Time to return to work by occupational class after total hip or knee arthroplasty

Kamp, T.; Gademan, M.G.J.; Zon, S.K.R. van; Nelissen, R.G.H.H.; Vlieland, T.P.M.V.; Stevens, M.; ... ; Longitudinal Leiden Orthopaedics O

■ ARTHROPLASTY

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T. Kamp,
M. G. J. Gademan,
S. K. R. van Zon,
R. G. H. H. Nelissen,
T. P. M. Vliet Vlieland,
M. Stevens,
S. Brouwer,
on behalf of the Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS) Group

From LUMC, Leiden, Netherlands

Aims

For the increasing number of working-age patients undergoing total hip or total knee arthroplasty (THA/TKA), return to work (RTW) after surgery is crucial. We investigated the association between occupational class and time to RTW after THA or TKA.

Methods

Data from the prospective multicentre Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study were used. Questionnaires were completed preoperatively and six and 12 months postoperatively. Time to RTW was defined as days from surgery until RTW (full or partial). Occupational class was preoperatively assessed and categorized into four categories according to the International Standard Classification of Occupations 2008 (blue-/white-collar, high-/low-skilled). Cox regression analyses were conducted separately for THA and TKA patients. Low-skilled blue-collar work was used as the reference category.

Results

A total of 360 THA and 276 TKA patients, preoperatively employed, were included. Patients were mainly high-skilled (THA 57%; TKA 41%) or low-skilled (THA 24%; TKA 38%) white-collar workers. Six months post-THA, RTW rates were 78% of low-skilled blue-collar workers compared to 83% to 86% within other occupational classes, increasing after 12 months to 87% to 90% in all occupational classes. Six months post-TKA, RTW rates were 58% of low-skilled and 64% of high-skilled blue-collar workers compared to 80% to 89% of white-collar workers, and after 12 months 79% of low-skilled blue-collar workers compared to 87% to 92% within other occupational classes. High-skilled white-collar workers (THA: hazard ratio (HR) 2.12 (95% confidence interval (CI) 1.32 to 3.40); TKA: HR 2.31 (95% CI 1.34 to 4.00)) and low-skilled white-collar workers (TKA: HR 1.82 (95% CI 1.04 to 3.18)) had a higher hazard to RTW within six months postoperatively.

Conclusion

Clear differences existed in time to RTW among both THA and TKA patients in each of the groups studied. These findings may help guide tailored patient-specific information during preoperative consultation and advice postoperatively, as well as to create awareness among workers and their employers.

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Introduction

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are highly effective treatments for end-stage hip or knee osteoarthritis (OA).[1] In recent years, the number of patients undergoing THA or TKA has risen rapidly in Western societies, and is expected to increase in the coming decades due to ageing populations, increasing prevalence of overweight and obesity, improved longevity of arthroplasties, and more sports-related joint injuries.[2,3] The greatest increase in THAs and TKAs is seen in patients aged 45 to 65 years, and it is anticipated that by 2030 at least 52% of THAs and 55% of TKAs will be performed in the working-age population.[4] This trend coincides with a delayed retirement age,[5] raising the number of working-age patients even further. For working patients, it is crucial to return to work (RTW) after

Correspondence should be sent to T. Kamp; email: t.kamp@umcg.nl

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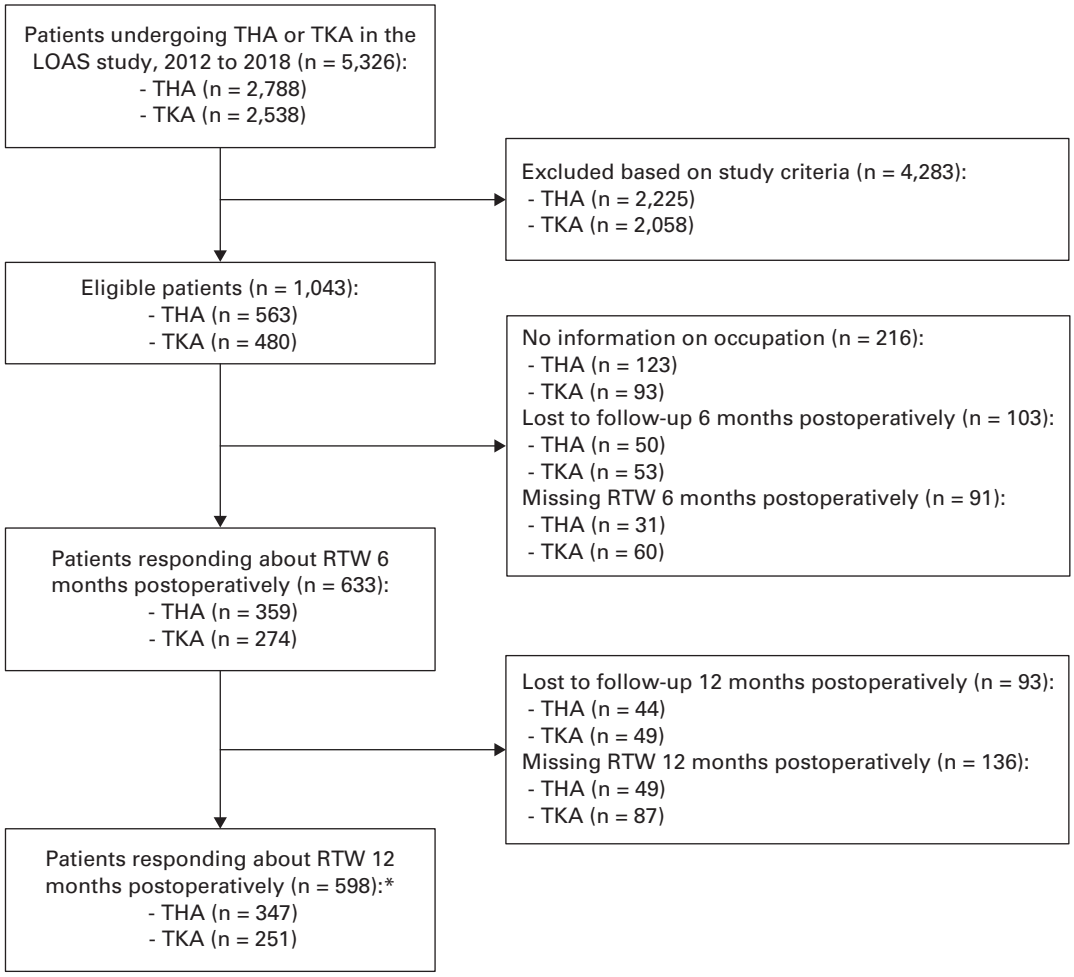

Fig. 1

Flowchart study enrolment and follow-up. *For some patients, data at six months postoperatively were missing, but data at 12 months postoperatively were available. RTW, return to work; THA, total hip arthroplasty; TKA, total knee arthroplasty.

surgery, for personal and societal reasons.[6,7] RTW after surgery is thus becoming an increasingly important treatment goal.[7,8]

Given the increasing number of working-age patients, considerable research has been undertaken to describe patterns of RTW following THA and TKA.[9-12] Previous research showed that most of these patients return to work within six months post-surgery, with a RTW rate of over 70%.[9–12] However, the time taken to return to work after THA and TKA is extremely variable, and has been reported to range between one and 17 weeks after THA and eight to 17 weeks after TKA.[10,11] In addition to personal factors (e.g. age, sex, health status) which have been found to be associated with time to RTW among TKA and THA patients,[10-13] time to RTW may also be influenced by occupational factors. Time to RTW has been found to be shorter if patients have flexible working conditions or are self-employed, and prolonged for manual workers (i.e. those with physically demanding jobs).[10–12] However, to our knowledge, the relationship between occupation and RTW is not well described, as most studies among THA and TKA patients classify work into two groups: mainly physical or mainly mental tasks.[14-17] The limitation of that classification is that it does not distinguish between different levels of occupations based on educational level, as well as types of occupation (e.g. unskilled workers, operators, transporters, sales workers, and managers).[18] Classifying occupations into different occupational classes (high-/low-skilled, blue-/white-collar) may help to gain better insight into occupational factors.[18]

Previous studies among working populations have shown that occupational class has a strong independent association with sickness absence and RTW.[19–22] This can be illustrated by studies showing that workers in lower occupational classes tend to have more strenuous working conditions and higher levels of work stress than workers in higher occupational classes, who tend to have more control and autonomy.[23–25] Psychosocial determinants, such as strenuous working conditions on the one hand and autonomy on the other hand, might influence the extent to which workers can adjust their work according to their needs, which could obstruct or facilitate the RTW process.[26] Knowledge of the association between occupational class and time to RTW among THA and TKA patients may help researchers to

Table I. Baseline characteristics. Patients were included if return to work data were available at six or 12 months' follow-up.

Variable	THA (n = 360)					TKA (n = 276)				
	Total	High-skilled white-collar	Low-skilled white-collar	High-skilled blue-collar	Low-skilled blue-collar	Total	High-skilled white-collar	Low-skilled white-collar	High-skilled blue-collar	Low-skilled blue-collar
Patients, n		204	89	35	32		112	105	31	28
Median age, yrs (IQR)	57 (53 to 61)	57 (53 to 62)	59 (55 to 64)	57 (53 to 61)	59 (57 to 62)	58 (55 to 61)	58 (55 to 61)	58 (54 to 62	61 (59 to 63)	59 (56 to 63)
Female, n (%)	171 (48)	94 (46)	63 (71)	3 (9)	11 (34)	151 (55)	61 (55)	74 (71)	2 (7)	14 (50)
Median BMI, kg/m² (IQR)	27 (24 to 30)	27 (24 to 30)	28 (25 to 32)	26 (25 to 28)	27 (24 to 31)	29 (26 to 32)	30 (27 to 34)	28 (26 to 31)	28 (25 to 31)	28 (26 to 31)
Comorbidities, n (%)	259 (72)	132 (65)	61 (69)	22 (63)	18 (56)	204 (74)	81 (72)	81 (77)	19 (61)	17 (61)
Median HOOS-PS/KOOS-PS (IQR)*	49 (37 to 61)	49 (39 to 59)	49 (37 to 61)	56 (45 to 67)	44 (31 to 57)	46 (38 to 54)	46 (38 to 54)	46 (39 to 53)	49 (35 to 63)	46 (35 to 57)
Self-employed, n (%)	39 (11)	17 (8)	7 (8)	12 (34)	3 (9)	18 (7)	8 (7)	4 (4)	6 (19)	0 (0)

*Scales ranged from 0 to 100; higher scores indicate better outcomes.
HOOS-PS, Hip disability and Osteoarthritis Outcome Score Physical function Short form; IQR, interquartile range; KOOS-PS, Knee injury and Osteoarthritis Outcome Score Physical function Short form; THA, total hip arthroplasty; TKA, total knee arthroplasty.

Table II. Median time to return to work in days, and proportion within the first six months postoperatively.

Occupational class	THA		TKA	
	Proportion, n (%)	Median time to RTW, days (IQR)	Proportion, n (%)	Median time to RTW, days (IQR)
High-skilled white-collar	181 (89)	60 (35 to 85)	97 (89)	69 (45 to 93)
Low-skilled white-collar	74 (83)	69 (33 to 105)	84 (80)	85 (47 to 124)
High-skilled blue-collar	30 (86)	76 (39 to 113)	18 (58)	127 (72 to 183)
Low-skilled blue-collar	25 (78)	94 (60 to 128)	18 (64)	120 (70 to 121)

IQR, interquartile range; RTW, return to work; THA, total hip arthroplasty; TKA, total knee arthroplasty.

gain more insight into the variability of time to RTW between individual patients. Ultimately, this could help to move towards tailored patient-specific advice in orthopaedic surgery and RTW guidance. Therefore, the aim of this study is to investigate the association between occupational class and time to RTW.

The primary outcome of this study is the distribution of occupational class among THA and TKA patients. The secondary outcome is the association between occupational class and time to RTW among THA and TKA patients. We focused on RTW within both six and 12 months postoperatively, as previous studies indicated that general recovery and recovery of work participation occurs between six and 12 months postoperatively.[27,28]

Methods

Study design and participants. Data from the prospective Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS; trial ID NTR3348) were used. The LOAS is an ongoing multicentre cohort study that started in 2012, and includes patients with hip or knee OA scheduled for THA or TKA. Participants were recruited at orthopaedic departments of eight Dutch medical centres in the western part of the Netherlands (one university hospital and seven regional hospitals). General inclusion criteria for the LOAS were a diagnosis of OA, age 18 years or older, being listed for THA or TKA, and sufficient Dutch-language skills to complete the questionnaires. The LOAS population is representative of the population in the Dutch Arthroplasty Register (LROI) based on age, sex, and BMI.[29] For the current study, we evaluated prospectively collected data. We selected a subgroup of the LOAS cohort: patients preoperatively employed, aged 18 to 64 years, with a primary or secondary OA diagnosis, and included between 2012 and 2018. The study was approved by the Medical Ethical Committee of Leiden University Medical Centre (registration number P12.047). Patient recruitment has been described previously.[30] All patients included in the LOAS provided informed consent according to the Declaration of Helsinki.[31] Data for this study were collected preoperatively, and at six and 12 months postoperatively, via self-administered questionnaires.

The primary outcome measure was time to RTW, defined as number of days from surgery to first time to either full or partial return to work. This was assessed at six and 12 months postoperatively, by asking the specific date on which patients had first returned to work, irrespective of whether that was the same as the number of hours they had been working preoperatively.

Occupational class. All patients were asked preoperatively about their occupation and the main tasks related to their occupation with the open questions "What is your occupation?" and "How would you describe your work tasks?". If data regarding occupation were incomplete or missing, additional information was gathered by phone. Patients whose occupation-related data were still incomplete were excluded. Occupations were classified in accordance with the International Standard Classification of Occupations 2008 (ISCO-08) by two independent researchers. The ISCO-08 is an international classification tool for organizing occupations that takes educational level and type of work into account.[18] If the assessors disagreed on the classification of a specific patient's occupation, a third researcher (TK) was consulted to act as a tie-breaker. The classification resulted in nine major occupational classes, which we redefined into four hierarchical categories: high-skilled white-collar workers (i.e. managers, professionals, technicians, associate professionals);

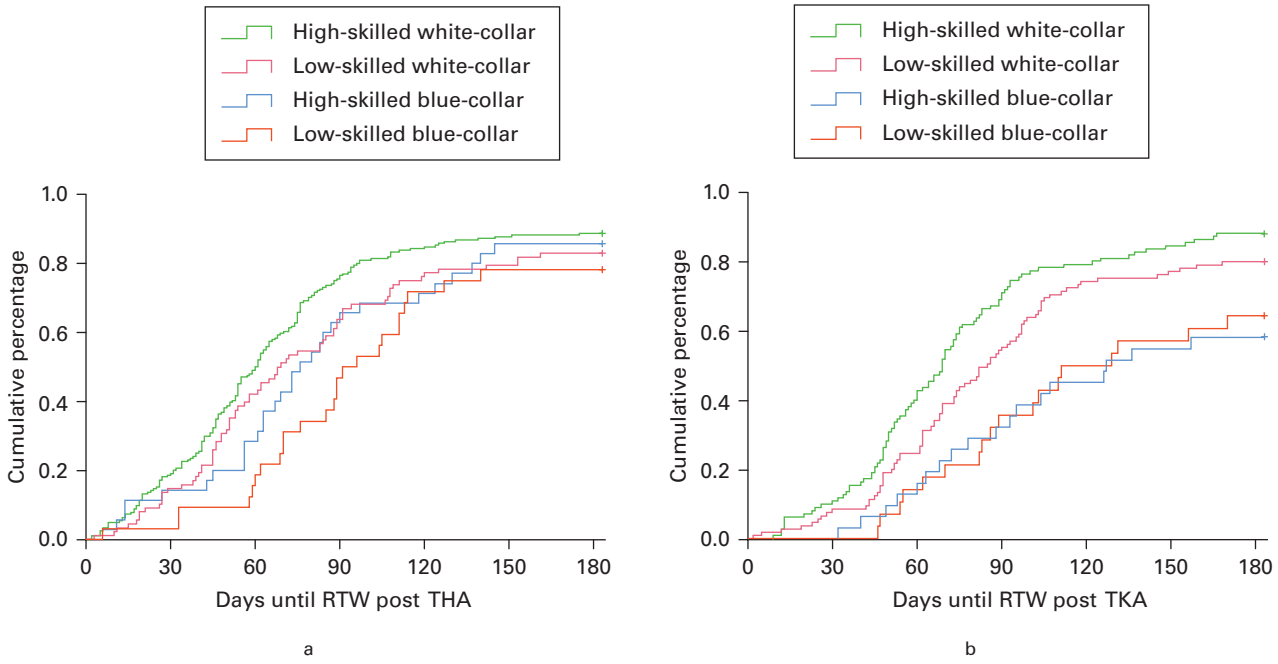

Fig. 2

Kaplan-Meier curves showing a) cumulative percentage of return to work (RTW) within the first six months after total hip arthroplasty (THA) and b) cumulative percentage of RTW within the first six months after total knee arthroplasty (TKA).

low-skilled white-collar workers (i.e. clerical support workers, service and sales workers); high-skilled blue-collar workers (i.e. skilled agricultural, forestry and fishery workers, craft and related trades workers); and low-skilled blue-collar workers (i.e. plant and machine operators, assemblers, elementary occupations).

Covariates. Data on age (years), sex, BMI, comorbidities, physical functioning, and self-employment (yes/no) were collected preoperatively. BMI was calculated from preoperative self-reported body height and weight. Comorbidities were measured preoperatively using a 19-item chronic conditions questionnaire developed by the Dutch Central Bureau of Statistics.[32] Comorbidities were dichotomized as present (one or more comorbidity) or absent (no comorbidities). Preoperative self-reported physical functioning was measured with the validated and responsive Hip disability or Knee injury and Osteoarthritis Outcome Score-Physical function Short form (HOOS-PS/KOOS-PS).[33] The HOOS-PS consists of five items and the KOOS-PS consists of seven items (scale 0 to 100, where higher scores indicate better function).

Statistical analysis. All analyses were conducted separately for patients undergoing THA and TKA. First, descriptive statistics were used to describe baseline characteristics of the total study population and stratified for occupational class. The Shapiro-Wilk test was used to check for normality. In case of skewed data, we reported medians and interquartile ranges (IQRs) instead of means and standard deviations (SDs). Complete case analysis was conducted for all analyses. Differences between participants excluded for missing follow-up data and those included were examined using chi-squared tests and non-parametric tests to detect possible selection bias. Separate Kaplan-Meier survival analyses were subsequently performed for THA and TKA to calculate RTW distribution for the four occupational classes within six and 12 months postoperatively. Next, the association between the four occupational classes and time to RTW was estimated using Cox regression analyses. After crude analyses (model 1), analyses were adjusted for sociodemographic factors (age and sex), BMI, and comorbidities (model 2). The control variables were chosen because they may confound the association between occupational class and time to RTW.[10,11] For the Cox regression, hazard ratios (HRs) were calculated including 95% confidence intervals (CIs). We used low-skilled blue-collar workers as the reference category. Proportionality assumptions were checked using Schoenfeld's method and were not violated for both patient groups (THA/TKA). All analyses were conducted using SPSS v. 28.0 (IBM, USA).

Results

In total, 636 out of 1,043 patients (61%) were included in the study (n = 360 THA; n = 276 TKA; Figure 1). Patients without information about their occupation (n = 216; 21%), patients lost to follow-up (six months postoperatively, n = 106 (10%); 12 months postoperatively, n = 123 (12%)), or patients with missing RTW data (six months postoperatively, n = 88 (8%); 12 months postoperatively, n = 106 (10%)) were excluded. Excluded patients had a significantly worse physical functioning score, and a higher proportion reported themselves as self-employed (Supplementary Table ii).

Distribution of occupational class. Patients undergoing THA or TKA were mainly high-skilled (THA 57%; TKA 41%) or low-skilled white-collar workers (THA 24%; TKA 38%). A

Table III. Cox regression for the outcome time to return to work. Model 1 is unadjusted; Model 2 is adjusted for age, sex, BMI, and comorbidity. Low-skilled blue-collar was the reference for both models.

Variables	THA		TKA	
	6 mths, HR (95% CI)	12 mths, HR (95% CI)	6 mths, HR (95% CI)	12 mths, HR (95% CI)
Model 1				
High-skilled white-collar	1.84 (1.21 to 2.80)*	1.67 (1.10 to 2.50)*	2.40 (1.45 to 3.97)*	2.06 (1.26 to 3.38)*
Low-skilled white-collar	1.39 (0.88 to 2.19)	1.46 (0.93 to 2.28)	1.70 (1.02 to 2.83)*	1.71 (1.04 to 2.80)*
High-skilled blue-collar	1.33 (0.78 to 2.27)	1.31 (0.77 to 2.21)	0.91 (0.47 to 1.74)	1.20 (0.65 to 2.23)
Model 2				
High-skilled white-collar	2.12 (1.32 to 3.40)*	1.88 (1.18 to 2.98)*	2.31 (1.34 to 4.00)*	2.08 (1.22 to 3.55)*
Low-skilled white-collar	1.62 (0.96 to 2.72)	1.62 (0.98 to 2.69)	1.82 (1.04 to 3.18)*	1.89 (1.10 to 3.26)*
High-skilled blue-collar	1.47 (0.82 to 2.64)	1.34 (0.75 to 2.40)	0.99 (0.48 to 2.06)	1.10 (0.54 to 2.24)

*Statistically significant.
CI, confidence interval; HR, hazard ratio; THA, total hip arthroplasty; TKA, total knee arthroplasty.

minority were high-skilled (THA 10%; TKA 11%) or low-skilled blue-collar workers (THA 9%; TKA 10%). The majority of low-skilled white-collar workers (both THA and TKA) were female, and the majority of high-skilled blue-collar workers (both THA and TKA) were male. Sex distribution within the other occupational classes was equal. A higher proportion of high-skilled blue-collar workers (THA, 34%; TKA, 19%) were self-employed compared to the other occupational classes (Table I).

THA. Six months postoperatively, 78% of low-skilled blue-collar workers returned to work compared to 83% to 89% in the other occupational classes (Table II). Median time to RTW of high-skilled white-collar workers was the shortest (60 days (IQR 35 to 85)). Low-skilled blue-collar workers needed the longest time to RTW (94 days (IQR 60 to 128); Table II and Figure 2a). At 12 months postoperatively, a similar percentage of patients within all occupational classes returned to work (range 87% to 90%; Supplementary Figure a).

Cox regression analyses showed that, after correction for potential confounders (model 2), high-skilled white-collar workers had a significantly higher probability to RTW within six months postoperatively relative to low-skilled blue-collar workers (HR 2.12 (95% CI 1.32 to 3.40); Table III). At 12 months postoperatively, our models yielded similar results (Table III).

TKA. Six months postoperatively, 58% of high-skilled blue-collar and 64% of low-skilled blue-collar workers had returned to work compared to 80% to 89% of white-collar workers (Table II). High-skilled white-collar workers had the shortest median time to RTW (69 days (IQR 45 to 93)). Blue-collar workers needed the longest time to RTW (high-skilled: 127 days (IQR 72 to 183); low-skilled: 120 days (IQR 70 to 171); Table II and Figure 2b). At 12 months postoperatively, 79% of low-skilled blue-collar workers returned to work compared to 87% to 92% in the other occupational classes (Supplementary Figure b).

Cox regression analyses showed that, after correction for potential confounders (model 2), high-skilled white-collar (HR 2.31 (95% CI 1.34 to 4.00)) and low-skilled white-collar workers (HR 1.82 (95% CI 1.04 to 3.18)) had a significantly higher probability of RTW within six months postoperatively compared to low-skilled blue-collar workers (Table III). At 12 months postoperatively, our models yielded similar results.

Discussion

The findings of this study showed that the majority of THA and TKA patients in our sample were white-collar workers; less than 20% were blue-collar. It was also found that low-skilled blue-collar THA patients needed about 1.5 times as long to RTW than high-skilled white-collar workers (median time of 94 vs 60 days). Time to RTW of high- and low-skilled blue-collar workers undergoing TKA was almost twice as high compared to high-skilled white-collar workers (median time of 120 and 127 vs 69 days).

The low percentage of low-skilled blue-collar workers in our sample was unexpected (THA: n = 32, 9%; TKA: n = 28, 10%). In other cohort studies, the percentage of blue-collar workers or workers with physically demanding jobs ranged between 9% and 30%.[15,34–36] To explore the generalizability of our findings, we compared the occupational class distribution of our sample with the general Dutch population (see Supplementary Table i): the THA sample consisted of more professionals (high-skilled white-collar) and the TKA sample consisted of more service and sales workers (low-skilled white-collar). Both patient groups consisted of fewer skilled-agricultural, forestry, and fishery workers (high-skilled blue-collar). The cause for the differences in distribution between our sample and the Dutch population could be the result of the geographical location of the participating hospitals, which is the western region of the Netherlands, as more blue-collar workers live in the northern and southern regions.[37] The differences could also result from the exclusion of preoperatively unemployed patients, or because patients with more physically demanding jobs and less secure employment would be less likely to submit to an arthroplasty while still of working age. Among the general working population, blue-collar workers are at risk for early involuntary exit from paid employment thanks to the availability of unemployment or disability benefits, despite strict Dutch social laws protecting employees from being fired due to disability.[38] Thus, blue-collar patients in our LOAS sub-sample could have already been unemployed preoperatively because of such problems, and consequently been excluded from the analyses.

The findings on RTW concord with previous studies among other patient groups.[21,22,39,40] A systematic review among individuals following acute orthopaedic trauma showed that blue-collar work was associated with longer time to RTW.[39] Among patients

with various cardiovascular diseases, blue-collar workers were less likely to RTW than white-collar workers (63% vs 76%).[40] We were unable to compare our results with previous studies among THA or TKA patients, as they used mainly a crude classification for work, i.e. physically or mentally demanding work tasks.[14-17] However, low occupational class (blue-collar work) has been linked to lower socioeconomic status, unhealthy lifestyle, obesity, and poorer physical health,[41,42] factors which have also been mentioned to negatively influence (time to) RTW in both THA and TKA patients.[13]

Our study likewise showed differences in RTW duration between high- and low-skilled occupations within the blue- and white-collar classes. Time to RTW shortened with a higher professional skills requirement, which might be the result of differences in psychosocial working environment or a better patient understanding of the likely results of surgery during the preoperative consultation. In terms of the working environment, RTW after THA or TKA could be hampered if possibilities to adjust work according to one's needs are lacking, since low occupational class is associated with strenuous working conditions and low job autonomy.[23,25]

Comparing time to RTW between THA and TKA patients showed that, overall, TKA patients need more time to RTW, which is in line with previous studies.[10,11] Differences in time to RTW between occupational classes were larger among TKA patients than among THA patients. These differences may exist because rehabilitation post-TKA takes more time (i.e. prolonged postoperative discomfort) than post-THA rehabilitation.[43] RTW might also take longer for TKA patients performing knee-demanding work (e.g. construction, cleaning, agriculture), since work-related knee-demanding activities (e.g. deep knee flexion) are known to remain difficult after TKA.[44]

This study has some noteworthy strengths: first is the large, multicentre cohort design, including a diverse patient population from both non-academic and academic hospitals. Second, it includes patients undergoing THA as well as those undergoing TKA, which enabled us to study both patient groups simultaneously. Third, refining the classification of work also allowed us to study differences within and between blue- and white-collar categories, and facilitates (future) inter-study comparison.

This study also has some limitations. Our data were subject to information bias, as patients had to recall their date of RTW. Attrition analyses showed that excluded patients had a significantly worse physical functioning score and a higher proportion were self-employed. Previous studies showed that preoperative physical functioning was not associated with RTW.[10,11] Uncertainties exist about the effect on RTW for self-employed patients.[10-12] Hence, we argue that the differences between included and excluded patients had a limited effect on our results. We only focused on first time to RTW, since we did not have data about recurrence of work absences. Hence, our results do not automatically imply sustainable RTW.

Our findings may have important implications for policy and clinical practice. The findings that blue-collar workers in particular need more time to RTW may help guide tailored patient-specific information during preoperative consultation, and postoperative advice, as well as create awareness among workers and their employers that some occupational classes need longer to RTW. As a result of the rise in working-age patients undergoing THA or TKA, work and RTW should be structurally discussed by the orthopaedic surgeon both preoperatively and postoperatively. Preoperatively, insights from this study may support orthopaedic surgeons and occupational physicians to effectively manage patient expectations regarding RTW to optimize postoperative outcome. Postoperatively, occupational physicians and employers should pay attention specifically to patients with blue-collar occupations, to determine whether work adjustments are necessary to support RTW.[26]

The results of this study may also have important implications for further research. To further unravel the association between occupational class and RTW among THA and TKA patients, future studies should use nationwide orthopaedic registry data to prevent geographical differences from influencing occupational distribution. Moreover, using nationwide orthopaedic registry data in other countries would be interesting to analyze the association between occupational class and RTW among THA and TKA patients in other healthcare and social security systems. Finally, further research is needed to explore the contributions of the underlying direct risk factors of occupational classes on RTW among THA and TKA patients.

Take home message

- It is important to distinguish between patients based on occupational class, as clear differences existed in time to return to work (RTW) among both total hip arthroplasty and total knee arthroplasty patients.
- Blue-collar workers in particular need more time to RTW, which may help guide tailored patient-specific information during preoperative consultation, and postoperative advice.

Supplementary material

Kaplan-Meier curves of return to work within first 12 months after total hip arthroplasty and total knee arthroplasty; occupational class distribution of study sample and general Dutch population.

References

1. **Katz JN**, **Arant KR**, **Loeser RF**. Diagnosis and treatment of hip and knee osteoarthritis: a review. *JAMA*. 2021;325(6):568–578.
2. **Otten R**, **van Roermund PM**, **Picavet HSJ**. (Trends in the number of knee and hip arthroplasties: considerably more knee and hip prostheses due to osteoarthritis in 2030). *Ned Tijdschr Geneeskd*. 2010;154:A1534. (Article in Dutch).
3. **Zhang Y**, **Jordan JM**. Epidemiology of osteoarthritis. *Clin Geriatr Med*. 2010;26(3):355–369.
4. **Kurtz SM**, **Lau E**, **Ong K**, **Zhao K**, **Kelly M**, **Bozic KJ**. Future young patient demand for primary and revision joint replacement: national projections from 2010 to 2030. *Clin Orthop Relat Res*. 2009;467(10):2606–2612.
5. **Hess M**. Rising preferred retirement age in Europe: are Europe's future pensioners adapting to pension system reforms? *J Aging Soc Policy*. 2017;29(3):245–261.
6. **Waddell G**, **Burton AK**. *Is Work Good For Your Health and Well-Being?* London, UK: The Stationery Office, 2006.
7. **Witjes S**, **van Geenen RCI**, **Koenraadt KLM**, **et al**. Expectations of younger patients concerning activities after knee arthroplasty: are we asking the right questions? *Qual Life Res*. 2017;26(2):403–417.
8. **Mancuso CA**, **Jout J**, **Salvati EA**, **Sculco TP**. Fulfillment of patients' expectations for total hip arthroplasty. *J Bone Joint Surg Am*. 2009;91-A(9):2073–2078.
9. **Kahlenberg CA**, **Krell EC**, **Sculco TP**, **et al**. Differences in time to return to work among patients undergoing simultaneous versus staged bilateral total knee arthroplasty. *Bone Joint J*. 2021;103-B(6 Supple A):108–112.
10. **Van Leemput D**, **Neirynck J**, **Berger P**, **Vandenneucker H**. Return to work after primary total knee arthroplasty under the age of 65 years: a systematic review. *J Knee Surg*. 2022;35(11):1249–1259.

11. **Hoorntje A**, **Janssen KY**, **Bolder SBT**, **et al**. The effect of total hip arthroplasty on sports and work participation: a systematic review and meta-analysis. *Sports Med*. 2018;48(7):1695–1726.
12. **Soleimani M**, **Babagoli M**, **Baghdadi S**, **et al**. Return to work following primary total hip arthroplasty: a systematic review and meta-analysis. *J Orthop Surg Res*. 2023;18(1):95.
13. **Tilbury C**, **Schaasberg W**, **Plevier JWM**, **Fiocco M**, **Nelissen R**, **Vliet Vlieland TPM**. Return to work after total hip and knee arthroplasty: a systematic review. *Rheumatology (Oxford)*. 2014;53(3):512–525.
14. **Al-Hourani K**, **MacDonald DJ**, **Turnbull GS**, **Breusch SJ**, **Scott CEH**. Return to work following total knee and hip arthroplasty: the effect of patient intent and preoperative work status. *J Arthroplasty*. 2021;36(2):434–441.
15. **Styron JF**, **Barsoum WK**, **Smyth KA**, **Singer ME**. Preoperative predictors of returning to work following primary total knee arthroplasty. *J Bone Joint Surg Am*. 2011;93-A(1):2–10.
16. **Foote JAJ**, **Smith HK**, **Jonas SC**, **Greenwood R**, **Weale AE**. Return to work following knee arthroplasty. *Knee*. 2010;17(1):19–22.
17. **Bohm ER**. The effect of total hip arthroplasty on employment. *J Arthroplasty*. 2010;25(1):15–18.
18. **International Labour Office**. International Standard Classification of Occupations. Structure, Group Definitions and Correspondence Tables, 2012. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf (date last accessed 18 July 2023).
19. **Piha K**, **Laaksonen M**, **Martikainen P**, **Rahkonen O**, **Lahelma E**. Interrelationships between education, occupational class, income and sickness absence. *Eur J Public Health*. 2010;20(3):276–280.
20. **Pekkala J**, **Blomgren J**, **Pietiläinen O**, **Lahelma E**, **Rahkonen O**. Occupational class differences in long sickness absence: a register-based study of 2.1 million finnish women and men in 1996-2013. *BMJ Open*. 2017;7(7):e014325.
21. **Roelen CAM**, **Koopmans PC**, **Schellart AJM**, **van der Beek AJ**. Resuming work after cancer: a prospective study of occupational register data. *J Occup Rehabil*. 2011;21(3):431–440.
22. **Murgatroyd DF**, **Harris IA**, **Tran Y**, **Cameron ID**, **Murgatroyd D**. Predictors of return to work following motor vehicle related orthopaedic trauma. *BMC Musculoskelet Disord*. 2016;17:171.
23. **Hoven H**, **Siegrist J**. Work characteristics, socioeconomic position and health: a systematic review of mediation and moderation effects in prospective studies. *Occup Environ Med*. 2013;70(9):663–669.
24. **Wahrendorf M**, **Dragano N**, **Siegrist J**. Social position, work stress, and retirement intentions: a study with older employees from 11 European countries. *Eur Sociol Rev*. 2013;29(4):792–802.
25. **Gallie D**, **Felstead A**, **Green F**. Changing patterns of task discretion in Britain. *Work Employ Soc*. 2004;18(2):243–266.
26. **van Oostrom SH**, **Driessen MT**, **de Vet HCW**, **et al**. Workplace interventions for preventing work disability. *Cochrane Database Syst Rev*. 2009;2:CD006955.
27. **Hylkema TH**, **Brouwer S**, **Stewart RE**, **et al**. Two-year recovery courses of physical and mental impairments, activity limitations, and participation restrictions after total knee arthroplasty among working-age patients. *Disabil Rehabil*. 2022;44(2):291–300.
28. **Davis AM**, **Perruccio AV**, **Ibrahim S**, **et al**. The trajectory of recovery and the inter-relationships of symptoms, activity and participation in the first year following total hip and knee replacement. *Osteoarthritis Cartilage*. 2011;19(12):1413–1421.
29. **No authors listed**. Online LROI Annual Report 2018, Dutch Arthroplasty Register (LROI. 2018:57–62. https://www.lroi-report.nl/app/uploads/2020/10/PDF-Online-LROI-annual-report-2018.docx-min.pdf (date last accessed 18 July 2023).
30. **Harmsen RTE**, **Haanstra TM**, **Den Oudsten BL**, **et al**. A high proportion of patients have unfulfilled sexual expectations after TKA: a prospective study. *Clin Orthop Relat Res*. 2020;478(9):2004–2016.
31. **World Medical Association**. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA*. 2013;310(20):2191–2194.
32. **No authors listed**. (Questionnaires Health Survey 2010 to 2013). Centraal Bureau voor de Statistiek. https://www.cbs.nl/nl-nl/onze-diensten/methoden/onderzoeksomschrijvingen/aanvullende-onderzoeksomschrijvingen/vragenlijsten-gezondheidsenquete-2010-t-m-2013 (date last accessed 19 July 2023). (Webpage in Dutch).
33. **Davis AM**, **Perruccio AV**, **Canizares M**, **et al**. Comparative, validity and responsiveness of the HOOS-PS and KOOS-PS to the WOMAC physical function subscale in total joint replacement for osteoarthritis. *Osteoarthritis Cartilage*. 2009;17(7):843–847.
34. **Kleim BD**, **Malviya A**, **Rushton S**, **Bardgett M**, **Deehan DJ**. Understanding the patient-reported factors determining time taken to return to work after hip and knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc*. 2015;23(12):3646–3652.
35. **Kuijer P**, **Kievit AJ**, **Pahlplatz TMJ**, **et al**. Which patients do not return to work after total knee arthroplasty? *Rheumatol Int*. 2016;36(9):1249–1254.
36. **Kamp T**, **Stevens M**, **Van Beveren J**, **et al**. Influence of social support on return to work after total hip or total knee arthroplasty: a prospective multicentre cohort study. *BMJ Open*. 2022;12(5):e059225.
37. **No authors listed**. (Employed labor force by region and occupation). Centraal Bureau voor de Statistiek. July 14, 2021. https://www.cbs.nl/nl-nl/maatwerk/2021/28/werkzame-beroepsbevolking-naar-regio-en-beroep (date last accessed 19 June 2023). (Article in German).
38. **Ots P**, **Oude Hengel KM**, **Burdorf A**, **et al**. Development and validation of a prediction model for unemployment and work disability among 55 950 Dutch workers. *Eur J Public Health*. 2022;32(4):578–585.
39. **Clay FJ**, **Newstead SV**, **McClure RJ**. A systematic review of early prognostic factors for return to work following acute orthopaedic trauma. *Injury*. 2010;41(8):787–803.
40. **Sadeghi M**, **Rahiminam H**, **Amerizadeh A**, **et al**. Prevalence of return to work in cardiovascular patients after cardiac rehabilitation: a systematic review and meta-analysis. *Curr Probl Cardiol*. 2022;47(7):100876.
41. **Majer IM**, **Nusselder WJ**, **Mackenbach JP**, **Kunst AE**. Socioeconomic inequalities in life and health expectancies around official retirement age in 10 Western-European countries. *J Epidemiol Community Health*. 2011;65(11):972–979.
42. **Sekine M**, **Chandola T**, **Martikainen P**, **Marmot M**, **Kagamimori S**. Socioeconomic inequalities in physical and mental functioning of British, Finnish, and Japanese civil servants: role of job demand, control, and work hours. *Soc Sci Med*. 2009;69(10):1417–1425.
43. **Bourne RB**, **Chesworth B**, **Davis A**, **Mahomed N**, **Charron K**. Comparing patient outcomes after THA and TKA: is there a difference? *Clin Orthop Relat Res*. 2010;468(2):542–546.
44. **Kievit AJ**, **van Geenen RCI**, **Kuijer P**, **Pahlplatz TMJ**, **Blankevoort L**, **Schafroth MU**. Total knee arthroplasty and the unforeseen impact on return to work: A cross-sectional multicenter survey. *J Arthroplasty*. 2014;29(6):1163–1168.

Author information:

T. Kamp, MSc, MD/PhD Student, Department of Health Sciences, Community and Occupational Medicine, University of Groningen, University Medical Centre Groningen, Groningen, Netherlands; Department of Orthopaedics, University of Groningen, University Medical Center Groningen, Groningen, Netherlands; Department of Orthopaedics, Leiden University Medical Center, Leiden, Netherlands.

M. G. J. Gademan, PhD, Assistant Professor, Department of Orthopaedics, Leiden University Medical Center, Leiden, Netherlands; Department of Epidemiology, Leiden University Medical Center, Leiden, Netherlands.

S. K. R. van Zon, PhD, Postdoctoral Researcher
S. Brouwer, Prof. Dr., Professor
Department of Health Sciences, Community and Occupational Medicine, University of Groningen, University Medical Centre Groningen, Groningen, Netherlands.

R. G. H. H. Nelissen, Prof. Dr., Professor
T. P. M. Vliet Vlieland, Prof. Dr., Professor
Department of Orthopaedics, Leiden University Medical Center, Leiden, Netherlands.

M. Stevens, Dr., Associate Professor/Research Coordinator, Department of Orthopaedics, University of Groningen, University Medical Center Groningen, Groningen, Netherlands.

Author contributions:

T. Kamp: Conceptualization, Data curation, Writing – original draft, Formal analysis.
M. G. J. Gademan: Conceptualization, Supervision, Resources, Writing – review & editing.
S. K. R. van Zon: Writing – review & editing.
R. G. H. H. Nelissen: Resources, Writing – review & editing.
T. P. M. Vliet Vlieland: Resources, Writing – review & editing.
M. Stevens: Conceptualization, Supervision, Writing – review & editing.
S. Brouwer: Conceptualization, Supervision, Writing – review & editing.

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