

# Improved Health-Related Quality of Life after Knee Arthroplasty Following an Outpatient Surgery Pathway: an Observational Comparative Case Study

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## Abstract

**Purpose:** Enhanced recovery pathways after knee arthroplasty have been introduced worldwide with positive results. The present study investigated the improvements of health-related quality of life and functional outcome in patients operated for knee arthroplasty who followed an Outpatient Surgery (OS) or Enhanced Recovery (ER) pathway.

**Methods:** We reviewed our institutional database of 361 consecutive patients undergoing knee arthroplasty (total and partial) who followed either the OS-pathway (n=94; 26.1%) or ER-pathway (n=267; 73.9%). Recorded outcomes included 4 different patient reported outcome measures (PROMs; EuroQol-5D (both index and VAS), Oxford Knee Score, Western Ontario and McMaster Universities Arthritis Index and the Pain-Numerical Rating Scale) obtained pre-and during the 3-and 12-months postoperative follow-up.

**Results:** 93 patients (99%) in the OS-group were discharged on the day of surgery as scheduled, whereas in the ER-group 70% of the patients were discharged <3 days postoperatively. At 12-month follow-up, the EQ-5D (both index and VAS) and other PROMs improved significantly ( $p < 0.000$ ) within each pathway. There were no significant differences between both pathways.

**Conclusion:** One year after knee arthroplasty, patients who were included in an Outpatient Surgery pathway had comparable quality of life and PROMs as patients operated in an Enhanced Recovery pathway.

**Level of evidence:** Case control study, Level III.

**Keywords:** Quality of life; Clinical pathways; Outpatient surgery; Knee arthroplasty; Clinical outcome

hypothesized that there would be no difference in quality of life between both pathways 1-yr after knee arthroplasty.

## Introduction

Modification of a selected number of literature-based protocols, used together, can be implemented in a care pathway. Such optimization is also known as 'outpatient joint arthroplasty', a multimodal clinical pathway based on well-defined patient selection criteria [1-3] with the focus on discharge on the day of surgery while ensuring patients' safety [1,4-8] and cost reduction [9,10,11]. Results have shown that quality of life after TKA, significantly improved within one year postoperative [11]. Although, these results were found after TKA in an enhanced recovery pathway, results during the early postoperative phase have shown that patients following the outpatient joint arthroplasty pathway were satisfied with sufficient physical activity [8,12,13]. Data on the quality of life after outpatient surgery on the long term are lacking.

This is the first study to evaluate the quality of life during the long postoperative phase in patients undergoing knee arthroplasty following an outpatient surgery (OS) pathway compared to the standard enhanced recovery pathway (ERP) as measured with the EQ-5D and other patient reported outcome measures (PROMs). It was

## Materials and Methods

This comparative case study reviewed a consecutive series of patients (n=361) operated for knee arthroplasty (total and partial), with the use of patient specific instruments (Signature, Zimmer-Biomet, Warsaw INC) by one experienced knee surgeon (NK). Patients were operated between January 2014 and June 2015. Allocation of patients for the OS pathway or ERP was performed based on previous described selection criteria [14].

Pre-, peri- and postoperative protocols were described in detail in previous study for OS [8]. A further optimization of the ERP resulted in similar protocols, regarding the use of Dexamethasone, Tranexamic acid (both perioperative). Knee flexion as a discharge criterion is no longer applied. The differences between both pathways are summarized in Table 1.

The clinical reports and patient information were identical in both groups as well as the pain protocol [8]. No adrenaline was used during local infiltration analgesia (LIA) in the OS pathway, since it was shown that adrenaline could be omitted from the LIA-mixture [14].

	Enhanced Recovery Pathway	Outpatient Surgery Pathway
Preoperative		
Admission	Night before/day of operation	Day of operation
Planned discharge	<3 days postoperative	Day of admission
Perioperative		
Antibiotics prophylactic	i.v.	i.v. and oral
Postoperative		
First mobilization	<6 h	<4 h
Compression bandages	24 h postoperative	8 h postoperative, first 4 days postoperative elastic bandage

**Table 1:** Differences between both pathways extracted for pre-, peri- and postoperative care and discharge criteria.

Prior to each outpatient visit (preoperative, 3- and 12-months postoperative) patients filled out 4 different Patient reported outcome measures (PROMs) as standard control in our department for knee arthroplasty patients. PROMs included the EuroQol-5D (EQ-5D; 0 to 1, 1 indicates the best health state) [15], Oxford Knee Score (OKS; 12 to 60, 12 being the best outcome) [16] and the Western Ontario and McMaster Universities Arthritis Index (WOMAC; 0 to 100, 100 being the best outcome) [17]. Experienced pain was measured by a Numerical Rating Scale (NRS, 0 to 10, 10 being 'worst pain').

This study was validated and approved by the Independent Review Board (METC Z, Heerlen, the Netherlands; IRB-nr.16N194) and registered online at the Dutch Trial Register (www.trialregister.nl).

**Statistical analysis**

SPSS Version 17.0 for windows (Inc., Chicago, IL) was used. Standard descriptive statistics were used to describe the patient demographic data and baseline characteristics. Fisher's exact test was used to test differences of proportions. Students T-tests were performed on the baseline conditions for significant interactions. A mixed model (GLMM) approach was used to take into account the repeated-measures design of the study, to cope with any missing data being collected during the pre-, 3- and 12-months postoperative follow-up and to cope with the wide range of a possible variation in relation to the time-frame the data was collected [18]. The GLMM contained fixed variables, to estimate the effect of the different pathways and age on the trend of the PROMs (dependent variables). For all analyses, a p-value was considered to be statistically significant at  $P \leq 0.05$ .

**Results**

94 cases (26.1%) followed the outpatient surgery pathway (OS), while 267 patients (73.9%) followed the protocols of an enhanced recovery pathway (ERP). Baseline and operative data are presented in Table 2.

	ERP (n=267)	OS (n=94)	p-value
Age (yrs) at index surgery	68.4 (9.0)	63.4 (8.0)	0.033

Gender, Male/ female	94/173	49/45	0.005
BMI, kg/m2	29.49 (5.05)	28.25 (3.68)	n.s.
ASA, ≤ II/>II	253/14	94/0	0.025
Implant, TKA/UKA	230/37	51/43	0.022

**Table 2:** Baseline and operative data presented as mean (± SD) or absolute numbers for both groups.

		ERP		OS		p-value GLMM
		Mean	SD	Mean	SD	
EQ-5D	Pre	0.77	0.06	0.80	0.07	n.s.
(Index)	3-months	0.85	0.10	0.86	0.10	
	12-months	0.88	0.10	0.85	0.08	
EQ-5D	Pre	62.5	18.5	66.4	19.4	n.s.
(VAS)	3-months	73.5	16.8	79.8	11.7	
	12-months	73.6	17.2	82.5	13.1	
OKS	Pre	36.9	7.7	34.8	8.0	n.s.
	3-months	25.9	8.1	23.6	7.5	
	12-months	21.3	7.2	19.2	5.8	
WOMAC	Pre	58.8	23.6	64.3	21.8	n.s.
	3-months	78.1	18.5	81.7	16.7	
	12-months	83.7	16.6	89.5	11.6	

**Table 3:** Mean (SD) and p-values are presented for the PROMs for both groups for each different follow-up visits tested with a generalized linear mixed model (GLMM).

93 patients (99%) in the OS pathway were discharged on the day of surgery as scheduled, whereas in the ERP pathway 70% of the patients were discharged <3 days postoperatively. One patient in the OS pathway had prolonged hospital stay because not fulfilling the discharge criteria walking stairs. The first day postoperative the patient was discharged.

At 12-month follow-up, the EQ-5D (both index and VAS), the OKS, WOMAC and NRS-pain score improved significantly ( $p < 0.000$ ) within each pathway. There were no significant differences between both pathways. Outcome measures data are summarized in Table 3.

**Discussion**

The most important findings of the present study were that preselected patients who followed the outpatient knee arthroplasty pathway have comparable quality of life and PROMs as patients who followed the conventional pathway.

Other studies showed that enhanced recovery pathways were as satisfying or even more satisfied compared to conventional pathways regarding the PROMs [19]. Increased PROMs were reported by Larsen et al. [11,20,21] at 3, 4 and 12 months postoperative. They reported

that early mobilization, a nurse-led organization and optimization of the preoperative education were a possible reasons for these improved PROMs [11,20,21]. Our preoperative education and postoperative organization was unchanged. Therefore, a possible explanation for our results could be the strict patient selection criteria to select patients into one of the two clinical pathways. Besides, the results of Larson et al. were found after TKA in an enhanced recovery pathway [11,20,21], data after outpatient surgery are lacking. Hoorntje et al. [12] recently published their case-controlled study regarding the presence of symptoms of anxiety and depression, by means of the Hospital Anxiety and Depression Scale (HADS) in patients operated after UKA. They found that at the first postoperative day, the median HADS score was significantly ( $p=0.02$ ) lower in the OS group compared to the ERP group and that patients in the OS group were significantly more satisfied (NRS satisfaction score,  $p=0.03$ ) without any differences between both groups at 3-month follow-up [12]. Pain relief and improved function are one of the principal aims of arthroplasty, thus it was expected that PROMs would improve significantly after knee arthroplasty. Due to aging and associated health issues, decreased self-rated health scores could be a logic consequence. However, the EQ-5D was still significantly better than the preoperative value but not different between both pathways. This shows that the possible problems associated with the knee arthritis alone, determine partially the overall health score. In the present study a wide range of PROMs were used to measure pre- and postoperative outcome after knee arthroplasty in preselected patients following ERP or OS. PROMs are a subjective measurement of clinical outcome after arthroplasty [22]. The used PROMs in this study did not capturing changes over time due to a lack of sensitivity to change of these scores [23]. Nonetheless, PROMs remain inherently subjective, prone to an individual's interpretation and perception of function [22,24].

A more accurate and objective measure to validate patient clinical outcome after knee arthroplasty is highly sought. In addition to PROMs, acceleration-based gait analysis has been accepted as an objective measurement of functional and clinical outcome in arthroplasty patients [25]. Recent results have shown that the physical activity parameters of patients after TKA, following the outpatient surgery pathway, were similar to patients who followed the standard enhanced recovery pathway [13]. Acceleration-based gait analysis provides more insight information rather than PROMs alone.

A potential criticism in the study was the significant differences in baseline condition. To ensure a proper comparison, both groups should be equal (e.g. age, gender and ASA classification). On the other hand, our primary goal was to compare two pathways in which different patient selection criteria were used.

Practical applicability of simplified protocols and new techniques are progressive. Although, these optimizations are associated with initial costs, they will reduce costs for the long term [26]. Firstly there must be an investment in training, knowledge and adjustments to daily practice for the surgeon, nurse and physiotherapist [27]. Good cooperation between these professionals and patients are necessary. All disciplines should be informed about, and involved in the whole process. Together with well-defined patient-based selection criteria, a change in mind set and a multidisciplinary approach, OS pathways are as safe and efficient as conventional pathways, in terms of readmissions, complications [8,14] and clinical outcome [12,13].

## Conclusion

With the present study, we are able to conclude that patients, who are selected according to strict criteria for inclusion in an outpatient knee arthroplasty pathway, have comparable quality of life and PROMs as patients operated in a conventional enhanced recovery pathway.

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## Authors Contribution

Martijn G.M. Schotanus, designed the study, gathered and analyzed all the data, wrote the initial draft of the manuscript and managed the study. Yoeri F.L. Bemelmans, ensured the accuracy of the data, analyzed the data, wrote and revised the manuscript. Nanne P. Kort, conceived the study and revised the manuscript.

## Conflict of Interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

One author (Nanne P. Kort) is a paid consultant for Zimmer-Biomet, Europe. The other authors certify that they have no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

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