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Return to work and workplace activity limitations following total hip or knee replacement

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SUMMARY

Objective: Total hip (THR) and knee (TKR) replacements increasingly are performed on younger people making return to work a salient outcome. This research evaluates characteristics of individuals with early and later return to work following THR and TKR. Additionally, at work limitations pre-surgery and upon returning to work, and factors associated with work limitations were evaluated.
Methods: 190 THR and 170 TKR of a total 931 cohort participants were eligible (i.e., working or on short-term disability pre-surgery). They completed questionnaires pre-surgery and 1, 3, 6 and 12 months post-surgery that included demographics, type of occupation, and the Workplace Activity Limitations Scale (WALS).
Results: 166 (87%) and 144 (85%) returned to work by 12 months following THR and TKR, respectively. Early (1 month) return to work was associated with, male gender, university education, working in business, finance or administration, and low physical demand work. People with THR returned to work earlier than those with TKR. For both groups, less pain and every day functional limitations were associated with less workplace activity limitations at the time return to work.
Conclusions: The majority of individuals working prior to surgery return to work following hip or knee replacement for osteoarthritis (OA) and experience fewer limitations at work than pre-surgery. The changing workforce dynamics and trends toward surgery at younger ages mean that these are important outcomes for clinicians to assess. Additionally, this is important information for employers in understanding continued participation in employment for people with OA.

Introduction

Total joint replacement (TJR), specifically total hip (THR) or knee (TKR) replacement, is effective in relieving pain, improving mobility, restoring function, and improving health-related quality of life for people with moderate to severe osteoarthritis (OA)[1–4]. The number of TJR procedures performed is growing and younger people under the age of 65 years represent an increasing proportion of people receiving TJR[5,6]. Kurtz *et al.* project that more than 50% of both TKR and THR procedures will be performed on individuals under 65 years of age by 2016[6]. This trend coincides with the aging of many North American and European workforces and with delayed retirement of workers, making the examination of employment outcomes following TJR particularly salient.

Arthritis, of which OA is the most common form[7], is the leading cause of disability in working-age Americans[8]. Examination of work and OA has revealed a bi-directional relationship where repetitive use of a joint is a risk factor for OA[9,10] and OA limits work participation[11]. Occupational limitations are reported to be 3–5 times higher in those with OA compared to those without OA and these

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work limitations led to decreased work productivity and considerable economic costs[12,13].

Given the known impact of OA on work and the high prevalence of TJR in those working, it is important to examine whether the benefits of TJR extend into the work domain. It has been reported that the majority of people employed prior to THR or TKR return to work following surgery[14–19]. The average time to return to work among working individuals was 10.5 weeks following THR[18], and between 8.9 and 12 weeks following TKR[15,19]. One study prospectively examined determinants of time taken to return to work and reported that urgency of return to work was the main factor accelerating return to work, while having less pain pre-operatively, having a physically demanding job, and receiving Worker's Compensation were associated with later return to work[19]. Theories of work and health also point to the importance of studying at work performance and an individual's capacity for work as important predictors of work participation[20]. Bohm found that people with THR reported improved ability in meeting job demands at 1 year follow-up[14] and Nunley reported that more than 90% of individuals returned to their prior job[17]. Foote found that about 30% with total or unicompartmental knee replacement reported an improved ability to work[15]. However, to date, data informing individual's experiences at return to work following TJR for OA are limited. In particular, we lack information on specific types of jobs and work functioning that may be problematic for individuals and that may act as barriers to return to work. This study examines when patients with OA undergoing THR or TKR return to work following surgery and describes characteristics of the individuals with early and later return to work. We further examine the type of workplace activity limitations individuals experience pre-surgery and upon return to work, and the factors associated with these workplace limitations. Specifically, we evaluated: (1) if individual demographic variables (age, sex and education), job sector and physical work demands were associated with when people returned to work; (2) the relationship of pain, physical function and higher demand activities with when people returned to work; and, (3) the association of work limitations on first return to work with individual demographic variables, job sector, job demands, pain, physical function and higher demand limitations.

Methods

Study design and setting

The current study is based on a sub-sample of a prospective longitudinal cohort of people with primary THR or TKR for OA recruited between 2005 and 2008 from four tertiary-care centers in Toronto, Canada[21]. For the cohort, participants were eligible if they were between 18 and 85 years of age, had English proficiency sufficient for completion of the self-report questionnaires and consented to participate. Exclusion criteria included: revision or hemi-arthroplasty, and TJR for trauma or malignancy. Ethical approval for the study was obtained from the participating institution review boards.

Cohort participants (hip: $n = 437$; knee: $n = 494$) completed a baseline questionnaire that probed employment status at their pre-surgery admission clinic visit approximately 2 weeks prior to surgery. Patients who reported that they chose not to participate in the workforce (i.e., not looking for work or a homemaker), were retired, were unemployed or were on long-term disability prior to their surgery were excluded, giving a sample of 190 people with THR and 170 with TKR.

Data collection

Data were collected *via* mailed questionnaire within 2 weeks prior to surgery and post-operatively at 1, 3, 6 and 12 months.

Outcomes

The primary outcome for the current study was defined as return to work (either full-time defined as 35 h or more per week or part-time as less than 35 h) based on response to the question: 'which of the following [responses] best describes your current employment status' on the first time of report of return to work, here after referred to as return to work. Time was coded as the first follow-up time at which the participant indicated that they first returned to work (i.e., 1, 3, 6 or 12 months). The secondary outcome was the Workplace Activity Limitations Scale (WALS) and was completed pre-surgery and at each post-operative time if the participant indicated they had returned to work. The 12-item WALS probes difficulties in completing work-related activities[22,23]. Study participants were asked to rate how much difficulty they experienced carrying out specified activities without help from another person or special equipment using a four-point scale, where 0 = no difficulty; 1 = some difficulty; 2 = a lot of difficulty; 3 = not able to do. Patients could indicate that the activity was not applicable to their job; in which case, the activity was assumed not to be limited and a score of 0 was assigned. The total score is a sum of the item scores (score range 0–36) with lower scores indicating fewer limitations. Internal consistency of the WALS based on Cronbach's alpha ranged from 0.78 to 0.87 in patients with OA and inflammatory arthritis. The WALS has demonstrated responsiveness (standardized response mean = 0.50) in people with OA and rheumatoid arthritis receiving medical therapy[23–25].

Descriptive data and covariates

The pre-surgery questionnaire, in addition to containing the validated patient-reported outcome measures outlined below, included age, sex, education, marital status, height and weight [to determine obesity defined as body mass index (BMI) >30], THR or TKR, job status (full-time, part-time or short-term disability), type of work and job title. Derived variables were created for job sector and physical demand at work based on type of work.

Occupation – Job sector: Occupation was classified based on the responses to the "type of work" and "job title" questions from the pre-surgery questionnaire using the Human Resources Development Canada National Occupation Classification Matrix 2006[26]. This matrix classifies jobs into nine sectors which were further collapsed into four sectors: (1) business, finance and administration; (2) health, science, teaching and the arts; (3) sales and service; and, (4) trades, transportation and manufacturing, as previously described by Gignac *et al.*[22]

Occupation – Physical demand: The expected lower extremity physical demands of the workplace were classified on a three-point scale, where 0 = no or low demand, 1 = high demand, and 2 = unable to determine. For instance, the response of "administrative assistant" was coded as low demand, whereas "hair stylist," which involves prolonged standing and mobility, was coded as high demand. There were several occupations, for example "consultant – market research" where the expected physical demand could not be determined. Two authors (AS, a second year medical student, and AMD, a physiotherapist and researcher) independently coded and came to consensus on the 15 cases (4%) where the assigned codes differed.

Standardized measures

Pain on activity and physical function: Pain and physical functioning were evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Likert-version 3.0. The WOMAC pain scale is a five-item measure assessing pain on activity

with responses ranging from 0 to 4, no pain to extreme pain. The WOMAC physical function subscale is a 17-item measure evaluating basic mobility and activities of daily living with responses ranging from 0 – no difficulty to 4 – extreme difficulty. Summary scores based on the sum of the items ranged from 0 to 20 for pain and 0–68 for physical function where higher scores indicate worse pain or higher levels of difficulty in physical function, respectively. This measure has been extensively tested and validated in people with TJR for OA[27]. Higher demand activities were reported using the limitations subscale of the Late Life Disability Index (LLDI)[28] where respondents rated the extent to which they feel limited in their ability to personally perform 16 socially expected life tasks (e.g., participating in active recreation, visiting friends and family, volunteering etc.) on a 1 – 'completely' to 5 – 'not at all' scale. Raw summed scores are converted to scaled interval level summary scores ranging from 0 to 100 with higher scores represent less limitations[29].

Analysis

THR and TKR data were analyzed separately as prior work demonstrated different recovery for the two groups[21]. Where necessary, standardized measure scores were re-coded such that higher scores represented more problems for all measures.

Descriptive statistics including means, standard deviations and proportions were calculated for all variables, including the WALS items at baseline for those returning and not returning to work. For each time of data capture, the proportion working with 95% confidence interval (CI) was calculated. For those returning to work at each time point, the WOMAC pain and function, LLDI limitations and WALS mean scores and 95% CI were calculated. Mean WALS scores from pre-surgery and 12 months post-surgery were compared by a paired *t*-test.

The association of age, sex, and education (entered as block 1), job sector (entered as block 2) and physical demands (entered as block 3) with return to work (early up to 1 month; mid 1–3 months; and later between 6 and 12 months) were evaluated using ordinal logistic regression for our three level outcome. Variables from block 1 significant at $P < 0.05$ were carried forward when block 2 and then block 3 were entered. Potential multicollinearity among candidate independent variables and model assumptions was evaluated.

Finally, after checking for multicollinearity among potential independent predictors and model assumptions, we evaluated the association of work limitations (WALS) on first return to work with age, sex, education (block 1), job sector, job demand (block 2), time of return to work (block 3), and WOMAC pain and function, and the Late Life Disability limitations (block 4) using multivariable linear regression. Variables from each block significant at $P < 0.05$ were carried forward to subsequent analyses.

Results

The descriptive data for the THR ($n = 190$) and TKR ($n = 170$) samples are presented in Table I. The mean age for both groups was in the mid-50s and 53% and 42% of THR and TKR patients respectively were male. Most individuals were employed full-time pre-surgery (65% for THR, 73% for TKR) with high physical demand work for 49% with TKR and 39% with THR. Seventy-four percent of those with THR and 70% with TKR worked in business, finance, administration; or, health, science and arts.

Proportion of individuals returning to work by 1, 3, 6 and 12 months

A total of 166 (87%) of THR and 144 (85%) of TKR patients returned to work by 12 months post-surgery. As shown in Fig. 1, a higher proportion of people with THR than with TKR had returned to work at all time-points post-surgery. By 1 month, 65 or 34% of people with THR had returned compared with 40 (24%) with TKR. By 3 months post-surgery, more than half of each of those with THR and TKR had returned to work. Table II provides the descriptive statistics for those with THR and TKR respectively by return to work status. Notably, about 40% (18 of 43) of those who were on short-term disability prior to their hip or knee replacement did not return to work. Of those returning to work, as shown in Table III, there

Table I
Descriptive statistics for the sample prior to hip or knee replacement

	Hip $n = 190$		Knee $n = 170$	
Age: mean, sd	56.1	9.9	57.5	7.2
	n	%	*n*	
Sex: male	100	53	72	42
BMI: <30	120	63	91	54
≥30	69	36	72	42
Education:				
Some elementary or high school	31	16	36	21
Some trade or community college	45	24	50	29
Some university	113	59	83	49
Marital status: married or with partner	131	69	103	61
Pre-surgery job status:				
Full-time	123	65	124	73
Part-time	29	15	32	19
Short-term disability	29	15	14	8
Job sector:				
Business, finance, administration	80	42	59	35
Health, science, arts (incl. teaching)	60	32	59	35
Sales and service	24	13	21	12
Trades, transportation, equipment operation	16	8	25	15
Physical demands at work:				
Low demand	88	46	66	39
High demand	74	39	83	49
Unable to classify	22	12	16	9
	Mean	*sd*	*Mean*	*sd*
WOMAC pain	10.2	3.1	10.5	3.5
WOMAC function	34.9	11.0	32.2	12.0
LLDI	40.2	11.9	38.9	13.3
WALS	7.3	5.5	9.0	5.6

Note: WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; WALS = Work Activity Limitations Scale. Low scores represent less pain or limitations for all measures.

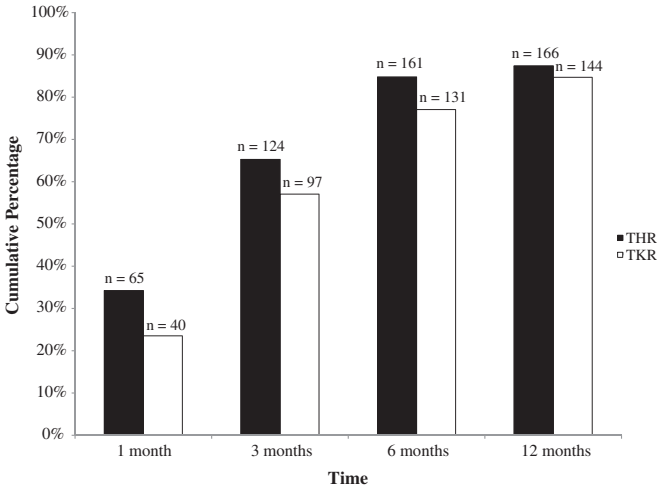

Fig. 1. Cummulative proportion of participants returned to work by each follow-up time following THR or TKR.

Table II
Descriptive statistics for individuals by return to work status

	THR				TKR			
	Did not return to work	Post-surgery return to work by:			Did not return to work	Post-surgery return to work by:		
	$n = 24$	1 mos $n = 65$	3 mos $n = 59$	6–12 mos $n = 42$	$n = 26$	1 mos $n = 40$	3 mos $n = 57$	6–12 mos $n = 47$
Age: mean, sd	51.9, 10.6	60.1, 8.7	56.4, 9.1	51.9, 10.0	56.8 (7.0)	60.5 (7.0)	57.0 (7.2)	55.8 (6.9)
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Sex: male	10 (42)	49 (75)	24 (41)	17 (40)	11 (42)	23 (57)	22 (39)	16 (34)
BMI: ≥30	7 (29)	23 (35)	21 (36)	18 (43)	9 (35)	12 (30)	30 (53)	21 (45)
Education:								
Some elementary or high school	6 (26)	6 (9)	6 (10)	13 (31)	10 (38)	7 (18)	11 (19)	9 (19)
Some trade or community college	10 (44)	7 (11)	15 (25)	13 (31)	5 (19)	7 (18)	18 (32)	20 (43)
Some university	7 (30)	52 (80)	38 (64)	16 (38)	11 (43)	26 (65)	27 (47)	18 (28)
Marital status: married or with partner	17 (71)	51 (78)	39 (66)	25 (60)	15 (58)	28 (70)	34 (60)	28 (60)
Pre-surgery job status:								
Full-time	6 (25)	56 (86)	41 (69)	29 (69)	14 (54)	32 (80)	44 (77)	34 (72)
Part-time	8 (33)	7 (11)	9 (15)	5 (12)	4 (15)	8 (20)	12 (21)	8 (17)
Short-term disability	10 (42)	2 (3)	9 (15)	8 (19)	8 (31)	0	1 (2)	5 (11)
Job sector:								
Business, finance, administration	4 (17)	37 (57)	22 (37)	14 (33)	7 (33)	20 (50)	24 (42)	11 (23)
Health, science, arts, teaching	8 (33)	18 (28)	24 (41)	10 (24)	7 (33)	15 (38)	22 (39)	14 (30)
Sales and service	7 (29)	3 (5)	9 (15)	8 (19)	4 (19)	1 (3)	5 (9)	9 (19)
Trades, transportation, equipment operation	5 (21)	3 (5)	2 (3)	8 (19)	3 (14)	4 (10)	6 (11)	9 (19)
Physical demands at work:								
Low	5 (21)	41 (63)	25 (42)	12 (29)	10 (48)	21 (53)	26 (46)	14 (30)
High	15 (62)	17 (26)	23 (39)	27 (64)	4 (19)	16 (40)	23 (40)	29 (62)
Unable to classify	4 (17)	6 (9)	10 (17)	2 (5)	7 (33)	3 (8)	8 (14)	1 (2)
Pre-surgery: mean (sd)								
WOMAC pain	12.3 (3.4)	9.4 (3.3)	10.2 (2.8)	11.3 (3.1)	11.9 (4.0)	9.5 (3.7)	10.7 (3.4)	11.7 (3.2)
WOMAC function	40.0 (11.8)	30.9 (9.4)	35.4 (11.1)	40.4 (10.9)	39.8 (14.8)	28.9 (11.0)	30.6 (12.8)	36.8 (10.6)
LLDI limitations	43.2 (14.0)	36.8(11.3)	40.9 (11.9)	44.8 (11.6)	47.8 (16.3)	35.9 (11.9)	36.6 (12.8)	44.8 (13.4)
WALS	13.2 (6.9)	10.8 (5.1)	12.6 (4.9)	15.1 (5.4)	16.3 (6.0)	11.4 (4.0)	12.2 (4.4)	15.0 (5.1)

Note: 6 and 12-month data have been combined as only 5 and 13 individuals returned to work between 6 and 12 months for THR and TKR respectively. Sum of % of subgroups for BMI, education, pre-surgery job status and job sector may not equal 100% due to missing data.

was a trend for those who returned by 1 month post-surgery, irrespective of hip or knee replacement, to have more pain and more limitations in function, in higher demand activities and in at work activities.

Factors influencing early versus later return to work following TJR

As shown in Table IV, for those with THR, being male, more than high school education, and having a job of low or unclassifiable physical demand were associated with earlier return to work. For people with TKR, males with job class of business, finance, administration or health, science, arts were more likely to return to work earlier.

Work limitations before and after TJR

There was significant improvement in the WALS score from pre-surgery to 12 months post-surgery for those with THR and TKR as shown in Figs. 2 and 3. Of note, those with TKR who returned to work at 1 month post-surgery continued to report work limitations similar to their pre-operative status (Fig. 3).

We descriptively examined the individual items of the WALS questionnaire in an attempt to understand the type of limitations people experienced at work. Based on a mean item score >1 (1 = some difficulty), similar limitations were reported prior to surgery irrespective of joint being replaced: (1) getting to, from and around the workplace; (2) standing; (3) lifting, carrying and

Table III
Mean (95% CI) WOMAC pain and function, LLDI and WALS scores at time of return to work

Return to work by (*n*)	WOMAC pain	WOMAC function	LLDI limitations	WALS
THR				
1 month (65)	3.4 (2.8, 4.0)	16.1 (13.8, 18.5)	34.4 (30.9, 37.8)	8.5 (6.9–10.1)
3 months (59)	2.0 (1.4, 2.5)	11.1 (9.0, 13.1)	25.1 (22.2, 28.0)	6.2 (5.1, 7.4)
6–12 months (42)	3.0 (2.1, 3.9)	12.4 (9.3, 15.6)	25.9 (22.5, 29.4)	6.9 (5.3, 8.5)
TKR				
1 month (40)	6.9 (5.9, 7.9)	21.6 (17.7, 24.8)	37.7 (32.4, 42.9)	12.0 (10.1, 14.0)
3 months (57)	4.0 (3.3, 4.8)	12.4 (9.9, 15.0)	24.4 (21.2, 27.5)	7.1 (5.9, 8.3)
6–12 months (47)	4.9 (3.9, 6.0)	16.1 (13.0, 19.2)	26.4 (23.8, 29.0)	8.8 (7.2, 10.4)

Note: WOMAC = Western Ontario McMaster Universities Osteoarthritis Index; WALS = Work Activity Limitations Scale. Lower scores represent less pain and limitations for all measures.

Table IV
Final models showing factors associated with time of return to work for people with THR ($n = 166$) or TKR ($n = 144$)
Outcome: return to work by 1 month, 3 months or 6–12 months (ref)

Parameter	THR OR (95% CI)	TKR OR (95% CI)
Age	1.0 (1.0–1.1)	1.1 (1.0–1.1)
Male	4.1 (2.1–8.2)	4.4 (2.1–9.3)
Education: greater than high school	2.0 (1.3–3.2)	*
Job class (ref: trades, transportation and manufacturing) business, finance, administration	2.0 (0.4–9.3)	5.5 (1.3–24.2)
Health, science, arts	1.6 (0.4–6.5)	4.0 (1.2–13.0)
Sales and service	1.4 (0.3–6.4)	0.9 (0.2–3.6)
Physical demand (ref: high) low	2.9 (1.1–7.6)	1.3 (0.5–3.8)
Unclassified	4.3 (1.3–14.1)	1.8 (0.5–6.6)

**Note*: Education was not significant in the first stage of modeling and was not carried forward to the final model.

moving objects; (4) crouching, bending and kneeling; (5) sitting for long periods; (6) pace of work; (7) meeting job demands; and, (8) hours of work. Individuals with TKR additionally reported difficulty concentrating on their work and this persisted post-surgery. Overall, people with TKR reported difficulty with more work activities as compared to those with THR and limitations were different with the exception of sitting for long periods. People with THR additionally continued to report difficulty in lifting, carrying and moving objects and in crouching, bending and kneeling whereas those with TKR reported ongoing difficulty with getting to and from work and around the workplace; pace of work; meeting job demands; and, hours of work.

Finally, in multivariable modeling, demographic factors, job type and job demands were not associated with WALS scores at the time of return to work for either the THR or TKR groups. However, for both groups, those reporting less pain and less limitations on both the WOMAC function and LLDI limitations subscale reported less workplace activity limitations at the time they reported having returned to work (Table V).

Discussion

TJR is being performed on an increasingly younger population[6], making it critical to understand outcomes beyond those of pain and function that are typically reported following THR and TKR[21,30–32]. Specifically, employment functioning and return to work are vital for a large proportion of people having joint replacement surgery. While others have reported when individuals return to work following TJR[14–19], this study evaluated both when individuals returned to work and the at work limitations experienced before and after joint replacement.

Our finding that 87% and 85% of the THR and TKR samples, respectively, returned to work following surgery is consistent with past studies[14–19]. Furthermore, results showing that approximately half the sample had returned to work by 3 months post-surgery for both THR and TKR are consistent with the median time of return to work reported in the literature[15,18,19]. Comparing THR and TKR, a higher proportion of people with THR had returned to work by 1 month following surgery, though as a caution, we did observe an overlap in the 95% CIs. This is in keeping with reports that people with THR recover sooner and achieve greater pain relief and improved physical function than those with TKR[2,33].

Of interest, although the numbers are small, only 58% of those on short-term disability returned to work after their joint replacement. We were unable to evaluate factors such as type of job and job demands that might impact why individuals did or did not return to work due to small sample size. However, this finding is in keeping with previous research that finds that a history of sick leave and receipt of sick leave benefits are associated with longer-term absences from work[18,34]. This highlights the need for additional research to understand whether health and functioning of some of those waiting for surgery deteriorated and necessitated short-term disability. It may be that earlier surgical intervention could reduce the incidence of short-term disability and further increase the number of individuals who could return to work overall and perhaps at an earlier time post-surgery, particularly as there may be a trend that more pre-operative symptoms and functional limitations may relate to time of return to work (Table II).

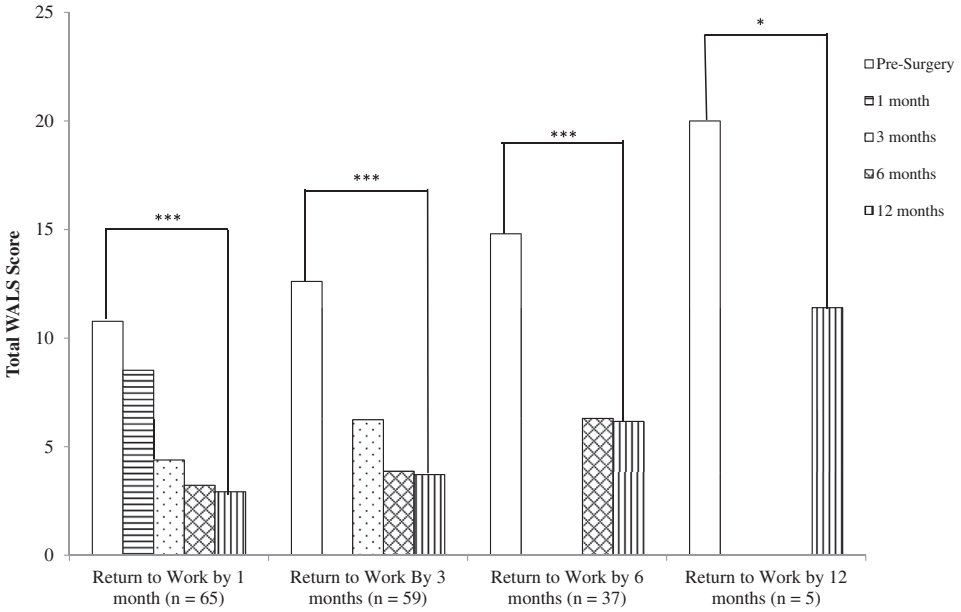

Fig. 2. Work Activity Scores over time by time of return to work (i.e., pre-surgery, 3, 6 and 12 months for those returning at 1 month post-surgery; pre-surgery, 6 and 12 months for those returning at 3 months and pre-surgery and 12 months for those returning at 12 months post-surgery) for people with THR.

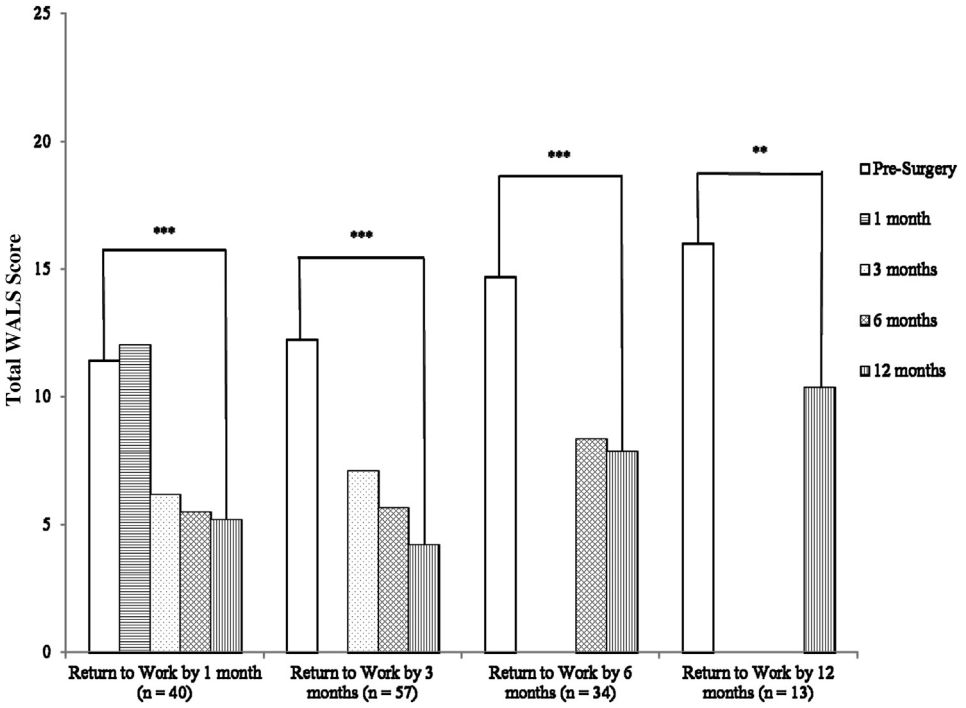

Fig. 3. Work Activity Scores over time by time of return to work (i.e., pre-surgery, 3, 6 and 12 months for those returning at 1 month post-surgery; pre-surgery, 6 and 12 months for those returning at 3 months and pre-surgery and 12 months for those returning at 12 months post-surgery) for people with TKR.

This work also points to the need for research on understanding factors that influence return to work including workplace benefits and an understanding of whether individuals who have concerns over losing benefits may be cautious and delay return to work.

On the other hand, we also found that about a third of people reported returning to work by 1 month post-surgery. In exploring pain, every day function and work limitations at time of return to work, we found that those who returned to work at 1 month tended to report more pain, function and work limitations than those who returned later post-surgery. While there was overlap in the CIs and we did not have sufficient sample size to evaluate covariates, these data raise interesting considerations regarding the optimum timing of return to work and further evaluation of how these individuals manage at work over time. There are few studies with multiple follow-up time-points that allow evaluation of work-related issues. Bohm reported that people with THR ($n = 60$) reported increased ability to meet work and productivity demands at 1 year follow-up[14]. In a retrospective study, as previously noted, Foote reported that about 30% of individuals with total or unicompartmental knee replacement ($n = 72$) reported improved ability at work. Some of these issues have been evaluated in people with arthritis. Common work transitions include productivity losses, changing jobs, reducing hours and leaving employment which were reported by more than 75% of people with arthritis in a longitudinal study spanning nearly 5 years[35]. While both medium and high arthritis-related limitations in workplace activity were associated with job modifications, high activity limitations were related to lost work time, being unable to attend meetings or business trips and permanently reducing work hours[36]. At the same time, findings from a systematic review indicated that while many individuals with OA faced problems at work, only a small proportion left the workforce because of these problems[11]. Episodic disability meant that individuals with arthritis often were not a permanent drain on workplace resources but that their disease had a variable impact[35]. From a personal and societal perspective, the ability to maintain employment without extended job interruptions is associated with numerous benefits, whereas loss of employment is related to increased depression and anxiety, reduced physical functioning, and mortality even after taking into account original health status[37–42]. Longitudinal research in people with TJR examining not only workplace functioning but also absenteeism, reduced productivity (i.e., presenteeism) and recurrence of sick disability would enable researchers to examine whether some individuals return to work too early and are at risk for negative job outcomes.

Table V
Factors associated with at Work Activity Limitations at the time of return to work (THR = 166 and TKR = 144)

Parameter	Estimate (SE)	*t*	*P*-value	Standardized estimate (95% CI)
THR				
WOMAC pain	0.43 (0.14)	2.96	0.004	0.26 (0.14–0.72)
WOMAC function	0.26 (0.05)	5.26	<0.0001	0.49 (0.16–0.36)
LLDI limitations	0.03 (0.03)	2.21	0.029	0.14 (0.01–0.12)
TKR				
WOMAC pain	0.35 (0.16)	2.18	0.031	0.15 (0.03–0.67)
WOMAC function	0.19 (0.05)	3.56	0.0005	0.31 (0.08–0.29)
LLDI limitations	0.17 (0.03)	5.11	<0.0001	0.39 (0.10–0.24)

WOMAC = Western Ontario McMaster Universities Osteoarthritis Index.
LLDI = Late Life Disability Index.
Models adjusted for age, sex, education, job sector, physical demands of work and time of return to work (by 1 month, by 3 months, by 6–12 months).
THR: Model $R^2 = 0.58$; TKR: Model $R^2 = 0.65$.

In contrast to work by others reporting that older age is associated with slower return to work after work disability due to musculoskeletal disorders[43], we found age was not associated with the time by which individuals returned to work. The fact that most patients in our sample which consisted of mostly middle-aged and older workers, irrespective of joint replaced, were able to return to work after surgery is a positive finding extending the benefits of TJR into the work domain. It is, however, important to note that we

were limited to evaluating age as a continuous variable to avoid over-fitting our model and it will be important for future research with larger sample sizes to evaluate if age categories are associated with variable timing in return to work. While more research is needed in this area, the current studies seem to indicate that some health problems like hip and knee OA, which is highly prevalent, may result in temporary absences from work, some of which are less than 3 months in duration.

The literature supports that most people return to their prior occupation after surgery[14,17,19] although high physical demand work has been reported by others as increasing the time for return to work following TKR[19]. We also found that work demands influenced return to work with people working in business, finance and administration and with low physical demand work at least twice as likely to have earlier return to work.

These findings related to demographic and work context factors point to the importance of including these variables in addition to health and work participation measures (e.g., return to work) in future studies of joint replacement. For example, additional studies examining age and gender differences are warranted to examine whether our finding that men are more likely to return to work related to financial necessity, type of work or some other factor. Moreover, at least one other study of TKR found women were more likely to return to work than men[34]. Results that lower education are related to longer return to work times even after controlling for the type of work may relate to difficulties in accommodating employees who may need modified duties post-surgery but who have limited skills. And finally, those with physically demanding jobs may need additional time to recover from surgery so as not to be at risk for injury and future employment interruptions.

Despite reporting work limitations prior to surgery, many individuals in both THR and TKR samples continued to work prior to surgery. 15% and 8% of THR and TKR samples were on sick leave or short-term disability prior to surgery, representing a minority of the sample. The fact that most individuals in our study continued to work despite morbidity from their OA prior to surgery and soon after their surgery is in keeping with findings in other research on people with OA[11], and underscores the importance of examining workplace experiences in addition to outcomes such as returning to work. Assessing workplace activity limitations also enabled a better understanding of the trajectory of recovery and demonstrated that work limitations were significantly reduced over 12 months post-surgery.

Standardized care pathways after hip and knee replacement surgery tend to focus on minimizing pain and maximizing range of motion, strength and mobility in the immediate acute care and rehabilitation periods following surgery[44]. Our finding that the limitations experienced at work were not purely physical but also included limitations in concentration, meeting job demands and transportation to and from work necessitates further research into identify interventions that might reduce these problems. This fits well with conceptual models of work functioning that emphasize both the demands of work and the capacity of the individual, as well as reviews of the literature such as the recently published Fit for Work Pan-European and Canadian reports on musculoskeletal disorders, highlighting the importance of thinking beyond the physical symptoms and implementing a biopsychosocial approach to treat patients in the context of their psychological and social circumstances[20,45]. Given the workplace activity limitations identified, such an approach might maximize rehabilitation outcomes.

Several limitations of this work need to be acknowledged. First, patient recruitment was confined to those having surgery in tertiary-care academic centers and we did not have specific times of return to work, rather whether individuals had returned to work in the periods coinciding with the time of follow-up data collection. Additionally, there may be bias in the estimates of our models due to conditional confounding from entering demographic variables as a block or exclusion of important variables. For example, we do not have data on workplace accommodations and changes to work that might have facilitated return to work for some employees. Finally, sample size limitations meant that we were limited in the number of covariates that we could model in relation to return to work. Further work with larger sample sizes will be important in further elucidating factors and disentangling the likely complex relationships among physical health, personal, social and environmental variables associated with time of return to work and the workplace experience of individuals upon returning to work after hip or knee replacement.

In conclusion, this study indicates that joint replacement surgery for individuals with limitations related to hip and knee OA enables return to work and is associated with fewer limitations at work. The changing workforce dynamics and trends toward surgery at younger ages mean that these are important outcomes for clinicians to assess. Additionally, this is important information for employers. They need to be aware that people with OA can continue to participate in employment.

Contributions

Contributions of authors are as follows: Conception and design: Davis, Gignac, Badley, Beaton, Sankar; Analysis and interpretation of the data: Davis, Palaganas, Sankar, Gignac, Badley, Beaton; Drafting of the article: Sankar, Davis, Gignac; Critical revision of the article for important intellectual content: Davis, Gignac, Badley, Beaton, Sankar, Palaganas; Final approval of the article: Davis, Gignac, Badley, Beaton, Sankar, Palaganas; Provision of study materials or patients: Davis; Statistical expertise: Davis, Gignac, Badley, Beaton, Palaganas; Obtaining of funding: Davis; Administrative, technical, or logistic support: Davis, Palaganas; Collection and assembly of data: Davis.

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The funding sponsors had no role in the conduct, interpretation or dissemination of this work.

Conflict of interests

None of the authors have any conflicts of interest to declare in relation to this work.

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