Title

Physical Measures Predicting Better Outcomes in Knee Arthroplasty Patients: A Secondary Analysis of the CORKA Randomised Controlled Trial.

Authors

Dr Benjamin David Weedon [1]

Dr Jon Room [1]

Professor Karen Louise Barker [1,2]

Affiliations

1. Physiotherapy Research Unit, Nuffield Orthopaedic Centre, Oxford University Hospital Trust Foundation NHS, Oxford, England
2. Nuffield Department of Orthopaedics, Rheumatology & Musculoskeletal Sciences, University of Oxford, Windmill Road, Oxford, UK

Corresponding Author

Dr Benjamin David Weedon

Physiotherapy Research Unit,

Nuffield Orthopaedic Centre,

Oxford University Hospital Trust Foundation NHS,

Oxford, England

ben.weedon@ouh.nhs.uk

Abstract

Keywords

Physiotherapy

Knee arthroplasty

Outcomes

Physical Activity

Late Life Function and Disability Instrument

Clinical implications

- A combination of functional and participation measures are required to predict short and long-term outcomes post-KA
- Physical activity may provide long-term predictive capacity for participation outcomes post-KA
- Transition from Functional to Participation-Focused Rehabilitation

Introduction

The National Joint Registry (NRJ) reports that 112,218 knee procedures were performed across the UK in 2022, with 103,303 being classed as a primary knee procedure, 85% were a total knee arthroplasty (KA) and around 14% were a unicompartmental KA[1]. Whilst most patients do well u~~U~~nfortunately, data from NHS Digital 2022/23 reports that 6.7% of patients undergoing a KA did not indicate improvements in their patient-reported outcomes measures (PROMs) post-surgery [2]. This may indicate that many patients did not improve their level of function, pain, or activities of daily living after their KA surgery.

Most patients undergoing KA in the NHS will be offered some form of rehabilitation from physiotherapy services which will target improvements in their outcomes in terms of function, activity, and participation. The International Classification of Functioning, Disability and Health (ICF) is an internationally adopted framework that describes an individual's health and sets out the definitions for a patient's function, activity and participation domains [3]. They describe function as impairments at the level of the body, activity as an impairment at the individual level and the limitations they experience in certain activities, and participation as the limitations an individual experiences as a functioning member of society.

Currently, there is little evidence that can accurately predict which patients are at risk of poor outcomes post KA, especially at the participation level [4]. A recent systematic review evaluated predictive models for clinical outcomes in patients post total KA [5]. They were able to categorise predictive variables into three groups: strong and clear associations, inconsistent associations, and low associations to clinical outcomes. Preoperative pain, PROMs and anxiety and depression have all shown strong and consistent associations with clinical outcome measures in patients post KA with demographic characteristics, comorbidities, surgical history, preoperative knee alignment and range of motion all showing inconsistent associations [5]. Objective performance-based physical measures such as the timed up and go test, chair rising test, and distance walked have also been reviewed to understand their predictive capacity post KA [6]. They were able to conclude that poor preoperative functional ability and poor preoperative ipsilateral quadriceps muscle strength were likely to predict suboptimal functional recovery at 6 months.

Most studies of outcome after KA focus on the recovery of functional outcomes either measured through questionnaire based patient reported outcome measures or through physical performance tests. Reviews that have tried to predict outcome similarly ~~Unfortunately, these previous reviews have~~ focus~~sed~~ solely on functional predictor variables ~~that~~ limit~~ing~~ any insight into rehabilitation at the participation level and have not incorporated participation outcome measures after KA [5, 6]. Including predictor variables, which capture participation, such as levels of habitual physical activity (PA) may provide stronger and more consistent associations with post-operative clinical outcomes [7-10].

Furthermore, it is recognised that outcome needs to measure more than simple capacity to perform functional tasks to be valued and useful in patients' lives [3, 9, 11]~~(ref Karimijahni 2025; Papalia 2020, Alviar 2011)~~. Improved understanding of the factors that predict improved participation and quality of life is important to direct effective rehabilitation~~.~~ [10].~~(Santoh 2025)~~

This ~~Therefore, this~~ study aims to ~~will~~ examine to what extent functional and participation predictor variables can predict~~have on functional and participation~~ outcome ~~measures~~ after KA surgery at 6, 12, and 24 months. We hypothesise that different predictor variables may predict function and participation.

Methods

Design

This was a retrospective secondary analysis of data from the CORKA trial, a multicentre prospective, single-blinded, two-arm randomised controlled superiority trial. The CORKA trial investigated the effect of a home-based intervention for patients at risk of poor outcomes compared to usual physiotherapy in patients following KA surgery with outcome assessed at 12 months after randomisation. The trial was registered (ISRCTN13517704) and followed the CONSORT guidelines. The study protocol was approved by the South-Central Research Ethics Committee (15/SC/0019), The University of Oxford was the sponsor. Ethics permission was obtained for all participating sites. Further information on recruitment, randomisation, and intervention arms are published in more detail elsewhere [12-14].

We recruited 621 participants. Based on our published statistical analysis plan,[14] ~~[reference]~~ the sample size calculation required data from a minimum of 620 participants, assuming a moderately small standardised effect size of 0.275, or 3 points on the LLFDI function score, with a power of 90% and an alpha of 0.05. This allowed for a withdrawal rate of 10%.

Participants

Recruitment was conducted across 14 NHS England sites. Inclusion criteria consisted of participants willing and able to give informed consent, aged 55 years or above, primary KA procedure, at risk of poor outcome as identified by the study screening tool, and willing to allow rehabilitation teams to attend their home to deliver the community-based rehabilitation programme. Exclusion criteria included any absolute contraindications to exercise, severe cardiovascular or pulmonary disease, severe dementia, Rheumatoid arthritis, further lower limb arthroplasty surgery planned within 12 months, and serious perioperative complications [12].

Full details of the rehabilitation received by participants has been published previously [13, 15] ~~(refs 9 plus new ref Room J)~~

~~For this analysis, the data from both arms were pooled, (Figure 1) as there was no significant difference between groups, except for a borderline significant difference at 6 months for the Late-Life Function and Disability Instrument (LLFDI) disability limitation score~~ [13]~~. The data was then used to predict functional and participation outcomes after KA in patients at 6, 12, and 24 months post baseline assessment.~~

Outcome Measures

The primary outcome was the Late-Life Function and Disability Instrument (LLFDI) score. This consisted of LLFDI functional, disability frequency, and disability limitation score. The LLFDI evaluates functional limitations in a person's ability to do discrete actions or activities and their ability to perform socially defined life tasks as a community-dwelling older adult [16, 17]. It has good reported reliability and sensitivity to change [18]. ~~(new ref beauchamp)~~

The ASA grading and Charnley score of participants was recorded as was any history of falls in the last year and the functional comorbidity index (Supplementary file) [reference 9 in original paper]For this analysis, the data from both arms were pooled, (Figure 1) as there was no significant difference between groups, except for a borderline significant difference at 6 months for the Late-Life Function and Disability Instrument (LLFDI) disability limitation score [9]. The data was collected at baseline, 6,12 and 24 months.

Predictor variables were measured at baseline and consisted of self-reported and physical measures. The self-reported measure included the Physical Activity Scale for the Elderly (PASE) questionnaire [19]. The physical measures included the Figure of 8 Walk Test (F8WT) [20], 30 second Chair Stand Test (30CST) [21], and the Single Leg Stance on the operated leg (SLS) [22]. These variables were measured at baseline, and used to predict the primary outcome score at 6, 12, and 24 months.

Analysis

Descriptive data are presented as means and standard deviations with their 95% confidence intervals. All data were assessed for normal distribution using histogram plots. T-tests were used to compare the mean differences for all variables by sex. A linear mixed effects model with repeated measures, adjusted for sex, age, BMI, baseline score, and recruitment site was used to assess the effects of the treatments over time for each outcome. An interaction between the outcome measurement time point and the allocated group will be fitted to allow estimation of the treatment effect at each time point. A multiple linear regression model was used to assess the predictive significance of the predictor variables on each outcome measure. Homoscedasticity was assessed by plotting residuals against predicted values. Each regression model was adjusted for sex, age, BMI, and recruitment site. These data were analysed by StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC, with p-value set at < 0.05.

Results

~~A total of 2788 patients were screened for the CORKA trial with 621 (250 male and 371 female) participants randomised into usual care (n=312) or home-based rehabilitation (n=309). Both treatment groups significantly improved LLFDI function, disability frequency and limitation score over 24 months. However, no significant difference existed between treatment group effects for LLFDI function, disability frequency or disability limitations over 24 months, except at 6 months for the LLFDI disability limitation score (*P*=0.04) (Figure 1).~~

~~Descriptive characteristics are presented by sex in Table 1. There were significant differences between all listed characteristics apart from age and LLFDI disability score at baseline, six months, and one year.~~

~~Table 2 shows the three models predicting LLFDI function at six, 12 and 24 months. Balance time for the operated leg was a significant predictor at all three time points, and the PASE total score significantly predicted LLFDI function at six and 24 months. The sit-to-stand test significantly predicted LLFDI function at 12 months. The model where the disability frequency was the dependent variable indicated that the PASE total score was a significant predictor for six, 12, and 24 months, with balancing on the operated leg and figure of 8 walk significant predictors at 12 and 24 months, respectively (Table 3). Table 4 reports data on the model where the disability limitation was the dependent variable. The PASE total score and the balance on the operated leg score were the only predictors of disability limitation at 12 and 24 months.~~

A total of 2,788 patients were screened for inclusion in the CORKA trial. Of these, 621 participants (250 male and 371 female) were randomised to either usual care (n = 312) or a home-based rehabilitation programme (n = 309).

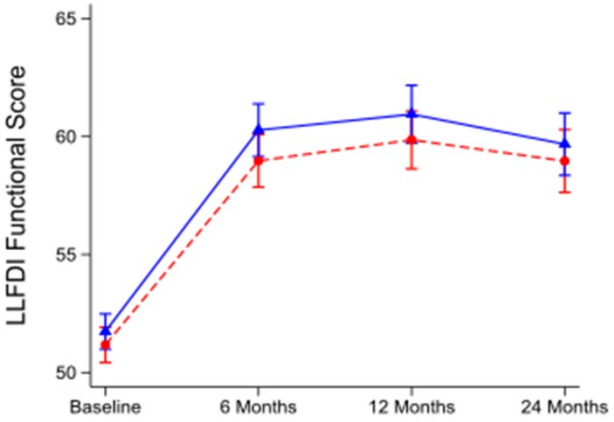
Descriptive characteristics of the participants, stratified by sex, are presented in Table 1. Statistically significant sex differences were observed for all listed baseline characteristics except for age and LLFDI disability scores, which did not differ significantly at baseline, 6 months, or 1 year.

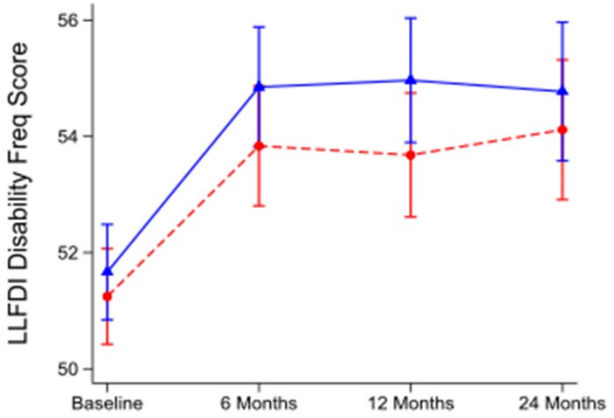
Both groups demonstrated significant improvements in LLFDI (Late-Life Function and Disability Instrument) function, disability frequency, and disability limitation scores over the 24-month follow-up period. However, there were no statistically significant differences between the two groups in the magnitude of improvement across these outcomes, except the LLFDI disability limitation score at 6 months. At this time point, the home-based rehabilitation group showed a greater improvement (mean score: 75.0; 95% CI: 73.5–76.53) compared to the usual care group (mean score: 72.3; 95% CI: 70.8–73.83; P = 0.04) (Figure 1). Therefore, this allowed the dataset to be combined for further prediction analysis.

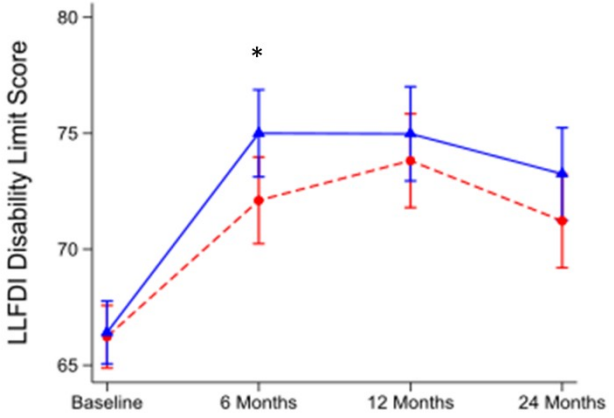
Predictive modelling results are reported in Tables 2–4. Table 2 presents three regression models predicting LLFDI function at 6, 12, and 24 months. Balance time on the operated leg emerged as a consistent significant predictor at all time points. Additionally, the Physical Activity Scale for the Elderly (PASE) total score significantly predicted LLFDI function at 6 and 24 months, while the sit-to-stand test was a significant predictor at 12 months.

Table 3 outlines the model predicting LLFDI disability frequency. The PASE total score was a significant predictor at 6, 12, and 24 months. Balance time on the operated leg and the figure-of-eight walk were also significant predictors at 12 and 24 months, respectively.

Finally, Table 4 presents the model for LLFDI disability limitation. At both 12 and 24 months, only the PASE total score and balance time on the operated leg were significant predictors of disability limitation.


LLFDI Functional Score
65
60
55
50
Baseline
6 Months
12 Months
24 Months


LLFDI Disability Freq Score
56
54
52
50
Baseline
6 Months
12 Months
24 Months


LLFDI Disability Limit Score
80
75
70
65
*
Baseline
6 Months
12 Months
24 Months

~~Figure 1: The LLFDI score for function (top), disability frequency (middle) and disability limitations (bottom) from baseline to 24 months post-randomisation. LLFDI = Late-Life Function and Disability Instrument. Blue triangles = home-based rehabilitation, red circles = usual care. * = significant difference between groups *P*=<0.05~~

Table 1: Descriptive Characteristics by sex

	Males					Females					
	n	Mean	SD	95%CI		n	Mean	SD	95%CI		p
Age [years]	250	70.4	8.1	69.7	71.8	371	70.2	8.0	69.4	71.0	0.379
Height [cm]	248	174.6	6.9	173.8	175.4	363	160.3	6.6	159.7	161.0	<0.001
Weight[kg]	250	93.8	15.0	92.0	95.7	363	82.3	14.1	80.9	83.8	<0.001
BMI [kg/m^2]	248	30.8	4.3	30.2	31.3	363	32.0	5.0	31.5	32.5	0.0015
Figure of 8 walk [s]	250	10.6	4.8	10.0	11.2	371	12.8	5.2	12.3	13.3	<0.001
Sit to stands [count]	178	9.7	3.4	9.2	10.2	247	8.4	3.5	8.0	8.9	<0.001
Balance time on operated Leg [s]	250	13.4	13.8	11.7	15.1	368	8.2	10.2	7.1	9.2	<0.001
PASE [score]	241	141.4	80.9	131.1	151.7	358	102.6	63.4	96.0	109.2	<0.001
LLFDI functional score baseline	249	54.4	7.1	53.5	55.3	367	49.4	6.4	48.8	50.1	<0.001
LLFDI functional score 6 months	233	63.2	10.9	61.8	64.6	326	57.2	9.2	56.2	58.2	<0.001
LLFDI functional score 12 months	234	63.4	11.8	61.9	64.9	332	58.7	10.3	57.6	59.8	<0.001
LLFDI functional score 24 months	189	63.0	12.3	61.2	64.7	288	57.8	10.7	56.6	59.1	<0.001
LLFDI disability limitation score baseline	250	68.6	12.7	67.1	70.2	367	64.6	11.6	63.4	65.8	<0.001
LLFDI disability limitation score 6 months	232	76.2	16.8	74.0	78.4	328	71.9	16.1	70.2	73.7	0.0025
LLFDI disability limitation score 12 months	234	77.2	18.1	74.9	79.5	332	72.6	17.7	70.7	74.5	0.0026
LLFDI disability limitation score 24 months	189	74.7	17.3	72.2	77.2	288	71.6	16.3	69.7	73.5	0.04
LLFDI disability frequency score baseline	250	51.1	7.1	50.3	52.0	369	51.6	7.5	50.8	52.4	0.45
LLFDI disability frequency score 6 months	232	54.1	8.7	52.9	55.2	326	55.0	9.1	54.1	56.0	0.20
LLFDI disability frequency score 12 months	234	53.9	8.8	52.8	55.1	332	55.1	9.6	54.0	56.1	0.15
LLFDI disability frequency score 24 months	189	54.0	9.8	52.6	55.5	288	55.9	9.9	54.8	57.1	0.04

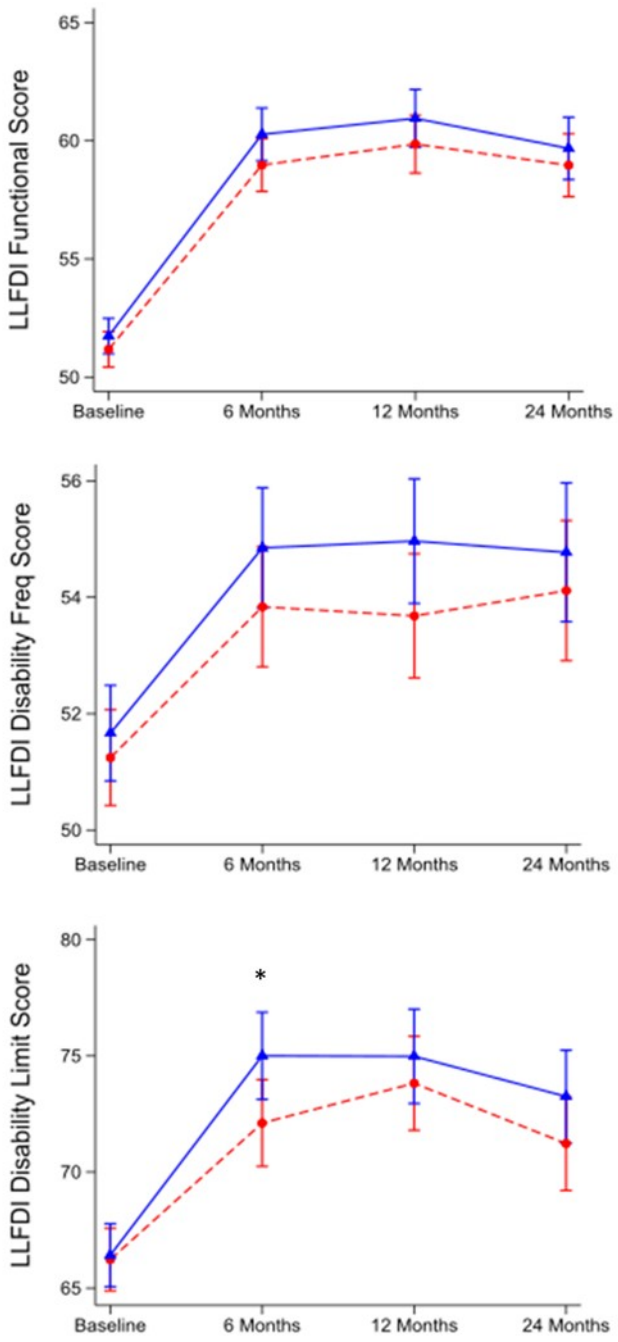


Figure 1: The LLFDI score for function (top), disability frequency (middle) and disability limitations (bottom) from baseline to 24 months post-randomisation. LLFDI = Late-Life Function and Disability Instrument. Blue triangles = home-based rehabilitation, red circles = usual care. * = significant difference between groups *P*=<0.05.

Table 2: Multiple linear regression models predicting LLFDI function at 6, 12 and 24 months

~~6 months LLFDI function~~	Coef.	Beta	95%CI		*p*
6 months LLFDI function (R^2=0.29, Adj R^2 = 0.28, p=<0.001)					
Figure of 8 walk	-0.22	-0.08	-0.50	0.07	0.134
Sit to stands	0.27	0.10	-0.02	0.55	0.065
Balance on operated Leg	0.14	0.18	0.06	0.22	**0.001**
PASE total score	0.02	0.14	0.01	0.03	**0.006**
12 months LLFDI function (R^2=0.23, Adj R^2 = 0.23, p=<0.001)					
Figure of 8 walk	-0.25	-0.10	-0.52	0.02	0.074
Sit to stands	0.36	0.12	0.04	0.68	**0.026**
Balance on operated Leg	0.18	0.21	0.09	0.27	**<0.001**
PASE total score	0.01	0.10	0.00	0.03	0.08
24 months LLFDI function (R^2=0.24, Adj R^2 = 0.23, p=<0.001)					
Figure of 8 walk	-0.31	-0.10	-0.66	0.05	0.089
Sit to stands	0.18	0.06	-0.17	0.53	0.31
Balance on operated Leg	0.21	0.24	0.11	0.31	**<0.001**
PASE total score	0.02	0.14	0.004	0.04	**0.012**

LLFDI = Late Life Functional and Disability Instrument. Coef. = Coefficient. Beta = beta coefficient, 95%CI = 95% confidence intervals. *p* = p-value. PASE = Physical Activity Scale for the Elderly.

Table 3: Multiple linear regression models predicting LLFDI disability frequency at 6, 12 and 24 months

	Coef.	Beta	95%CI		*p*
6 months LLFDI disability frequency (R^2=0.12, Adj R^2 = 0.12, p=<0.001)					
Figure of 8 walk	-0.29	-0.12	-0.58	0.00	0.051
Sit to stands	-0.06	-0.02	-0.35	0.23	0.685
Balance on operated Leg	0.07	0.09	-0.02	0.15	0.118
PASE total score	0.03	0.29	0.02	0.05	**<0.001**
12 months LLFDI disability frequency (R^2=0.11, Adj R^2 = 0.12, p=<0.001)					
Figure of 8 walk	-0.19	-0.08	-0.45	0.08	0.162
Sit to stands	-0.10	-0.04	-0.41	0.20	0.515
Balance on operated Leg	0.13	0.17	0.04	0.21	**0.005**
PASE total score	0.04	0.29	0.02	0.05	**<0.001**
24 months LLFDI disability frequency (R^2=0.08, Adj R^2 = 0.08, p=<0.001)					
Figure of 8 walk	-0.37	-0.13	-0.73	-0.01	**0.044**
Sit to stands	-0.11	-0.04	-0.47	0.24	0.54
Balance on operated Leg	0.06	0.08	-0.04	0.16	0.238

PASE total score	0.03	0.21	0.01	0.05	**0.001**

Table 3: Multiple linear regression models predicting LLFDI disability frequency at 6, 12 and 24 months

6 months LLFDI disability frequency	**Coef.**	**Beta**	**95%CI**		***p***
Figure of 8 walk	-0.29	-0.12	-0.58	0.00	0.051
Sit to stands	-0.06	-0.02	-0.35	0.23	0.685
Balance on operated Leg	0.07	0.09	-0.02	0.15	0.118
PASE total score	0.03	0.29	0.02	0.05	**<0.001**
12 months LLFDI disability frequency					
Figure of 8 walk	-0.19	-0.08	-0.45	0.08	0.162
Sit to stands	-0.10	-0.04	-0.41	0.20	0.515
Balance on operated Leg	0.13	0.17	0.04	0.21	**0.005**
PASE total score	0.04	0.29	0.02	0.05	**<0.001**
24 months LLFDI disability frequency					
Figure of 8 walk	-0.37	-0.13	-0.73	-0.01	**0.044**
Sit to stands	-0.11	-0.04	-0.47	0.24	0.54
Balance on operated Leg	0.06	0.08	-0.04	0.16	0.238
PASE total score	0.03	0.21	0.01	0.05	**0.001**

LLFDI = Late Life Functional and Disability Instrument. Coef. = Coefficient. Beta = beta coefficient, 95%CI = 95% confidence intervals. *p* = p-value. PASE = Physical Activity Scale for the Elderly.

Table 4: Multiple linear regression models predicting LLFDI disability limitation at 6, 12 and 24 months

6 months LLFDI disability limitation	**Coef.**	**Beta**	**95%CI**		***p***
6 months LLFDI disability limitation (R^2=0.13, Adj R^2 = 0.11, p=<0.001)					
Figure of 8 walk	-0.41	-0.09	-0.92	0.11	0.123
Sit to stands	0.45	0.10	-0.06	0.96	0.085
Balance on operated Leg	0.11	0.08	-0.04	0.25	0.161
PASE total score	0.02	0.11	0.00	0.05	0.064
12 months LLFDI disability limitation (R^2=0.15, Adj R^2 = 0.13, p=<0.001)					
Figure of 8 walk	-0.41	-0.09	-0.89	0.07	0.093
Sit to stands	0.29	0.06	-0.27	0.85	0.313
Balance on operated Leg	0.26	0.18	0.10	0.42	**0.002**

PASE total score	0.04	0.17	0.01	0.07	**0.003**
24 months LLFDI disability limitation (R^2=0.18, Adj R^2 = 0.16, p=<0.001)					
Figure of 8 walk	-0.27	-0.06	-0.84	0.30	0.35
Sit to stands	0.44	0.09	-0.13	1.00	0.129
Balance on operated Leg	0.28	0.21	0.12	0.44	**0.001**
PASE total score	0.04	0.18	0.01	0.07	**0.003**

LLFDI = Late Life Functional and Disability Instrument. Coef. = Coefficient. Beta = beta coefficient, 95%CI = 95% confidence intervals. *p* = p-value. PASE = Physical Activity Scale for the Elderly.

Discussion

This secondary analysis of the CORKA trial data found that different questionnaire data and performance tests predicted short term and longer term outcome after knee arthroplasty. Physical performance outcome measures such as single leg balance test and the figure of eight walk test predicted functional recovery measured using the LLFDI functional scale. Measures of activity such as the PASE questionnaire predicted longer term disability limitation at 12 and 24 months.

elucidates significant predictors of functional and participation outcomes following KA. Baseline balance on the operated leg emerged as a consistent predictor of functional and participation outcomes across all time points (6, 12, and 24 months). The PASE score significantly predicted participation outcomes, specifically disability frequency and limitation at 24 months. This indicates that while functional measures such as balance are critical in the early stages of recovery, baseline participation measures like habitual physical activityPA may become increasingly important for longer-term recovery.

Notably, our current study is the first to highlight baseline balance on the operated leg as a predictor for improved functional and participation outcomes over 6-24 months. We expect that higher levels of preoperative balance may facilitate a faster return to independent mobilisation [23]. This, in turn, may result in an increased walking ability [24]. These factors could facilitate a greater return to pre-operative participation level activities and indicate why balance was a predictor of functional as well as participation outcomes. Importantly they are also modifiable with structured targeted rehabilitation pre and post surgery [25, 26].[ref]

Unfortunately, there is very little evidence exploring the predictive capacity of functional measures on participation outcomes and therefore, limits our ability to make further comparisons.

There is, however, recent work assessing how functional preoperative balance measures can predict functional outcomes in patients following KA with largely inconsistent results [27]. One study reported that balance is not a preoperative predictor for hospital discharge or hospital length of stay after KA but was associated with improvements in various pain metrics [27]. This study had a relatively small sample size (n=40) compared to our study. However, it highlights the multiple effects that preoperative balance may have on improving functional outcomes measures up to 24 months post-operatively.

Higher levels of self-reported physical activityPA as measured by the PASE questionnaire reported significantly higher participation outcomes after KA. More interestingly, our study has provided novel findings that suggest physical activityPA levels pre KA significantly predict better participation outcomes two years post KA. Currently, there is very little data reporting the effect of KA on participation outcomes over an extended follow-up period of two years, although . However, one study has reported that pre-operative PA significantly predicted PA three months post KA [28]. Unfortunately, we are unable to determine if this prediction was clinically meaningful or improved their overall outcomes. A further study has supported these findings and suggested that patients who had higher levels of activityPA pre-op achieved a score of 7/10 or more on the UCLA Activity Scale questionnaire (equivalent to returning to cycling) at their 1 year post-op follow-up [29]. This is important as being able to cycle may suggest that these patients had greater balance therefore allowing increased engagement in various participation activities 1-year post-op. Although these findings are supportive of our study it had a relatively large amount of missing data and included patients undergoing primary and revision hip and knee surgeries.

Conversely, there have been some studies that have reported that pre-op physical activityPA levels have no relationship to recovery or outcomes post-lower limb arthroplasty [30, 31]. One review highlighted that there were only four studies that assessed physical activityPA as a predictor for disability outcomes post-lower limb arthroplasty [31]. Only one study scored good on their quality index and their maximum follow-up period was one year [30]. Due to the current heterogeneity in physical activityPA measures, outcomes used, and length of follow-up makes it is difficult to find a clear effect of pre-operative PA levels on post-op outcomes.

OHowever, our study has used a participation measure (PASE) as a predictor for participation outcomes (LLFDI) over an extended follow-up period (two years) and provided evidence that participation outcomes over the longer term can provide more information on recovery from KA. This may suggest that incorporating participation interventions into the rehab setting to could further improve outcomes than relying solely on functional rehabilitation methods immediately post-op.

One intervention that may provide this continued progression in long-term recovery from KA could be social prescribing. Social prescribing, which involves referring patients to non-medical services to support their health and well-being, could play a pivotal role in enhancing long-term PA outcomes post KA [32, 33]. By addressing the social determinants of health, social prescribing can bridge the gap between medical care and community resources, fostering longer-term recovery. Given the significant predictive capacity of PA on participation outcomes from our study, linking patients to community resources and activities could facilitate sustained engagement in physical activities, thereby improving overall recovery and quality of life.

By mapping outcomes to the ICF framework outcomes can be chosen that are more applicable to clinical practice and important to patients; for example the Oxford Knee Score maps to ICF activity and participation domains as does the LLFDI covering a large number of possible activity and participation categories in the ICF OA core dataset. These align with the perspective of patients who rank activity and participation as their primary concern after knee arthroplasty [34, 35]. (refs)

This study has several limitations that warrant further consideration. Firstly, the dataset used in this research combined interventional arms from a randomized controlled trial, where the two groups underwent different rehabilitation methods following knee arthroplasty (KA) surgery. Although the analysis revealed no significant differences in the Late-Life Function and Disability Instrument (LLFDI) scores for function, disability frequency, or disability limitation across all time points, except for disability limitation at 6 months, the heterogeneity in rehabilitation approaches may still influence outcomes. Additionally, the dataset included both total knee replacements (TKR) and unicompartmental knee replacements (UKR). The combination of these two distinct surgical procedures could potentially obscure the predictive accuracy of specific functional and participation measures over time. Future research may benefit from analysing these KA procedures separately to refine outcome predictions. Lastly, physical activity (PA) was assessed using the Physical Activity Scale for the Elderly (PASE), a self-reported questionnaire. For a more precise evaluation of PA, future studies might consider employing objective measurement tools.

We also recognise that there are many factors that may influence outcome that were not measured within our study such as socioeconomic deprivation, mental health such as anxiety and depression and social support {Batailler, 2021 #354;Judge, 2012 #450} {Batailler, 2021 #354}{Judge, 2012 #450} {Batailler, 2021 #354;Judge, 2012 #450}.[ref].

In conclusion, the findings from this study highlight the importance of both functional and participation measures in predicting outcomes post KA. We suggest that including measures that focus on function, activity and participation are all inter-related and important to provide a true reflection of recovery. Our analysis suggests that functional measures may be more appropriate for short-term outcome prediction with participation measures more suitable for long-term outcome predictions post KA. The potential of social prescribing to enhance long-term recovery may provide a suitable intervention to promote long-term recovery and bridge the gap between short and long term outcomes.

Acknowledgements

The authors would like to acknowledge the site principal investigators and research clinicians. Leon Palmer-Wilson, Ana Glennon (Ashford Open access Hospital), Helen Wilson (Countess of Chester Hospital), Christian Brookes, Denise Hill (Dorset County Hospital), Susan Dowdle, Hazel Burt (Dorset HealthCare Hospital), Jane Harrison (Epsom Hospital), Sarah Adcock, Justine Theaker (Manchester Royal Infirmary), Gladys Nadar Arulmani (Medway Community Hospital), Sunil Jain (Medway Maritime Hospital), Mike Reed (North Tyneside General Hospital), Jonathan Room (Oxford University Hospitals), Genevieve Simpson, Gemma Knight (Royal United Hospitals Bath), Tricia Monroe (Moorgreen Hospital), Gareth Stephens, Sarah Rich (Royal Orthopaedic Hospital Birmingham).

Funding

This trial was funded by the National Institute for Health Research Health Technology Assessment Programme (HTA 12/196/08) and supported by the Oxford NIHR BRC..

References

1. National Joint Registry. *National Joint Registry 19th Annual Report 2022*. 2022 02/11/2023]; Available from: https://reports.njrcentre.org.uk/Portals/0/PDFdownloads/NJR%2019th%20Annual%20Report%202022.pdf.
2. NHS Digital. *Provisional Patient Reported Outcome Measures (PROMs) in England for Hip and Knee Replacement Procedures (April 2022 to March 2023)*. 2023 02/11/23]; Available from: https://digital.nhs.uk/data-and-information/publications/statistical/patient-reported-outcome-measures-proms/hip-and-knee-replacement-procedures-april-2022-to-march-2023.
3. Alviar, M.J., et al., *Do patient-reported outcome measures used in assessing outcomes in rehabilitation after hip and knee arthroplasty capture issues relevant to patients? Results of a systematic review and ICF linking process.* J Rehabil Med, 2011. **43**(5): p. 374-81.
4. Maxwell, J.L., et al., *Participation following knee replacement: the MOST cohort study.* Phys Ther, 2013. **93**(11): p. 1467-74.
5. Batailler, C., et al., *Predictive Models for Clinical Outcomes in Total Knee Arthroplasty: A Systematic Analysis.* Arthroplast Today, 2021. **9**: p. 1-15.
6. Devasenapathy, N., et al., *Preoperative Quadriceps Muscle Strength and Functional Ability Predict Performance-Based Outcomes 6 Months After Total Knee Arthroplasty: A Systematic Review.* Phys Ther, 2019. **99**(1): p. 46-61.
7. Vasta, S., et al., *The influence of preoperative physical activity on postoperative outcomes of knee and hip arthroplasty surgery in the elderly: a systematic review.* Journal of clinical medicine, 2020. **9**(4): p. 969.
8. Mark, P.P., et al., *Physical Therapists' Perspectives on Recovery in Total Joint Arthroplasty Care.* J Arthroplasty, 2025.
9. Papalia, R., et al., *The Role of Physical Activity and Rehabilitation Following Hip and Knee Arthroplasty in the Elderly.* J Clin Med, 2020. **9**(5).
10. Santoh, K., et al., *Exploration of combined factors related to quality of life after knee replacement surgery.* PLoS One, 2025. **20**(5): p. e0323007.
11. Karimijashni, M., et al., *Development and content validation of a questionnaire identifying patients' functional priorities and abilities after hip or knee arthroplasty.* Disabil Rehabil, 2025. **47**(8): p. 2146-2160.
12. Barker, K.L., et al., *COmmunity-based Rehabilitation after Knee Arthroplasty (CORKA): study protocol for a randomised controlled trial.* Trials, 2016. **17**(1): p. 501.
13. Barker, K.L., et al., *Home-based rehabilitation programme compared with traditional physiotherapy for patients at risk of poor outcome after knee arthroplasty: the CORKA randomised controlled trial.* BMJ Open, 2021. **11**(8): p. e052598.
14. Vadher, K., et al., *COmmunity-based Rehabilitation after Knee Arthroplasty (CORKA): statistical analysis plan for a randomised controlled trial.* Trials, 2018. **19**(1): p. 638.
15. Room, J., M. Batting, and K.L. Barker, *Development of a functional rehabilitation intervention for post knee arthroplasty patients: COmmunity based Rehabilitation post Knee Arthroplasty (CORKA) trial.* Physiotherapy, 2020. **106**: p. 52-64.
16. Haley, S.M., et al., *Late Life Function and Disability Instrument: II. Development and evaluation of the function component.* The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2002. **57**(4): p. M217-M222.
17. Jette, A.M., et al., *Late life function and disability instrument: I. Development and evaluation of the disability component.* The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2002. **57**(4): p. M209-M216.
18. Beauchamp, M.K., et al., *Psychometric properties of the Late-Life Function and Disability Instrument: a systematic review.* BMC geriatrics, 2014. **14**: p. 1-12.
19. Washburn, R.A., et al., *The Physical Activity Scale for the Elderly (PASE): development and evaluation.* Journal of clinical epidemiology, 1993. **46**(2): p. 153-162.

20. Hess, R.J., et al., *Walking skill can be assessed in older adults: validity of the Figure-of-8 Walk Test.* Physical therapy, 2010. **90**(1): p. 89-99.
21. Jones, C.J., R.E. Rikli, and W.C. Beam, *A 30-s chair-stand test as a measure of lower body strength in community-residing older adults.* Research quarterly for exercise and sport, 1999. **70**(2): p. 113-119.
22. Springer, B.A., et al., *Normative values for the unipedal stance test with eyes open and closed.* Journal of geriatric physical therapy, 2007. **30**(1): p. 8-15.
23. Jogi, P., et al., *Effectiveness of balance exercises in the acute post-operative phase following total hip and knee arthroplasty: A randomized clinical trial.* SAGE Open Med, 2015. **3**: p. 2050312115570769.
24. Doma, K., A. Grant, and J. Morris, *The Effects of Balance Training on Balance Performance and Functional Outcome Measures Following Total Knee Arthroplasty: A Systematic Review and Meta-Analysis.* Sports Med, 2018. **48**(10): p. 2367-2385.
25. An, J., S.-J. Cheon, and B.-H. Lee, *The Effect of Combined Balance Exercise on Knee Range of Motion, Balance, Gait, and Functional Outcomes in Acute Phase Following Total Knee Arthroplasty: A Single-Blind Randomized Controlled Trial.* Medicina, 2024. **60**(9): p. 1389.
26. Keogh, J.A., et al., *The Effects of Structured Prehabilitation on Postoperative Outcomes Following Total Hip and Total Knee Arthroplasty: An Overview of Systematic Reviews and Meta-analyses of Randomized Controlled Trials.* Journal of Orthopaedic & Sports Physical Therapy, 2025. **55**(5): p. 344-365.
27. Lee, J.J., et al., *A balance focused biometric does not predict rehabilitation needs and outcomes following total knee arthroplasty.* BMC Musculoskelet Disord, 2024. **25**(1): p. 473.
28. Lebleu, J., et al., *Predicting physical activity recovery after hip and knee arthroplasty? A longitudinal cohort study.* Braz J Phys Ther, 2021. **25**(1): p. 30-39.
29. Williams, D.H., et al., *Predictors of participation in sports after hip and knee arthroplasty.* Clin Orthop Relat Res, 2012. **470**(2): p. 555-61.
30. Poortinga, S., et al., *Preoperative physical activity level has no relationship to the degree of recovery one year after primary total hip or knee arthroplasty: a cohort study.* PLoS One, 2014. **9**(12): p. e115559.
31. Pozzobon, D., et al., *Can obesity and physical activity predict outcomes of elective knee or hip surgery due to osteoarthritis? A meta-analysis of cohort studies.* BMJ Open, 2018. **8**(2): p. e017689.
32. Bickerdike, L., et al., *Social prescribing: less rhetoric and more reality. A systematic review of the evidence.* BMJ Open, 2017. **7**(4): p. e013384.
33. Moore, C., et al., *Social prescribing: Exploring general practitioners' and healthcare professionals' perceptions of, and engagement with, the NHS model.* Health Soc Care Community, 2022. **30**(6): p. e5176-e5185.
34. Karimijashni, M., et al., *Functional Patient-Reported Outcome Measures After Hip or Knee Arthroplasty: A Systematic Review and Content Analysis Using the International Classification of Functioning, Disability, and Health.* Arthritis Care & Research, 2024. **76**(12): p. 1703-1722.
35. Rastogi, R., A.M. Davis, and B.M. Chesworth, *A cross-sectional look at patient concerns in the first six weeks following primary total knee arthroplasty.* Health and Quality of Life Outcomes, 2007. **5**: p. 1-7.