care was associated with better QoR. It was also concluded that fulfilment of knowledge expectations has a limited effect on QoR.

## Relevance to clinical practice

The result emphasises the need to improve patients' satisfaction with care by meeting their personal needs. To be able to detect patients in need of early support in their preparation and recovery process, it is important to identify factors related to QoR for each kind of arthroplasty. Nurses should therefore identify patients' emotional state before surgery and support them in moderating their negative emotions. Patients undergoing knee replacement need better pain management.

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## Disclosure

The authors have confirmed that all authors meet the ICMJE criteria for authorship credit ([www.icmje.org/ethical\\_1author.html](http://www.icmje.org/ethical_1author.html)), as follows: (1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content and (3) final approval of the version to be published.

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## Conflict of interest

No conflict of interest has been declared by the authors.

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