BMJ Open

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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-059225
Article Type:	Original research
Date Submitted by the Author:	11-Nov-2021
Complete List of Authors:	Kamp, Tamara; UMCG, Orthopedics; University of Groningen, Health Sciences, Community and Occupational Medicine van Beveren, Jan; Röpcke-Zweers Ziekenhuis, Orthopedics Rijk, Paul C; Medisch Centrum Leeuwarden, Orthopedics Stevens, Martin; UMCG, Orthopedics Brouwer, Reinoud; Martini Hospital, Orthopedics Bulstra, Sjoerd ; UMCG, Orthopedics Brouwer, Sandra; University of Groningen, Health Sciences, Community and Occupational Medicine
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, Adult orthopaedics < ORTHOPAEDIC & TRAUMA SURGERY, Hip < ORTHOPAEDIC & TRAUMA SURGERY, Knee < ORTHOPAEDIC & TRAUMA SURGERY, Musculoskeletal disorders < ORTHOPAEDIC & TRAUMA SURGERY, PUBLIC HEALTH

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Work-related social support affects return to work after total hip or total knee arthroplasty

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Word count main text: 3288 words
Word count abstract: 297 words
Number of figures/tables: 3 tables, 1 figures
Number of references: 46 references

Declarations

Ethics approval

This study was approved by the Medical Ethics Board of University Medical Center Groningen (METc 2012.153).

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Funding

No funding was received for conducting this study.

Acknowledgements

No acknowledgements.

Availability of data and material

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Abstract

Objectives There is strong evidence that social support is an important determinant of return to work (RTW). Little is known about the role of social support in RTW after total hip or knee arthroplasty (THA/TKA). Objective was to examine the predictive value of preoperative and postoperative perceived social support on RTW status 6 months postoperatively.

Design A prospective multicenter survey study was conducted.

Setting Orthopedic departments of four Dutch medical centers; a tertiary university hospital, two large teaching hospitals and a general hospital.

Participants Patients planned to undergo THA/TKA, aged 18-63 and employed preoperatively were included.

Main outcome measures Questionnaires were filled out preoperatively and 3 and 6 months postoperatively, and included questions to assess patients' perceived social support targeting three sources of social support: from home (friends, family), from work (coworkers, supervisors) and from healthcare (occupational physician, general practitioner, other caregivers).Control variables included age, gender, education, type of arthroplasty and comorbidities. RTW was defined as having fully returned to work 6 months postoperatively. Univariate and multivariate logistic regression analyses were conducted.

Results Enrolled were 246 patients (n=100 THA, n=146 TKA, median age 56 years, 57% female). The majority returned to work (64%). Preoperatively, social support from the occupational physician predicted RTW (OR 2.58, 95%CI 1.18–5.65). Postoperatively, social support from the occupational physician (OR 3.12, 95%CI 1.49-6.54) and the supervisor (OR 2.53, 95%CI 1.08-5.89) predicted RTW at 6 months postoperatively.

Conclusions This study underscores the importance of work-related social support originating from the occupational physician and supervisor in facilitating RTW after primary THA/TKA, both preoperatively and postoperatively. Further research is needed to confirm our results and

to understand the facilitating role of social support in RTW, as arthroplasty is being performed on an increasingly younger population for whom participating in work is of critical importance.

Key words: knee prothesis, hip prothesis, return to work, workplace, occupational health

Article Summary

Strengths and limitations of this study

- Prospective multicenter design with a relatively large number of patients and a follow-up of 6 months
- Generalizability of the outcomes as a result of the representative sample
- Multivariate analysis on three different sources of social support, investigating both preoperative and postoperative data.
- Due to limited power our study only focused on preoperative and postoperative data separately.
- We only focused on the first time workers fully returned to work

Introduction

Adequate social support is known to have positive effects on health status and health behaviors [1], wellbeing and work participation [2,3] . Social support has been defined as the assistance and protection given to an individual [1], which can come from a variety of sources such as friends, family, co-workers, organizations and healthcare professionals. There are different dimensions of social support – instrumental, informational, appraisal and emotional, where the former two are known as instrumental support and the latter two as perceived social support [4–7].

There is strong evidence that perceived social support from home, work and occupational healthcare is an important determinant in the return to work (RTW) process and work disability among a variety of working populations [2,3,8–13]. Social support within and outside the workplace has shown to contribute to the RTW process [2,3,8–12]. In a recent systematic review on the influence of social support and social integration on RTW outcomes among individuals with work-related injuries, receiving support from family, regular contact and good communication with the employer, and genuine concern and support from co-workers and supervisors were identified as facilitators of RTW [2], whereas perceived lack of emotional support, especially lack of ongoing support from supervisors, was seen as a barrier to the RTW process. Regarding healthcare support, positive RTW recommendations from healthcare professionals showed to be associated with a 60% higher RTW rate in a cohort of 325 patients with low back injury [14]. Multiple qualitative studies conducted among different patient groups evidence the important role of perceived support from healthcare professionals in the RTW process [15–17]. Although these studies emphasize the importance of social support from home, work and healthcare, so far little is known about the role of social support in the RTW process among the rapidly growing patient group undergoing a total hip arthroplasty (THA) or total knee arthroplasty (TKA).

The number of THA and TKA procedures performed annually in the Netherlands continues to increase steadily, most rapidly among working-age patients [18]. In 2018, 14,768 primary THAs and 12,777 primary TKAs were performed among working-age adults in the Netherlands, a 56% and 32% increase compared to 2010, respectively [19]. Similar trends, with the largest increase among working-age patients, are seen in the United States and other Western countries [20,21]. This increase is mainly due to increased prosthetic survivorship and the fact that particularly the severity of the osteoarthritis (OA), instead of age, has become a major criterion when deciding whether to undergo THA or TKA [22,23]. On the one hand the rise in THA and TKA procedures performed in younger patients and on the other hand the increase in retirement age results in higher numbers of patients expecting to remain in paid employment after surgery [18,24]. Previous studies show that 59-85% of patients return to work within 6 months [25–27], so the absolute number of patients who have not returned to work within 6 months is substantial.

Little research has been conducted among THA and TKA patients on the effect of social support on RTW outcomes. Some qualitative studies have shown that absence of workplace support by the supervisor was associated with a negative experience of returning to work in arthroplasty patients [28]. It was also found that a supportive environment at home and at work as well as supportive care from healthcare professionals might be helpful in facilitating successful RTW, rehabilitation and postoperative satisfaction [28–30]. No quantitative studies have been found so far that examined the effect of different types of social support on RTW among THA and TKA patients. No evidence exists either on the timing of social support, i.e. the effect of social support immediately before or after surgery compared to later postoperatively. The aim of this study was therefore to investigate the predictive value of perceived social support from different sources (home, work, healthcare) on RTW status 6 months postoperatively in a sample of THA and TKA patients.

Materials and methods

Design and procedure

A prospective multicenter survey study was conducted among patients who underwent THA or TKA for primary OA. This study was part of the "Work participation In Patients with Osteoarthritis" cohort (WIPO, Trial-ID NTR3497) [31–34]. Between March 2012 and July 2014 Patients were recruited at the orthopedic departments of the following Dutch medical centers: (1) University Medical Center Groningen (tertiary university hospital), (2) Martini Hospital Groningen (large teaching hospital), (3) Medical Center Leeuwarden (large teaching hospital) and (4) Röpcke-Zweers Hospital Hardenberg (general hospital), all in the northern Netherlands. The study was approved by the Medical Ethical Committee of University Medical Center Groningen (METc 2012.153). Patients waiting for THA or TKA were contacted by phone and invited to participate. Preoperative questionnaires were filled in approximately one month before surgery. Postoperative follow-up data, for this study, were collected after 3 and 6 months. If applicable, missing answers were added later to the questionnaire after retrieving them by telephone. Informed consent was assumed as being obtained when patients returned finished questionnaires and thereby granting our request to participate in the study. If patients did not want to participate in the study, they were asked to return a blank questionnaire. Patients were informed of this consent method by mail, in an information letter that also communicated the voluntary nature of the study and the anonymous nature of all the data to be processed. The Medical Ethical Committee specifically approved this consent procedure.

Study population

Patients with primary hip and knee OA undergoing THA or TKA, aged 18-63 and employed preoperatively were included. Excluded were patients who in the previous six months

received another joint arthroplasty, THA or TKA due to secondary OA, unicompartmental knee arthroplasty, THA or TKA revision and with inadequate understanding of the Dutch language. A dropout was defined as a patient leaving the study preterm by not filling in the 6-month postoperative questionnaire for any reason.

Measures

Dependent variable

Return to work (yes/no) was measured at the 6-month postoperative follow-up. Patients were asked whether they returned to work, with the following answering possibilities: no return to work, partial return to work, full return to work. RTW was defined as participants who answered that they fully returned to work after surgery, no RTW was defined as participants who answered that they did not or partially return to work.

Independent variables

Perceived social support was measured preoperatively (baseline) and 3 months postoperatively using three questionnaires targeting support from home, work and healthcare.

Social support from home, i.e. friends and family, was assessed with the Groningen Orthopaedic Social Support Scale (GO-SSS). The GO-SSS consists of 12 questions divided into two subscales: perceived social support (seven items) and instrumental social support (five items). This study focused on the perceived social support subscale. On a Likert scale four answers were possible (never or rarely, occasionally, regularly, often). A sum score was computed, where higher scores indicated more perceived social support. The GO-SSS showed to be a reliable and valid instrument to assess social support for patients following

arthroplasty, with a 0.89 Cronbach alpha for the entire questionnaire and 0.86 internal consistency for the perceived social support (PSS) subscale [35].

Social support from work was assessed with a self-constructed scale focusing on perceived social support. The questionnaire consisted of two questions about perceived support from co-workers and the supervisor. Each item is preceded by the question "How much support did you receive during your period of recuperation from…" with responses on a 1–3 point scale (no support, little support, ample support). Dichotomous variables were computed, distinguishing between no perceived support and perceived support (consisting of little or ample support). The two questions were analyzed separately.

Social support from healthcare was measured with a self-constructed scale focusing on perceived social support. The questionnaire included three questions about perceived support from an occupational physician (OP), a general practitioner (GP) and other caregivers. Each item is preceded by the question "How much support did you receive during your period of recuperation from…" with responses on a 1–3 point scale (no support, little support, ample support). Dichotomous variables were computed, distinguishing between no perceived support and perceived support (consisting of a little or ample support). The three questions were analyzed separately.

Covariates

Data about the following sociodemographic characteristics were collected preoperatively: age (years), gender, education (categorized into elementary, secondary and higher), marital status (living with or without a partner), being breadwinner (yes/no). Disease-related information was gathered by inquiring about type of arthroplasty (THA or TKA), body mass index (BMI)

divided into normal (<25 kg/m^2) and overweight or obese (>25 kg/m^2), and comorbidity measured with a 27-item chronic conditions questionnaire ("Statistics Netherlands. Health questionnaire 1989). Amount of comorbidities was divided into none, one or two, or more than two. Data about work-related characteristics included questions about self-employment (yes/no), company size (number of employees: 1-9, 10-99, more than 100), contractual hours (h), working hours (h), type of job (executive/administrative/advisory/management/policy), and type of tasks (physical/mental/combination). Physical work demands were measured by asking whether patients had to perform physical activities like standing, sitting, walking, kneeling or squatting during work (yes/no).

Statistical analysis

Descriptive statistics – mean (SD), n (%) – were used to describe baseline characteristics of the study population. Univariate and multivariate logistic regression analyses were used to study the prognostic factors for RTW 6 months postoperatively. Separate analyses were conducted for perceived social support measured preoperatively and 3 months postoperatively.

The association between each potential prognostic factor and RTW was univariately assessed. All prognostic factors with a p-value ≤0.20 in the univariate analyses were included in the multivariate regression analyses. Variables were omitted by backward selection, depending on their level of statistical significance (P<0.05). Control variables for the analyses included sex, age, education, type of surgery and comorbidities [37,38]. Control variables were based on previous literature and were defined a priori. Sensitivity analyses were conducted for THA and TKA groups separately, since previous literature suggests that postoperative recovery and RTW differs between these groups [39,40]. Odds ratios were calculated, including 95% confidence intervals (CI). A non-response analysis was performed. Statistical analyses

were performed with IBM Statistical Package for the Social Sciences (SPSS) version 25.0 and Mplus version 7.1.

Insert table 1

Results

From the 311 patients who had undergone a primary THA or TKA, 246 (n= 100 THA, n=146 TKA; response rate 79.1%) were included in the study. Figure 1 is a flowchart showing the total number of patients at baseline and the drop-outs to follow-up. The characteristics of the study sample are presented in Table 1. Median age was 56 years (interquartile range (IQR) 51-59 years). The sample consisted of 107 (43%) men and 139 (57%) women, 100 (41%) THA patients and 146 (59%) TKA patients. For educational level, 33% had completed elementary school, 43% secondary school and 21% higher education. BMI of 76% was above 25 kg/m^2 and 35% had two or more comorbidities. Patients worked on average 31 hours, three hours more than their contract prescribed. Our cohort had mostly executive jobs (58%). A combination of physically and mentally challenging tasks was performed by 40% of patients; the remaining patients were divided equally into performing either physical or mental work tasks. Work demands of the majority included standing, sitting and/or walking, and a quarter of the patients had to perform kneeling or squatting work demands. The majority of patients returned to work (64%) by 6 months post-surgery. To correct for the drop-out rate during follow-up we conducted a non-response analysis, which showed no significant differences on baseline characteristics or independent variables.

Univariate and multivariate logistic regression analyses

In the *preoperative* univariate analyses, social support from the OP was the only variable below the cut-off value of $p<0.2$, therefore no multivariate analyses were performed. Preoperative social support from the OP was significantly associated with RTW (OR 2.58,

95%CI 1.18–5.65). Perceived social support from the OP preoperatively was associated with a 2.6 times higher odds of a patient having returned to work 6 months postoperatively (Table 2). In the *postoperative* univariate analyses social support from the supervisor, the OP, the GP and other caregivers were below the cut-off value of $p<0.2$ and were therefore used in the multivariate analyses. In the multivariate model perceived social support from the OP (OR 3.12, 95%CI 1.49-6.54) and from the supervisor (OR 2.53, 95%CI 1.08-5.89) showed statistically significant associations with RTW. The chances of an individual having returned to work 6 months post-surgery increased by 3.12 and 2.53 for those patients who perceived social support from the OP and from the supervisor, respectively (Table 2).

Insert table 2

Sensitivity analyses

Analyzing the THA and TKA groups separately, the *preoperative* multivariate model showed no association between social support and RTW in both subgroups (Table 3). The *postoperative* multivariate model of THA patients showed that perceived social support from the GP was significantly associated with RTW (OR 4.30, 95%CI 1.05–17.57; Table 3). The *postoperative* multivariate model of TKA patients showed a significant association between perceived social support from the OP and RTW (OR 5.18, 95%CI 1.88–14.28; Table 3).

Insert table 3

Discussion

This study aimed to investigate the predictive value of preoperative and postoperative perceived social support from home, work and healthcare on RTW status 6 months postoperatively in a sample of THA and TKA patients. We found that patients who perceived social support from the OP preoperatively had 2.6 times higher odds of returning to work within 6 months postoperatively compared to patients who perceived no support. Patients who

perceived social support from the occupational physician and from the supervisor 3 months postoperatively had 3.1 and 2.5 times higher odds for RTW, respectively. This implies the important role of workplace support in the RTW process, as both the occupational physician and supervisor are linked to the workplace.

In our study the majority of patients (64%) returned to work within 6 months postoperatively, which is in line with previous studies [25–27]. Our findings that the perceived social support from the OP is important, both preoperatively and postoperatively, is in line with previous quantitative studies on social support from the OP in other populations [13,14,17]. In qualitative studies among THA and TKA patients, employers and clinicians also indicated the added value of OPs, especially if there already was contact before surgery [28,41].

Our finding that social support from the supervisor predicted RTW is also in line with previous studies conducted among other population groups [2,42,43]. Supervisors play a considerable role in initiating effective support strategies [44–46]: they are expected to communicate the process of RTW with the employee and the OP and implement accommodations, both in agreement with the OP [2,11]. In our multivariate analyses, we only found an association between postoperative social support from the supervisor and RTW, leaving questions about optimal timing. An explanation might be that the supervisor is better able to perform specific actions postoperatively to facilitate RTW.

In contrast to previous studies, we did not find an association between social support from home or coworkers and RTW in our study population. A possible explanation for this absence in our study might relate to the duration of sickness absence: other studies that found an association between social support from home or coworkers and RTW were mainly conducted among population groups with long-term absence (>6 months) [3,13], whereas a THA or TKA often leads to a short-term work absence (<3-6 months) for most patients. Disease chronicity

and long-term absence may influence the necessity and contributing value of social support from home and coworkers for RTW outcomes.

Lastly, in our study we did not find an effect of perceived social support from other caregivers (e.g. physiotherapists) on RTW. This might be because we did not further specify the question and patients could have experienced it as implicit. The role of social support from a physiotherapist on RTW warrants further research, since our particular subsample has frequent contact with these specific healthcare professionals. Value of a physiotherapist is illustrated by Lysaght & Larmour-Trode, 2008, who reported in their qualitative research that half of the workers experienced support by a physiotherapist. More research is needed to evaluate the role of physiotherapists and their contribution to the RTW process.

Our sensitivity analyses showed some differences in predicting factors for RTW between THA and TKA patients. Postoperative perceived social support from the GP predicted RTW of THA patients and postoperative perceived social support from the OP predicted RTW of TKA patients. This dissimilarity in findings may be explained by differences in the rehabilitation process. It is known that for THA patients rehabilitation is easier than for TKA patients [39,40]. It could be hypothesized that support from the GP is enough to RTW after THA, just like support from a specialist (an OP) is necessary to RTW after TKA. However, it must be kept in mind that the wide 95% CI indicated our sample size is too small. These results need to be replicated with a larger sample size before definitive conclusions can be drawn.

Lastly, our non-response analyses did not show significant differences on baseline characteristics or independent variables. However, it might be that non-response could partly be explained by unfavorable return to work outcome.

Strengths & limitations

An important strength of this study is its prospective multicenter design with a relatively large number of patients and a follow-up of 6 months. Another strength is the representative sample of patients and therefore the generalizability of the outcomes. We provided multivariate analysis on three different sources of social support, plus investigated both preoperative and postoperative data, in contrast to previous research on social support among other patient groups [2]. This study does have some limitations. Due to limited power our study only focused on preoperative and postoperative data separately. The sample sizes of our subgroups (THA and TKA) in the sensitivity analyses lacked power to draw definitive conclusions, and we only focused on the first time workers fully returned to work. Future research should also include sustainable RTW to assess the impact of social support on these RTW trajectories. Another limitations were the self-reported measurements, which are generally susceptible to the effects of reporting bias.

Implications

Changing workforce dynamics and trends towards THA or TKA surgery among working-age employees propel an urgent need to understand the facilitators and barriers for RTW, besides those of pain and function [32]. There are still many uncertainties about the potential influence of psychosocial work factors (including social support), timing of interventions designed to facilitate RTW, and engagement of clinicians and employers as key actors in the RTW process.

To our knowledge, this is the first quantitative study to examine the role of social support among this specific population. The differences in predicting factors between THA and TKA patients might imply a need for group-specific approaches. Further research on social support is needed to confirm our results and to understand the facilitating role of social support on RTW. The optimal timing to implement contact, i.e. social support, and the

courses of social support from different sources and their effect on RTW should also be investigated.

Conclusion

This study showed that, in particular, perceived social support from OPs and supervisors may predict RTW after THA and TKA. Both preoperative and postoperative social support were associated with RTW, which may suggest that perceived work-related social support of OPs and supervisors are important factors over an extended period of time. Some differences in factors were found between THA and TKA patients, where postoperative social support from the GP predicted RTW of THA patients and postoperative social support from the OP predicted RTW of TKA patients. Further research on the role of social support in returning to work after THA and TKA is needed, as arthroplasty is being performed on an increasingly younger population for whom participating in work is of critical importance.

Declarations

Ethics approval

This study was approved by the Medical Ethics Board of University Medical Center Groningen (METc 2012.153).

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Funding

No funding was received for conducting this study.

Acknowledgements

No acknowledgements.

Availability of data and material

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Author contributions:

TK conceived and designed the study, wrote the manuscript, performed statistical analysis, prepared the figures. MS conceived and designed the study, supervised the work, made substantial changes to the manuscript, arranged the data. JB arranged the data, critically assessed and corrected the manuscript. PR arranged the data, critically assessed and corrected the manuscript. RB arranged the data, critically assessed and corrected the manuscript. SKB conceived and designed the study, arranged the data. SB conceived and designed the study, supervised the work, made substantial changes to the manuscript, arranged the data.

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Fig. 1 Flowchart study enrolment and follow-up

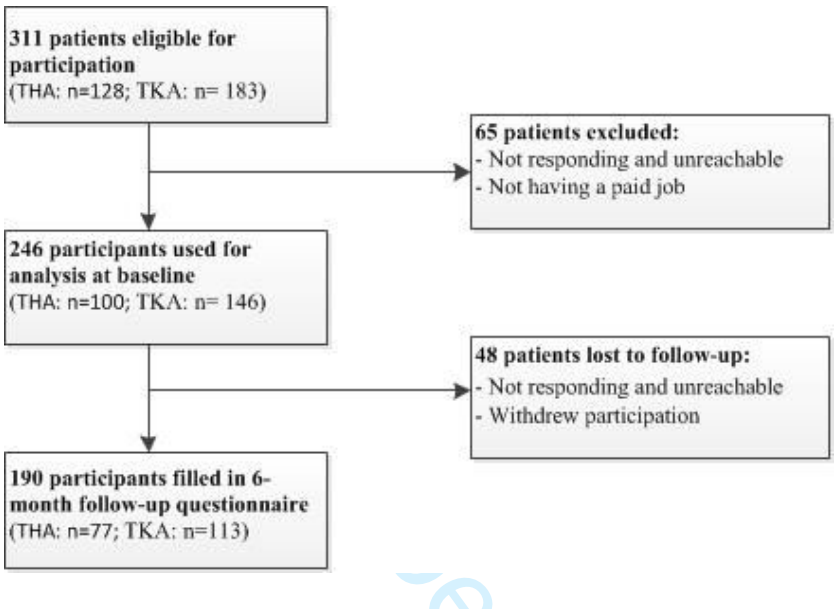

Table 1 : Baseline study population characteristics.

Variables	Total (N=246)
Age, median (IQR)	56 (51-59)
Male/female, n (%)	107(43)/139(57)
Highest educational level (n (%))	
- Lower (elementary school, vocational education)	81 (32)
- Secondary (high school, intermediate vocational education)	105 (43)
- Higher (higher professional education university)	52 (21)
Partner, n (%)	224 (91)
Wage earner, n (%)	133 (54)
THA/TKA, n (%)	100 (41) / 146 (59)
BMI (kg/m^2), n (%)	
- <25	54 (22)
- >25	187 (76)
Number of comorbidities, n (%)	
- No	20 (8)
- One or two	138 (56)
- More than two	87 (35)
Self-employed, n (%)	31 (13)
Company size (number of employees), n (%)	
- 1-9	42 (17)
- 10-99	60 (24)
- >100	129 (52)
Contractual hours (median, IQR)	32 (21 - 38)
Working hours (median, IQR)	32 (20 - 40)
Job type, n (%)	
- Executive	143 (59)
- Administrative	29 (12)
- Advisory (policy/consultative)	15 (6)
- Management	32 (13)
- Executive and policy-based	25 (10)
Work tasks n (%)	
- Physical	67 (27)
- Mental	69 (28)
- Both	90 (37)
Work demands, n (%)	
- Standing	117 (46)
- Sitting	129 (54)
- Walking	123 (50)
- Kneeling or squatting	58 (24)
Return to work by 6 months (yes/no) , n (%)[a]	122 (64.2) / 68 (35.8)

All numbers are represented as median with interquartile range (IQR), or numbers (n) and percentages (%).
[a]N=190

Table 2: Preoperative and three months postoperative univariate and multivariate logistic regression analyses of perceived social support variables on return to work (RTW) status including odds ratios (OR) and 95 % confidence intervals (CI)

	Univariate			Multivariate		
Variables	**OR**	**P**	**95% CI**	**OR**	**P**	**95% CI**
Preoperative						
Support from home	1.04	0.34	0.96–1.14			
Support from co-workers (ref=no)	1.18	0.73	0.47–2.98			
Support from supervisor (ref=no)	1.40	0.41	0.63–3.14			
Support from OP (ref=no)	2.58	0.02^	1.18–5.65	2.58	0.02*	1.18–5.65
Support from GP (ref=no)	1.50	0.27	0.73–3.05			
Support from other caregivers (ref=no)	1.28	0.53	0.60–2.70			
Three months postoperative						
Support from home	1.00	0.88	0.92–1.10			
Support from co-workers (ref=no)	1.24	0.61	0.54–2.81			
Support from supervisor (ref=no)	2.53	0.02^	1.13–5.68	2.53	0.03*	1.08–5.89
Support from OP (ref=no)	3.12	0.00^	1.51–6.44	3.12	0.00*	1.49–6.54
Support from GP (ref=no)	2.56	0.01^	1.21–5.38			
Support from other caregivers (ref=no)	1.67	0.15^	0.83–3.37			

*Adjusted for sex, age, education, type of surgery and number of comorbidities; ^ p<0.2; *p<0.05; OR, odds ratio; CI, confidence intervals; OP, occupational physician; GP, general practitioner.*

Table 3: Preoperative and three months postoperative univariate and multivariate logistic regression analyses of perceived social support variables on return to work (RTW) status among subsamples of THA and TKA patients

	Univariate			Multivariate		
Variables	**OR**	**95% CI**	**P**	**OR**	**95% CI**	**P**
Preoperative						
THA						
Support from home	1.03	0.89–1.20	0.68			
Support from co-workers (ref=no)	1.82	0.34–9.77	0.48			
Support from supervisor (ref=no)	2.23	0.52–9.50	0.28			
Support from OP (ref=no)	3.31	0.81–13.60	0.10^			
Support from GP (ref=no)	1.17	0.35–3.90	0.81			
Support from other caregivers (ref=no)	0.67	0.19–2.29	0.52			
TKA						
Support from home	1.06	0.95–1.18	0.33			
Support from co-workers (ref=no)	1.00	0.30–3.25	0.99			
Support from supervisor (ref=no)	1.12	0.41–3.05	0.82			
Support from OP (ref=no)	2.17	0.81–5.82	0.13^			
Support from GP (ref=no)	1.65	0.64–4.21	0.30			
Support from other caregivers (ref=no)	1.70	0.63–4.63	0.30			
Three months postoperative						
THA						
Support from home	1.08	0.93–1.26	0.32			
Support from co-workers (ref=no)	2.79	0.54–14.53	0.22			
Support from supervisor (ref=no)	4.30	1.05–17.57	0.04^			
Support from OP (ref=no)	1.77	0.52–6.02	0.36			
Support from GP (ref=no)	3.25	0.77–13.62	0.11^	4.30	1.05–17.57	0.04*
Support from other caregivers (ref=no)	0.65	0.18–2.38	0.51			
TKA						
Support from home	0.98	0.88–1.09	0.66			
Support from co-workers (ref=no)	1.21	0.44-3.29	0.71			
Support from supervisor (ref=no)	2.44	0.82-7.28	0.11^			
Support from OP (ref=no)	5.18	1.88–14.28	0.00^	5.18	1.88–14.28	0.00*
Support from GP (ref=no)	2.46	0.97–6.24	0.06^			
Support from other caregivers (ref=no)	2.37	0.93–6.01	0.07^			

*Adjusted for sex, age, education, and number of comorbidities; ^ p<0.2; *p<0.05; OR, odds ratio; CI, confidence intervals; OP, occupational physician; GP, general practitioner.*

TRIPOD Checklist: Prediction Model Development

Section/Topic	Item	Checklist Item	Page
Title and abstract			
Title	1	Identify the study as developing and/or validating a multivariable prediction model, the target population, and the outcome to be predicted.	1
Abstract	2	Provide a summary of objectives, study design, setting, participants, sample size, predictors, outcome, statistical analysis, results, and conclusions.	2
Introduction			
Background and objectives	3a	Explain the medical context (including whether diagnostic or prognostic) and rationale for developing or validating the multivariable prediction model, including references to existing models.	5-6
	3b	Specify the objectives, including whether the study describes the development or validation of the model or both.	5-6
Methods			
Source of data	4a	Describe the study design or source of data (e.g., randomized trial, cohort, or registry data), separately for the development and validation data sets, if applicable.	7
	4b	Specify the key study dates, including start of accrual; end of accrual; and, if applicable, end of follow-up.	7
Participants	5a	Specify key elements of the study setting (e.g., primary care, secondary care, general population) including number and location of centres.	7-8
	5b	Describe eligibility criteria for participants.	7-8
	5c	Give details of treatments received, if relevant.	-
Outcome	6a	Clearly define the outcome that is predicted by the prediction model, including how and when assessed.	8
	6b	Report any actions to blind assessment of the outcome to be predicted.	8
Predictors	7a	Clearly define all predictors used in developing or validating the multivariable prediction model, including how and when they were measured.	8-10
	7b	Report any actions to blind assessment of predictors for the outcome and other predictors.	8-10
Sample size	8	Explain how the study size was arrived at.	11
Missing data	9	Describe how missing data were handled (e.g., complete-case analysis, single imputation, multiple imputation) with details of any imputation method.	7-8
Statistical analysis methods	10a	Describe how predictors were handled in the analyses.	10-11
	10b	Specify type of model, all model-building procedures (including any predictor selection), and method for internal validation.	10-11
	10d	Specify all measures used to assess model performance and, if relevant, to compare multiple models.	10-11
Risk groups	11	Provide details on how risk groups were created, if done.	-
Results			
Participants	13a	Describe the flow of participants through the study, including the number of participants with and without the outcome and, if applicable, a summary of the follow-up time. A diagram may be helpful.	11
	13b	Describe the characteristics of the participants (basic demographics, clinical features, available predictors), including the number of participants with missing data for predictors and outcome.	11
Model development	14a	Specify the number of participants and outcome events in each analysis.	11 - 12
	14b	If done, report the unadjusted association between each candidate predictor and outcome.	-
Model specification	15a	Present the full prediction model to allow predictions for individuals (i.e., all regression coefficients, and model intercept or baseline survival at a given time point).	11 - 12
	15b	Explain how to the use the prediction model.	11 - 12
Model performance	16	Report performance measures (with CIs) for the prediction model.	11 - 12
Discussion			
Limitations	18	Discuss any limitations of the study (such as nonrepresentative sample, few events per predictor, missing data).	15
Interpretation	19b	Give an overall interpretation of the results, considering objectives, limitations, and results from similar studies, and other relevant evidence.	12 - 14
Implications	20	Discuss the potential clinical use of the model and implications for future research.	15 - 16
Other information			
Supplementary information	21	Provide information about the availability of supplementary resources, such as study protocol, Web calculator, and data sets.	17
Funding	22	Give the source of funding and the role of the funders for the present study.	17

We recommend using the TRIPOD Checklist in conjunction with the TRIPOD Explanation and Elaboration document.

BMJ Open

The influence of social support on return to work after total hip or total knee arthroplasty: a prospective multicentre study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-059225.R1
Article Type:	Original research
Date Submitted by the Author:	15-Feb-2022
Complete List of Authors:	Kamp, Tamara; University Medical Centre Groningen, Orthopedics; UMCG, Health Sciences, Community and Occupational Medicine Stevens, Martin; University Medical Centre Groningen, Orthopedics van Beveren, Jan; Röpcke-Zweers Ziekenhuis, Orthopedics Rijk, Paul C; Medisch Centrum Leeuwarden, Orthopedics Brouwer, Reinoud; Martini Hospital, Orthopedics Bulstra, Sjoerd ; UMCG, Orthopedics Brouwer, Sandra; University Medical Centre Groningen, Health Sciences, Community and Occupational Medicine
Primary Subject Heading:	Occupational and environmental medicine
Secondary Subject Heading:	Occupational and environmental medicine
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, Adult orthopaedics < ORTHOPAEDIC & TRAUMA SURGERY, Hip < ORTHOPAEDIC & TRAUMA SURGERY, Knee < ORTHOPAEDIC & TRAUMA SURGERY, Musculoskeletal disorders < ORTHOPAEDIC & TRAUMA SURGERY

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The influence of social support on return to work after total hip or total knee arthroplasty: a prospective multicentre study

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Word count main text: 3345 words
Word count abstract: 292 words
Number of figures/tables: 3 tables, 1 figure
Number of references: 51 references

Declarations

Ethics approval

This study was approved by the Medical Ethics Board of University Medical Center Groningen (METc 2012.153).

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Funding

No funding was received for conducting this study.

Acknowledgements

No acknowledgements.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Abstract

Objectives There is strong evidence that social support is an important determinant of return to work (RTW). Little is known about the role of social support in RTW after total hip or knee arthroplasty (THA/TKA). Objective was to examine the influence of preoperative and postoperative perceived social support on RTW status 6 months postoperatively.

Design A prospective multicentre survey study was conducted.

Setting Orthopaedic departments of four Dutch medical centres; a tertiary university hospital, two large teaching hospitals and a general hospital.

Participants Patients planned to undergo THA/TKA, aged 18-63 and employed preoperatively were included.

Main outcome measures Questionnaires were filled out preoperatively and 3 and 6 months postoperatively, and included questions to assess patients' perceived social support targeting three sources of social support: from home (friends, family), from work (co-workers, supervisors) and from healthcare (occupational physician, general practitioner, other caregivers). Control variables included age, gender, education, type of arthroplasty and comorbidities. RTW was defined as having fully returned to work 6 months postoperatively. Univariate and multivariate logistic regression analyses were conducted.

Results Enrolled were 246 patients (n=100 THA, n=146 TKA, median age 56 years, 57% female). The majority returned to work (64%). Preoperatively, social support from the occupational physician was associated with RTW (OR 2.58, 95%CI 1.18–5.65). Postoperatively, social support from the occupational physician (OR 3.12, 95%CI 1.49-6.54) and the supervisor (OR 2.53, 95%CI 1.08-5.89) was associated with RTW.

Conclusions This study underscores the importance of work-related social support originating from the occupational physician and supervisor in facilitating RTW after primary THA/TKA, both preoperatively and postoperatively. Further research is needed to confirm our results and

to understand the facilitating role of social support in RTW, as arthroplasty is being performed on a younger population for whom work participation is critical.

Key words: knee prothesis, hip prothesis, return to work, workplace, occupational health

Article Summary

Strengths and limitations of this study

- Prospective multicentre design with a relatively large number of patients and a follow-up of 6 months
- Generalizability of the outcomes as a result of the representative sample
- Multivariate analysis on three different sources of social support, investigating both preoperative and postoperative data
- Due to limited power our study only focused on preoperative and postoperative data separately
- We only focused on the first time workers fully returned to work

Introduction

Adequate social support is known to have positive effects on health status and health behaviors[1], wellbeing and work participation[2,3] . Social support has been defined as the assistance and protection given to an individual[1], which can come from a variety of sources such as friends, family, co-workers, organizations and healthcare professionals. There are different dimensions of social support – instrumental, informational, appraisal and emotional, where the former two are known as instrumental support and the latter two as perceived social support[4–7].

There is strong evidence that perceived social support from home, work and occupational healthcare is an important determinant in the return to work (RTW) process and work disability among a variety of working populations[2,3,8–13]. Social support within and outside the workplace has shown to contribute to the RTW process[2,8–12]. In a recent systematic review about the influence of social support and social integration on RTW outcomes among individuals with work-related injuries, receiving support from family, regular contact and good communication with the employer, and genuine concern and support from co-workers and supervisors were identified as facilitators of RTW[2]. Whereas perceived lack of emotional support, especially lack of on-going support from supervisors, was seen as a barrier to the RTW process[2]. Regarding healthcare support, positive RTW recommendations from healthcare professionals showed to be associated with a 60% higher RTW rate in a cohort of 325 patients with low back injury[14]. Multiple qualitative studies conducted among different patient groups showed the important role of perceived support from healthcare professionals in the RTW process[15–17]. Although these studies emphasize the importance of social support from home, work and healthcare, so far little is known about the role of social support in the RTW process among the rapidly growing patient group undergoing a total hip arthroplasty (THA) or total knee arthroplasty (TKA).

The number of THA and TKA procedures performed annually in the Netherlands continues to increase steadily, most rapidly among working-age patients[18]. In 2018, 14,768 primary THAs and 12,777 primary TKAs were performed among working-age adults in the Netherlands, a 56% and 32% increase compared to 2010, respectively[19]. Similar trends, with the largest increase among working-age patients, are seen in the United States and other Western countries[20,21]. This increase is mainly due to increased prosthetic survivorship and the fact that particularly the severity of the osteoarthritis (OA) and patients' preferences, instead of age, have become a major criteria when deciding whether to undergo THA or TKA[22,23]. On the one hand the rise in THA and TKA procedures performed in younger patients and on the other hand the increase in retirement age results in higher numbers of patients expecting to remain in paid employment after surgery[18,24]. Previous studies show that 59-85% of patients return to work within 6 months[25–27], so the absolute number of patients who have not returned to work within 6 months is substantial.

Our previous study, which also used data from the "Work participation In Patients with Osteoarthritis" (WIPO) cohort, showed the importance of psychosocial working conditions in time to RTW after THA or TKA[28]. However, little research has been conducted among THA and TKA patients on the effect of social support on RTW outcomes. Some qualitative studies have shown that absence of workplace support by the supervisor was associated with a negative experience of returning to work in arthroplasty patients[29]. It was also found that a supportive environment at home and at work, as well as supportive care from healthcare professionals might be helpful in facilitating successful RTW, rehabilitation, and postoperative satisfaction[29–31]. No quantitative studies have been found so far that examined the effect of different types of social support on RTW among THA and TKA patients. No evidence exists either on the timing of social support, i.e. the effect of social support immediately before or after surgery compared to later postoperatively. The aim of this

study was therefore to investigate the influence of perceived social support from different sources (home, work, healthcare) on RTW status 6 months postoperatively in a sample of THA and TKA patients.

Materials and methods

Design and procedure

A prospective multicentre survey study was conducted among patients who underwent THA or TKA for primary OA. This study was part of the "Work participation In Patients with Osteoarthritis" cohort (WIPO, Trial-ID NTR3497)[28,32–34]. Between March 2012 and July 2014 Patients were recruited at the orthopaedic departments of the following Dutch medical centres: (1) University Medical Center Groningen (tertiary university hospital), (2) Martini Hospital Groningen (large teaching hospital), (3) Medical Center Leeuwarden (large teaching hospital) and (4) Röpcke-Zweers Hospital Hardenberg (general hospital), all in the northern Netherlands. The study was approved by the Medical Ethical Committee of University Medical Center Groningen (METc 2012.153). Patients waiting for THA or TKA were contacted by phone and invited to participate. Preoperative questionnaires were filled in approximately one month before surgery. Postoperative follow-up data, for this study, were collected after 3 and 6 months. If applicable, missing answers were added later to the questionnaire after retrieving them by telephone. Informed consent was assumed as being obtained when patients returned finished questionnaires and thereby granting our request to participate in the study. If patients did not want to participate in the study, they were asked to return a blank questionnaire. Patients were informed of this consent method by mail, in an information letter that also communicated the voluntary nature of the study and the anonymous nature of all the data to be processed. The Medical Ethical Committee specifically approved this consent procedure.

Study population

Patients with primary hip and knee OA undergoing THA or TKA, aged 18-63 and employed preoperatively were included. Excluded were patients who in the previous six months received another joint arthroplasty, THA or TKA due to secondary OA, unicompartmental knee arthroplasty, THA or TKA revision and with inadequate understanding of the Dutch language. A dropout was defined as a patient leaving the study preterm by not filling in the 6-month postoperative questionnaire for any reason.

Measures

Dependent variable

Return to work (yes/no) was measured at the 6-month postoperative follow-up. Patients were asked whether they returned to work, with the following answering possibilities: no return to work, partial return to work, full return to work. RTW was defined as participants who answered that they fully returned to work after surgery, no RTW was defined as participants who answered that they did not or partially return to work.

Independent variables

Perceived social support was measured preoperatively (baseline) and 3 months postoperatively using three questionnaires targeting support from home, work, and healthcare.

Social support from home, i.e. friends and family, was assessed with the Groningen Orthopaedic Social Support Scale (GO-SSS). The GO-SSS consists of 12 questions divided into two subscales: perceived social support (seven items) and instrumental social support

(five items). This study focused on the perceived social support subscale. On a Likert scale four answers were possible (never or rarely, occasionally, regularly, often). A sum score was computed, where higher scores indicated more perceived social support. The GO-SSS showed to be a reliable and valid instrument to assess social support for patients following arthroplasty, with a 0.89 Cronbach alpha for the entire questionnaire and 0.86 internal consistency for the perceived social support (PSS) subscale[35].

Social support from work was assessed with a self-constructed scale focusing on perceived social support. The questionnaire consisted of two questions about perceived support from co-workers and the supervisor. Each item is preceded by the question "How much support did you receive during your period of recuperation from…" with responses on a 1–3 point scale (no support, little support, ample support). Dichotomous variables were computed, distinguishing between no perceived support and perceived support (consisting of little or ample support). The two questions were analysed separately.

Social support from healthcare was measured with a self-constructed scale focusing on perceived social support. The questionnaire included three questions about perceived support from an occupational physician (OP), a general practitioner (GP) and other caregivers. Each item is preceded by the question "How much support did you receive during your period of recuperation from…" with responses on a 1–3 point scale (no support, little support, ample support). Dichotomous variables were computed, distinguishing between no perceived support and perceived support (consisting of a little or ample support). The three questions were analysed separately.

Covariates

Data about the following sociodemographic characteristics were collected preoperatively: age (years), gender, education (categorized into elementary, secondary and higher), being breadwinner (yes/no). Disease-related information was gathered by inquiring about type of arthroplasty (THA or TKA), body mass index (BMI) divided into normal (<25 kg/m^2) and overweight or obese (>25 kg/m^2), and comorbidity measured with a 27-item chronic conditions questionnaire (Statistics Netherlands. Health questionnaire 1989)[36]. Amount of comorbidities was divided into none, one or two, or more than two. Data about work-related characteristics included questions about self-employment (yes/no), company size (number of employees: 1-9, 10-99, more than 100), contractual hours (h), working hours (h), type of job (executive/administrative/advisory/management/policy), and type of tasks (physical/mental/combination). Executive jobs cover blue collar workers, i.e. requiring manual labour. Physical work demands were measured by asking whether patients had to perform physical activities like standing, sitting, walking, kneeling or squatting during work (yes/no).

Statistical analysis

Descriptive statistics – mean (SD), n (%) – were used to describe baseline characteristics of the study population. Univariate and multivariate logistic regression analyses were used to study the prognostic factors for RTW 6 months postoperatively. Separate analyses were conducted for perceived social support measured preoperatively and 3 months postoperatively.

The association between each potential prognostic factor and RTW was univariately assessed. All prognostic factors with a p-value ≤0.20 in the univariate analyses were included in the multivariate regression analyses[37]. Variables were omitted by backward selection, depending on their level of statistical significance (P<0.05). Control variables for the analyses

included sex, age, education, type of surgery and comorbidities[38–41]. Control variables were based on previous literature and were defined a priori. Sensitivity analyses were conducted for THA and TKA groups separately, since previous literature suggests that postoperative recovery and RTW differs between these groups [42,43]. Odds ratios were calculated, including 95% confidence intervals (CI). A non-response analysis was performed. Statistical analyses were performed with IBM Statistical Package for the Social Sciences (SPSS) version 25.0 and Mplus version 7.1.

Patient and public involvement statement

Neither patients nor the public were involved in the design, conduct, reporting or dissemination plans of our research.

*Insert figure 1 about here (**Fig. 1** Flowchart study enrolment and follow-up)*

Results

From the 311 patients who had undergone a primary THA or TKA, 246 (n= 100 THA, n=146 TKA; response rate 79.1%) were included in the study. Figure 1 is a flowchart showing the total number of patients at baseline and the drop-outs to follow-up. The characteristics of the study sample are presented in Table 1. Median age was 56 years (interquartile range (IQR) 51-59 years). The sample consisted of 107 (43%) men and 139 (57%) women, 100 (41%) THA patients and 146 (59%) TKA patients. For educational level, 33% had completed elementary school, 43% secondary school and 21% higher education. BMI of 76% was above 25 kg/m^2 and 35% had two or more comorbidities. Patients worked on average 31 hours, three hours more than their contract prescribed. Our cohort had mostly executive jobs (58%; blue collar). A combination of physically and mentally challenging tasks was performed by 40% of patients; the remaining patients were divided equally into performing either physical or

mental work tasks. Work demands of the majority included standing, sitting and/or walking, and a quarter of the patients had to perform kneeling or squatting work demands. The majority of patients returned to work (64%) by 6 months post-surgery. To correct for the drop-out rate during follow-up we conducted a non-response analysis, which showed no significant differences on baseline characteristics or independent variables.

Insert table 1 about here

Univariate and multivariate logistic regression analyses

In the *preoperative* univariate analyses, social support from the OP was the only variable below the cut-off value of $p<0.2$, therefore no multivariate analyses were performed. Preoperative social support from the OP was univariately significantly associated with RTW (OR 2.58, 95%CI 1.18–5.65; Table 2). In the *postoperative* univariate analyses social support from the supervisor, the OP, the GP and other caregivers were below the cut-off value of $p<0.2$ and were therefore used in the multivariate analyses. In the multivariate model perceived social support from the OP (OR 3.12, 95%CI 1.49-6.54) and from the supervisor (OR 2.53, 95%CI 1.08-5.89) showed statistically significant associations with RTW. The odds of an individual having returned to work 6 months post-surgery increased by 3.12 and 2.53 for those patients who perceived social support from the OP and from the supervisor, respectively (Table 2).

Insert table 2 about here

Sensitivity analyses

Analysing the THA and TKA groups separately, the *preoperative* multivariate model showed no association between social support and RTW in both subgroups (Table 3). The *postoperative* multivariate model of THA patients showed that perceived social support from the supervisor was significantly associated with RTW (OR 4.30, 95%CI 1.05–17.57; Table 3). The *postoperative* multivariate model of TKA patients showed a significant association

between perceived social support from the OP and RTW (OR 5.18, 95%CI 1.88–14.28; Table 3).

Insert table 3 about here

Discussion

This study aimed to investigate the influence of preoperative and postoperative perceived social support from home, work and healthcare on RTW status 6 months postoperatively in a sample of THA and TKA patients. We found that patients who perceived social support from the OP preoperatively had 2.6 times higher odds of RTW within 6 months postoperatively compared to patients who perceived no support. Patients who perceived social support from the OP and from the supervisor 3 months postoperatively had 3.1 and 2.5 times higher odds of RTW, respectively. These results imply the important role of workplace support in the RTW process, as both the OP and supervisor are linked to the workplace.

In our study the majority of patients (64%) returned to work within 6 months postoperatively, which is in line with previous studies[25–27]. Our findings that perceived social support from the OP is important, both preoperatively and postoperatively, is in line with previous quantitative studies on social support from the OP in other populations[13,14,17]. In qualitative studies among THA and TKA patients, employers and clinicians also indicated the added value of OPs, especially if there already was contact before surgery[29,44].

Our findings that social support from the supervisor was associated with RTW is also in line with previous studies conducted among other population groups[2,45,46]. Supervisors play a considerable role in initiating effective support strategies[47–49]: they are expected to communicate the process of RTW with the employee and the OP and implement accommodations, both in agreement with the OP[2,11]. In our multivariate analyses, we found an association between postoperative and not preoperative social support from the supervisor and RTW, leaving questions about optimal timing. An explanation might be that the supervisor is

better able to perform specific actions postoperatively to facilitate RTW. Furthermore, our findings suggest that social support from the supervisor and from the OP might not be related, as the results of the multivariate analyses only showed minor differences compared to the univariate analyses.

In contrast to previous studies, we did not find an association between social support from home or co-workers and RTW in our study population. A possible explanation for this absence in our study might relate to the duration of sickness absence: other studies that found an association between social support from home or co-workers and RTW were mainly conducted among population groups with long-term absence (>6 months)[3,13], whereas a THA or TKA often leads to a short-term work absence (<3-6 months) for most patients. Disease chronicity and long-term absence may influence the necessity and contributing value of social support from home and co-workers for RTW outcomes.

Lastly, in our study we did not find an effect of perceived social support from other caregivers (e.g. physiotherapists) on RTW. This might be because we did not further specify the question and patients could have experienced it as implicit. The role of social support from a physiotherapist on RTW warrants further research, since our particular subsample has frequent contact with these specific healthcare professionals. Value of a physiotherapist is illustrated by Lysaght et al., who reported in their qualitative research that half of the workers experienced support by a physiotherapist[11]. More research is needed to evaluate the role of physiotherapists and their contribution to the RTW process.

Our sensitivity analyses showed some differences in factors associated with RTW between THA and TKA patients. Postoperative perceived social support from the supervisor was associated with RTW of THA patients and postoperative perceived social support from the

OP was associated with RTW of TKA patients. This dissimilarity in findings may be explained by differences in the rehabilitation process. It is known that for THA patients rehabilitation is easier than for TKA patients[42,43]. However, it must be kept in mind that the wide 95% CI indicated our sample size is too small. These results need to be replicated with a larger sample size before definitive conclusions can be drawn.

Lastly, our non-response analyses did not show significant differences on baseline characteristics or independent variables. However, it might be that non-response could partly be explained by unfavourable return to work outcomes.

Strengths & limitations

An important strength of this study is its prospective multicentre design with a relatively large number of patients and a follow-up of 6 months. Another strength is the representative sample of patients and therefore the generalizability of the outcomes. We provided multivariate analysis on three different sources of social support, plus investigated both preoperative and postoperative data, in contrast to previous research on social support among other patient groups[2]. This study does have some limitations. Due to limited power our study only focused on preoperative and postoperative data separately. The sample sizes of our subgroups (THA and TKA) in the sensitivity analyses lacked power to draw definitive conclusions, and we only focused on the first time workers fully returned to work. Future research should also include sustainable RTW to assess the impact of social support on these RTW trajectories. Another limitation of the study is that it might be that patients who answered that they did not receive social support, did not have contact with these potential sources of social support. Lastly, another limitation were the self-reported measurements, which are generally susceptible to the effects of reporting bias.

Implications

Changing workforce dynamics and trends towards THA or TKA surgery among working-age employees propel an urgent need to understand the facilitators and barriers for RTW, besides those of pain and function [33]. There are still many uncertainties about the potential influence of psychosocial work factors (including social support), timing of interventions designed to facilitate RTW, and engagement of clinicians and employers as key actors in the RTW process.

To our knowledge, this is the first quantitative study to examine the role of social support among this specific population. The differences in predicting factors between THA and TKA patients might imply a need for group-specific approaches. Further research on social support is needed to confirm our results and to understand the facilitating role of social support on RTW. The optimal timing to implement contact, i.e. social support, the course (change over time) of social support from different sources and their effect on RTW should also be investigated. Therefore, studies among THA and TKA patients specifically focused at social support, and using validated questionnaires to measure social support from different sources[50,51], would be very valuable.

Conclusion

This study showed that, in particular, perceived social support from OPs and supervisors may predict RTW after THA and TKA. Both preoperative and postoperative social support were associated with RTW, which may suggest that perceived work-related social support from OPs and supervisors are important factors over an extended period of time. Some differences in factors were found between THA and TKA patients, where postoperative social support from the supervisor predicted RTW of THA patients and postoperative social support from the OP predicted RTW of TKA patients. Further research on the role of social support in

returning to work after THA and TKA is needed, as arthroplasty is being performed on an increasingly younger population for whom work participation is of critical importance.

Declarations

Ethics approval
This study was approved by the Medical Ethics Board of University Medical Center Groningen (METc 2012.153).

Competing interests
The authors have no competing interests to declare that are relevant to the content of this article.

Funding
No funding was received for conducting this study.

Acknowledgements
No acknowledgements.

Availability of data and material
The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Author contributions:
TK conceived and designed the study, wrote the manuscript, performed statistical analysis, prepared the figures. MS conceived and designed the study, supervised the work, made substantial changes to the manuscript, arranged the data. JB arranged the data, critically assessed and corrected the manuscript. PR arranged the data, critically assessed and corrected the manuscript. RB arranged the data, critically assessed and corrected the manuscript. SKB conceived and designed the study, arranged the data. SB conceived and designed the study, supervised the work, made substantial changes to the manuscript, arranged the data.

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Fig. 1 Flowchart study enrolment and follow-up

Table 1 : Baseline study population characteristics.

Variables	Total (N=246)
Age, median (IQR)	56 (51-59)
Male/female, n (%)	107(43)/139(57)
Highest educational level (n (%))	
- Lower (elementary school, vocational education)	81 (32)
- Secondary (high school, intermediate vocational education)	105 (43)
- Higher (higher professional education university)	52 (21)
Wage earner, n (%)	133 (54)
THA/TKA, n (%)	100 (41) / 146 (59)
BMI (kg/m^2), n (%)	
- <25	54 (22)
- >25	187 (76)
Number of comorbidities, n (%)	
- No	20 (8)
- One or two	138 (56)
- More than two	87 (35)
Self-employed, n (%)	31 (13)
Company size (number of employees), n (%)	
- 1-9	42 (17)
- 10-99	60 (24)
- >100	129 (52)
Contractual hours (median, IQR)	32 (21 - 38)
Working hours (median, IQR)	32 (20 - 40)
Job type, n (%)	
- Executive	143 (58)
- Administrative	29 (12)
- Advisory	15 (6)
- Management	32 (13)
- Policy	25 (10)
Work tasks n (%)	
- Physical	67 (27)
- Mental	69 (28)
- Both	90 (37)
Work demands, n (%)	
- Standing	117 (46)
- Sitting	129 (54)
- Walking	123 (50)
- Kneeling or squatting	58 (24)
Return to work by 6 months, n (%)[a]	122 (64)

All numbers are represented as median with interquartile range (IQR), or numbers (n) and percentages (%).
[a]*N=190*

Table 2: Preoperative and three months postoperative univariate and multivariate logistic regression analyses of perceived social support variables on return to work (RTW) status

	Univariate			Multivariate		
Variables	**OR**	**P**	**95% CI**	**OR**	**P**	**95% CI**
Preoperative						
Support from home	1.04	0.34	0.96–1.14			
Support from co-workers (ref=no)	1.18	0.73	0.47–2.98			
Support from supervisor (ref=no)	1.40	0.41	0.63–3.14			
Support from OP (ref=no)	2.58	0.02*	1.18–5.65			
Support from GP (ref=no)	1.50	0.27	0.73–3.05			
Support from other caregivers (ref=no)	1.28	0.53	0.60–2.70			
Three months postoperative						
Support from home	1.00	0.88	0.92–1.10			
Support from co-workers (ref=no)	1.24	0.61	0.54–2.81			
Support from supervisor (ref=no)	2.53	0.02^	1.13–5.68	2.53	0.03*	1.08–5.89
Support from OP (ref=no)	3.12	0.00^	1.51–6.44	3.12	0.00*	1.49–6.54
Support from GP (ref=no)	2.56	0.01^	1.21–5.38			
Support from other caregivers (ref=no)	1.67	0.15^	0.83–3.37			

*Adjusted for sex, age, education, type of surgery and number of comorbidities; ^ p<0.2; *p<0.05; OR, odds ratio; CI, confidence intervals; OP, occupational physician; GP, general practitioner.*

Table 3: Preoperative and three months postoperative univariate and multivariate logistic regression analyses of perceived social support variables on return to work (RTW) status among subsamples of THA and TKA patients

	Univariate			Multivariate		
Variables	**OR**	**95% CI**	**P**	**OR**	**95% CI**	**P**
Preoperative						
THA (n=77)						
Support from home	1.03	0.89–1.20	0.68			
Support from co-workers (ref=no)	1.82	0.34–9.77	0.48			
Support from supervisor (ref=no)	2.23	0.52–9.50	0.28			
Support from OP (ref=no)	3.31	0.81–13.60	0.10^			
Support from GP (ref=no)	1.17	0.35–3.90	0.81			
Support from other caregivers (ref=no)	0.67	0.19–2.29	0.52			
TKA (n=113)						
Support from home	1.06	0.95–1.18	0.33			
Support from co-workers (ref=no)	1.00	0.30–3.25	0.99			
Support from supervisor (ref=no)	1.12	0.41–3.05	0.82			
Support from OP (ref=no)	2.17	0.81–5.82	0.13^			
Support from GP (ref=no)	1.65	0.64–4.21	0.30			
Support from other caregivers (ref=no)	1.70	0.63–4.63	0.30			
Three months postoperative						
THA (n=77)						
Support from home	1.08	0.93–1.26	0.32			
Support from co-workers (ref=no)	2.79	0.54–14.53	0.22			
Support from supervisor (ref=no)	4.30	1.05–17.57	0.04^	4.30	1.05–17.57	0.04*
Support from OP (ref=no)	1.77	0.52–6.02	0.36			
Support from GP (ref=no)	3.25	0.77–13.62	0.11^			
Support from other caregivers (ref=no)	0.65	0.18–2.38	0.51			
TKA (n=113)						
Support from home	0.98	0.88–1.09	0.66			
Support from co-workers (ref=no)	1.21	0.44-3.29	0.71			
Support from supervisor (ref=no)	2.44	0.82-7.28	0.11^			
Support from OP (ref=no)	5.18	1.88–14.28	0.00^	5.18	1.88–14.28	0.00*
Support from GP (ref=no)	2.46	0.97–6.24	0.06^			
Support from other caregivers (ref=no)	2.37	0.93–6.01	0.07^			

*Adjusted for sex, age, education, and number of comorbidities; ^ p<0.2; *p<0.05; OR, odds ratio; CI, confidence intervals; OP, occupational physician; GP, general practitioner.*

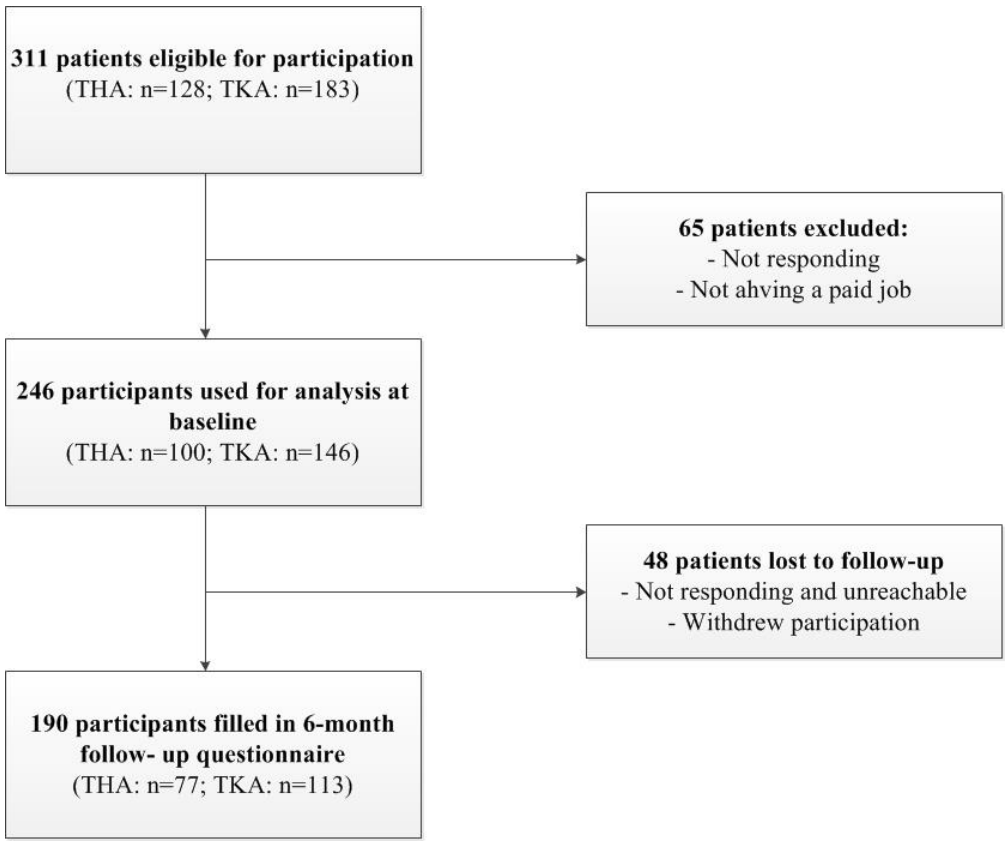

Fig. 1 Flowchart study enrolment and follow-up

220x184mm (96 x 96 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	5-6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	7-8
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	11
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	10-11
		(*c*) Explain how missing data were addressed	10-11
		(*d*) If applicable, explain how loss to follow-up was addressed	10-11
		(*e*) Describe any sensitivity analyses	10-11
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	11
		(c) Consider use of a flow diagram	11
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11-12 - -
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

BMJ Open

The influence of social support on return to work after total hip or total knee arthroplasty: a prospective multicentre cohort study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-059225.R2
Article Type:	Original research
Date Submitted by the Author:	04-Apr-2022
Complete List of Authors:	Kamp, Tamara; Department of Orthopedics, University of Groningen, University Medical Center Groningen; Department of Health Sciences, Community and Occupational Medicine, University of Groningen, University Medical Center Groningen Stevens, Martin; Department of Orthopedics, University of Groningen, University Medical Center Groningen van Beveren, Jan; Department of Orthopedics, Röpcke-Zweers Hospital Hardenberg Rijk, Paul C; Department of Orthopedics, Medical Center Leeuwarden Brouwer, Reinoud; Department of Orthopedics, Martini Hospital Groningen Bulstra, Sjoerd ; Department of Orthopedics, University of Groningen, University Medical Center Groningen Brouwer, Sandra; Department of Health Sciences, Community and Occupational Medicine, University of Groningen, University Medical Center Groningen
Primary Subject Heading:	Occupational and environmental medicine
Secondary Subject Heading:	Occupational and environmental medicine
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, Adult orthopaedics < ORTHOPAEDIC & TRAUMA SURGERY, Hip < ORTHOPAEDIC & TRAUMA SURGERY, Knee < ORTHOPAEDIC & TRAUMA SURGERY, Musculoskeletal disorders < ORTHOPAEDIC & TRAUMA SURGERY

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The influence of social support on return to work after total hip or total knee arthroplasty: a prospective multicentre cohort study

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Word count main text: 3345 words
Word count abstract: 292 words
Number of figures/tables: 3 tables, 1 figure
Number of references: 51 references

Declarations

Ethics approval

This study was approved by the Medical Ethics Board of University Medical Center Groningen (METc 2012.153).

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Funding

No funding was received for conducting this study.

Acknowledgements

No acknowledgements.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Abstract

Objectives There is strong evidence that social support is an important determinant of return to work (RTW). Little is known about the role of social support in RTW after total hip or knee arthroplasty (THA/TKA). Objective was to examine the influence of preoperative and postoperative perceived social support on RTW status 6 months postoperatively.

Design A prospective multicentre cohort study was conducted.

Setting Orthopaedic departments of four Dutch medical centres; a tertiary university hospital, two large teaching hospitals, and a general hospital.

Participants Patients planned to undergo THA/TKA, aged 18-63 and employed preoperatively were included.

Main outcome measures Questionnaires were filled out preoperatively and 3 and 6 months postoperatively, and included questions to assess patients' perceived social support targeting three sources of social support: from home (friends, family), from work (co-workers, supervisors) and from healthcare (occupational physician, general practitioner, other caregivers). Control variables included age, gender, education, type of arthroplasty and comorbidities. RTW was defined as having fully returned to work 6 months postoperatively. Univariate and multivariate logistic regression analyses were conducted.

Results Enrolled were 190 patients (n=77 THA, n=113 TKA, median age 56 years, 56% female). The majority returned to work (64%). Preoperatively, social support from the occupational physician was associated with RTW (OR 2.53, 95%CI 1.15–5.54). Postoperatively, social support from the occupational physician (OR 3.04, 95%CI 1.43-6.47) and the supervisor (OR 2.56, 95%CI 1.08-6.06) was associated with RTW.

Conclusions This study underscores the importance of work-related social support originating from the occupational physician and supervisor in facilitating RTW after primary THA/TKA, both preoperatively and postoperatively. Further research is needed to confirm our results and to understand the facilitating role of social support in RTW, as arthroplasty is being performed on a younger population for whom work participation is critical.

Key words: knee prothesis, hip prothesis, return to work, workplace, occupational health

Article Summary

Strengths and limitations of this study

- Prospective multicentre design with a relatively large number of patients and a follow-up of 6 months
- Generalizability of the outcomes as a result of the representative sample
- Multivariate analysis on three different sources of social support, investigating both preoperative and postoperative data
- Due to limited power our study only focused on preoperative and postoperative data separately
- We only focused on the first time workers fully returned to work

Introduction

Adequate social support is known to have positive effects on health status and health behaviors[1], wellbeing and work participation[2,3] . Social support has been defined as the assistance and protection given to an individual[1], which can come from a variety of sources such as friends, family, co-workers, organizations and healthcare professionals. There are different dimensions of social support – instrumental, informational, appraisal and emotional, where the former two are known as instrumental support and the latter two as perceived social support[4–7].

There is strong evidence that perceived social support from home, work and occupational healthcare is an important determinant in the return to work (RTW) process and work disability among a variety of working populations[2,3,8–13]. Social support within and outside the workplace has shown to contribute to the RTW process[2,8–12]. In a recent systematic review about the influence of social support and social integration on RTW outcomes among individuals with work-related injuries, receiving support from family, regular contact and good communication with the employer, and genuine concern and support from co-workers and supervisors were identified as facilitators of RTW[2]. Whereas perceived lack of emotional support, especially lack of on-going support from supervisors, was seen as a barrier to the RTW process[2]. Regarding healthcare support, positive RTW recommendations from healthcare professionals showed to be associated with a 60% higher RTW rate in a cohort of 325 patients with low back injury[14]. Multiple qualitative studies conducted among different patient groups showed the important role of perceived support from healthcare professionals in the RTW process[15–17]. Although these studies emphasize the importance of social support from home, work and healthcare, so far little is known about the role of social support in the RTW process among the rapidly growing patient group undergoing a total hip arthroplasty (THA) or total knee arthroplasty (TKA).

The number of THA and TKA procedures performed annually in the Netherlands continues to increase steadily, most rapidly among working-age patients[18]. In 2018, 14,768 primary THAs and 12,777 primary TKAs were performed among working-age adults in the Netherlands, a 56% and 32% increase compared to 2010, respectively[19]. Similar trends, with the largest increase among working-age patients, are seen in the United States and other Western countries[20,21]. This increase is mainly due

to increased prosthetic survivorship and the fact that particularly the severity of the osteoarthritis (OA) and patients' preferences, instead of age, have become a major criteria when deciding whether to undergo THA or TKA[22,23]. On the one hand the rise in THA and TKA procedures performed in younger patients and on the other hand the increase in retirement age results in higher numbers of patients expecting to remain in paid employment after surgery[18,24]. Previous studies show that 59-85% of patients return to work within 6 months[25–27], so the absolute number of patients who have not returned to work within 6 months is substantial.

Our previous study, which also used data from the "Work participation In Patients with Osteoarthritis" (WIPO) cohort, showed the importance of psychosocial working conditions in time to RTW after THA or TKA[28]. However, little research has been conducted among THA and TKA patients on the effect of social support on RTW outcomes. Some qualitative studies have shown that absence of workplace support by the supervisor was associated with a negative experience of returning to work in arthroplasty patients[29]. It was also found that a supportive environment at home and at work, as well as supportive care from healthcare professionals might be helpful in facilitating successful RTW, rehabilitation, and postoperative satisfaction[29–31]. No quantitative studies have been found so far that examined the effect of different types of social support on RTW among THA and TKA patients. No evidence exists either on the timing of social support, i.e. the effect of social support immediately before or after surgery compared to later postoperatively. The aim of this study was therefore to investigate the influence of perceived social support from different sources (home, work, healthcare) on RTW status 6 months postoperatively in a sample of THA and TKA patients.

Materials and methods

Design and procedure

A prospective multicentre cohort study was conducted among patients who underwent THA or TKA for primary OA. This study was part of the "Work participation In Patients with Osteoarthritis" cohort (WIPO, Trial-ID NTR3497)[28,32–34]. Between March 2012 and July 2014 Patients were recruited at the orthopaedic departments of the following Dutch medical centres: (1) University Medical Center Groningen (tertiary university hospital), (2) Martini Hospital Groningen (large teaching hospital), (3)

Medical Center Leeuwarden (large teaching hospital) and (4) Röpcke-Zweers Hospital Hardenberg (general hospital), all in the northern Netherlands. The study was approved by the Medical Ethical Committee of University Medical Center Groningen (METc 2012.153). Patients waiting for THA or TKA were contacted by phone and invited to participate. Preoperative questionnaires were filled in approximately one month before surgery. Postoperative follow-up data, for this study, were collected after 3 and 6 months. If applicable, missing answers were added later to the questionnaire after retrieving them by telephone. Informed consent was assumed as being obtained when patients returned finished questionnaires and thereby granting our request to participate in the study. If patients did not want to participate in the study, they were asked to return a blank questionnaire. Patients were informed of this consent method by mail, in an information letter that also communicated the voluntary nature of the study and the anonymous nature of all the data to be processed. The Medical Ethical Committee specifically approved this consent procedure.

Study population

Patients with primary hip and knee OA undergoing THA or TKA, aged 18-63 and employed preoperatively were included. Excluded were patients who in the previous six months received another joint arthroplasty, THA or TKA due to secondary OA, unicompartmental knee arthroplasty, THA or TKA revision and with inadequate understanding of the Dutch language. A dropout was defined as a patient leaving the study preterm by not filling in the 6-month postoperative questionnaire for any reason.

Measures

Dependent variable

Return to work (yes/no) was measured at the 6-month postoperative follow-up. Patients were asked whether they returned to work, with the following answering possibilities: no return to work, partial return to work, full return to work. RTW was defined as participants who answered that they fully

returned to work after surgery, no RTW was defined as participants who answered that they did not or partially return to work.

Independent variables

Perceived social support was measured preoperatively (baseline) and 3 months postoperatively using three questionnaires targeting support from home, work, and healthcare.

Social support from home, i.e. friends and family, was assessed with the Groningen Orthopaedic Social Support Scale (GO-SSS). The GO-SSS consists of 12 questions divided into two subscales: perceived social support (seven items) and instrumental social support (five items). This study focused on the perceived social support subscale. On a Likert scale four answers were possible (never or rarely, occasionally, regularly, often). A sum score was computed, where higher scores indicated more perceived social support. The GO-SSS showed to be a reliable and valid instrument to assess social support for patients following arthroplasty, with a 0.89 Cronbach alpha for the entire questionnaire and 0.86 internal consistency for the perceived social support (PSS) subscale[35].

Social support from work was assessed with a self-constructed scale focusing on perceived social support. The questionnaire consisted of two questions about perceived support from co-workers and the supervisor. Each item is preceded by the question "How much support did you receive during your period of recuperation from…" with responses on a 1–3 point scale (no support, little support, ample support). Dichotomous variables were computed, distinguishing between no perceived support and perceived support (consisting of little or ample support). The two questions were analysed separately.

Social support from healthcare was measured with a self-constructed scale focusing on perceived social support regarding work. The questionnaire included three questions about perceived support from an occupational physician (OP), a general practitioner (GP) and other caregivers. Each item is preceded by the question "How much support regarding work did you receive during your period of

recuperation from…" with responses on a 1–3 point scale (no support, little support, ample support). Dichotomous variables were computed, distinguishing between no perceived support and perceived support (consisting of a little or ample support). The three questions were analysed separately.

Covariates

Data about the following sociodemographic characteristics were collected preoperatively: age (years), gender, education (categorized into elementary, secondary and higher), being breadwinner (yes/no). Disease-related information was gathered by inquiring about type of arthroplasty (THA or TKA), body mass index (BMI) divided into normal (<25 kg/m^2) and overweight or obese (>25 kg/m^2), and comorbidity measured with a 27-item chronic conditions questionnaire (Statistics Netherlands. Health questionnaire 1989)[36]. Amount of comorbidities was divided into none, one or two, or more than two. Data about work-related characteristics included questions about self-employment (yes/no), company size (number of employees: 1-9, 10-99, more than 100), contractual hours (h), working hours (h), type of job (executive/administrative/advisory/management/policy), and type of tasks (physical/mental/combination). Executive jobs cover blue collar workers, i.e. requiring manual labour. Physical work demands were measured by asking whether patients had to perform physical activities like standing, sitting, walking, kneeling or squatting during work (yes/no).

Statistical analysis

Descriptive statistics – mean (SD), n (%) – were used to describe baseline characteristics of the study population. Univariate and multivariate logistic regression analyses were used to study the prognostic factors for RTW 6 months postoperatively. Separate analyses were conducted for perceived social support measured preoperatively and 3 months postoperatively.

The association between each potential prognostic factor and RTW was univariately assessed. All prognostic factors with a p-value ≤0.20 in the univariate analyses were included in the multivariate regression analyses[37], after checking for multicollinearity. Variables were omitted by backward selection, depending on their level of statistical significance (P<0.05). Control variables for the analyses included sex, age, education, type of surgery, comorbidities, and work tasks[38–41]. Control variables were based on previous literature and were defined a priori. Sensitivity analyses were

conducted for THA and TKA groups separately, since previous literature suggests that postoperative recovery and RTW differs between these groups [42,43]. Odds ratios were calculated, including 95% confidence intervals (CI). A non-response analysis was performed. Statistical analyses were performed with IBM Statistical Package for the Social Sciences (SPSS) version 25.0 and Mplus version 7.1.

Patient and public involvement statement

Neither patients nor the public were involved in the design, conduct, reporting or dissemination plans of our research.

*Insert figure 1 about here (**Fig. 1** Flowchart study enrolment and follow-up)*

Results

From the 311 patients who had undergone a primary THA or TKA, 190 (n=77 THA, n=113 TKA) were included in the study. Figure 1 is a flowchart showing the total number of patients at baseline and the drop-outs to follow-up. The characteristics of the study sample are presented in Table 1 and Supplementary Table 1. Median age was 56 years (interquartile range (IQR) 52-60 years). The sample consisted of 84 (44%) men and 106 (56%) women, 77 (41%) THA patients and 113 (59%) TKA patients. For educational level, 33% had completed elementary school, 44% secondary school and 21% higher education. BMI of 77% was above 25 kg/m^2 and 46% had two or more comorbidities. Patients worked on average 32 hours. Our cohort had mostly executive jobs (55%; blue collar). A combination of physically and mentally challenging tasks was performed by 39% of patients; the remaining patients were divided equally into performing either physical or mental work tasks. Work demands of the majority included sitting and/or walking, and a quarter of the patients had to perform kneeling or squatting work demands. The majority of patients returned to work (64%) by 6 months post-surgery. To correct for the drop-out rate during follow-up we conducted a non-response analysis, which showed no significant differences on baseline characteristics or independent variables.

Insert table 1 about here

Univariate and multivariate logistic regression analyses

In the *preoperative* univariate analyses, social support from the OP was the only variable below the cut-off value of p<0.2, therefore no multivariate analyses were performed. Preoperative social support from the OP was univariately significantly associated with RTW (OR 2.53, 95%CI 1.15–5.54; Table 2). In the *postoperative* univariate analyses social support from the supervisor, the OP, the GP and other caregivers were below the cut-off value of p<0.2 and were therefore used in the multivariate analyses. In the multivariate model perceived social support from the OP (OR 3.04, 95%CI 1.43-6.47) and from the supervisor (OR 2.56, 95%CI 1.08-6.06) showed statistically significant associations with RTW. The odds of an individual having returned to work 6 months post-surgery increased by 3.04 and 2.56 for those patients who perceived social support from the OP and from the supervisor, respectively (Table 2).

Insert table 2 about here

Sensitivity analyses

Analysing the THA and TKA groups separately, the *preoperative* multivariate model showed no association between social support and RTW in both subgroups (Table 3). The *postoperative* multivariate model of THA patients showed that perceived social support from the supervisor was significantly associated with RTW (OR 1.90, 95%CI 1.12–21.53; Table 3). The *postoperative* multivariate model of TKA patients showed a significant association between perceived social support from the OP and RTW (OR 5.14, 95%CI 1.84–14.36; Table 3).

Insert table 3 about here

Discussion

This study aimed to investigate the influence of preoperative and postoperative perceived social support from home, work and healthcare on RTW status 6 months postoperatively in a sample of THA and TKA patients. We found that patients who perceived social support from the OP preoperatively had 2.5 times higher odds of RTW within 6 months postoperatively compared to patients who perceived no support. Patients who perceived social support from the OP and from the supervisor 3

months postoperatively had 3.0 and 2.6 times higher odds of RTW, respectively. These results imply the important role of workplace support in the RTW process, as both the OP and supervisor are linked to the workplace.

In our study the majority of patients (64%) returned to work within 6 months postoperatively, which is in line with previous studies[25–27]. Our findings that perceived social support from the OP is important, both preoperatively and postoperatively, is in line with previous quantitative studies on social support from the OP in other populations[13,14,17]. In qualitative studies among THA and TKA patients, employers and clinicians also indicated the added value of OPs, especially if there already was contact before surgery[29,44].

Our findings that social support from the supervisor was associated with RTW is also in line with previous studies conducted among other population groups[2,45,46]. Supervisors play a considerable role in initiating effective support strategies[47–49]: they are expected to communicate the process of RTW with the employee and the OP and implement accommodations, both in agreement with the OP[2,11]. In our multivariate analyses, we only found an association between postoperative and not preoperative social support from the supervisor and RTW, leaving questions about optimal timing. An explanation might be that the supervisor is better able to perform specific actions postoperatively to facilitate RTW.

In contrast to previous studies, we did not find an association between social support from home or co-workers and RTW in our study population. A possible explanation for this absence in our study might relate to the duration of sickness absence: other studies that found an association between social support from home or co-workers and RTW were mainly conducted among population groups with long-term absence (>6 months)[3,13], whereas a THA or TKA often leads to a short-term work absence (<3-6 months) for most patients. Disease chronicity and long-term absence may influence the necessity and contributing value of social support from home and co-workers for RTW outcomes.

In our study we did not find an effect of perceived social support from other caregivers (e.g. physiotherapists) on RTW. This might be because we did not further specify the question and patients could have experienced it as implicit. The role of social support from a physiotherapist on RTW

warrants further research, since our particular subsample has frequent contact with these specific healthcare professionals. Value of a physiotherapist is illustrated by Lysaght et al., who reported in their qualitative research that half of the workers experienced support by a physiotherapist[11]. More research is needed to evaluate the role of physiotherapists and their contribution to the RTW process.

Our sensitivity analyses showed some differences in factors associated with RTW between THA and TKA patients. Postoperative perceived social support from the supervisor was associated with RTW of THA patients and postoperative perceived social support from the OP was associated with RTW of TKA patients. This dissimilarity in findings may be explained by differences in the rehabilitation process. It is known that for THA patients rehabilitation is easier than for TKA patients[42,43]. However, it must be kept in mind that the wide 95% CI indicated our sample size is too small. These results need to be replicated with a larger sample size before definitive conclusions can be drawn.

Lastly, our non-response analyses did not show significant differences on baseline characteristics or independent variables. However, it might be that non-response could partly be explained by unfavourable return to work outcomes.

Strengths & limitations

An important strength of this study is its prospective multicentre design with a relatively large number of patients and a follow-up of 6 months. Another strength is the representative sample of patients and therefore the generalizability of the outcomes. We provided multivariate analysis on three different sources of social support, plus investigated both preoperative and postoperative data, in contrast to previous research on social support among other patient groups[2]. This study does have some limitations. Due to limited power our study only focused on preoperative and postoperative data separately. The sample sizes of our subgroups (THA and TKA) in the sensitivity analyses lacked power to draw definitive conclusions, and we only focused on the first time workers fully returned to

work. Future research should also include sustainable RTW to assess the impact of social support on these RTW trajectories.

Lastly, another limitation were the self-reported measurements, which are generally susceptible to the effects of reporting bias.

Implications

Changing workforce dynamics and trends towards THA or TKA surgery among working-age employees propel an urgent need to understand the facilitators and barriers for RTW, besides those of pain and function [33]. There are still many uncertainties about the potential influence of psychosocial work factors (including social support), timing of interventions designed to facilitate RTW, and engagement of clinicians and employers as key actors in the RTW process.

To our knowledge, this is the first quantitative study to examine the role of social support among this specific population. The differences in predicting factors between THA and TKA patients might imply a need for group-specific approaches. Further research on social support is needed to confirm our results and to understand the facilitating role of social support on RTW. The optimal timing to implement contact, i.e. social support, the course (change over time) of social support from different sources and their effect on RTW should also be investigated. Therefore, studies among THA and TKA patients specifically focused at social support, and using validated questionnaires to measure social support from different sources[50,51], would be very valuable.

Conclusion

This study showed that, in particular, perceived social support from OPs and supervisors may predict RTW after THA and TKA. Both preoperative and postoperative social support were associated with RTW, which may suggest that perceived work-related social support from OPs and supervisors are important factors over an extended period of time. Some differences in factors were found between THA and TKA patients, where postoperative social support from the supervisor predicted RTW of THA patients and postoperative social support from the OP predicted RTW of TKA patients. Further research on the role of social support in returning to work after THA and TKA is needed, as

arthroplasty is being performed on an increasingly younger population for whom work participation is of critical importance.

Declarations

Ethics approval

This study was approved by the Medical Ethics Board of University Medical Center Groningen (METc 2012.153).

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Funding

No funding was received for conducting this study.

Acknowledgements

No acknowledgements.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Author contributions:

TK conceived and designed the study, wrote the manuscript, performed statistical analysis, prepared the figures. MS conceived and designed the study, supervised the work, made substantial changes to the manuscript, arranged the data. JB arranged the data, critically assessed and corrected the manuscript. PR arranged the data, critically assessed and corrected the manuscript. RB arranged the data, critically assessed and corrected the manuscript. SKB conceived and designed the study, arranged the data. SB conceived and designed the study, supervised the work, made substantial changes to the manuscript, arranged the data.

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Fig. 1 Flowchart study enrolment and follow-up

Table 1 : Baseline study population characteristics.

Variables	Total (N=190)
Age, median (IQR)	56 (52 – 60)
Male/female, n (%)	84 (44) / 106 (56)
Highest educational level (n (%))	
- Lower (elementary school, vocational education)	62 (33)
- Secondary (high school, intermediate vocational education)	84 (44)
- Higher (higher professional education university)	39 (21)
Wage earner, n (%)	106 (56)
THA/TKA, n (%)	77 (41) / 113 (59)
BMI (kg/m^2), n (%)	
- <25	40 (21)
- >25	147 (77)
Number of comorbidities, n (%)	
- No	19 (10)
- One or two	62 (33)
- More than two	88 (46)
Self-employed, n (%)	22 (12)
Company size (number of employees), n (%)	
- 1-9	28 (15)
- 10-99	50 (26)
- >100	112 (59)
Contractual hours (median, IQR)	32 (21 - 37)
Working hours (median, IQR)	32 (22 - 40)
Job type, n (%)	
- Executive	105 (55)
- Administrative	22 (12)
- Advisory	11 (6)
- Management	27 (14)
- Policy	23 (12)
Work tasks n (%)	
- Physical	57 (30)
- Mental	57 (30)
- Both	74 (39)
Work demands, n (%)	
- Standing	100 (47)
- Sitting	107 (56)
- Walking	104 (55)
- Kneeling or squatting	52 (27)

All numbers are represented as median with interquartile range (IQR), or numbers (n) and percentages (%).

Table 2: Preoperative and three months postoperative univariate and multivariate logistic regression analyses of perceived social support variables on return to work (RTW) status

	Univariate			Multivariate		
Variables	**OR**	**P**	**95% CI**	**OR**	**P**	**95% CI**
Preoperative						
Support from home	1.04	0.40	0.95 – 1.14			
Support from co-workers (ref=no)	1.26	0.64	0.48 – 3.31			
Support from supervisor (ref=no)	1.57	0.30	0.68 – 3.62			
Support from OP (ref=no)	2.53	0.02*	1.15 – 5.54			
Support from GP (ref=no)	1.46	0.30	0.71 – 2.98			
Support from other caregivers (ref=no)	1.24	0.57	0.59 – 2.63			
Three months postoperative						
Support from home	1.01	0.92	0.92 – 1.10			
Support from co-workers (ref=no)	1.28	0.56	0.56 – 2.93			
Support from supervisor (ref=no)	2.71	0.02^	1.18 – 6.23	2.56	0.03*	1.08 – 6.06
Support from OP (ref=no)	3.17	0.00^	1.51 – 6.66	3.04	0.00*	1.43 – 6.47
Support from GP (ref=no)	2.51	0.02^	1.19 – 5.29			
Support from other caregivers (ref=no)	1.64	0.17^	0.81 – 3.32			

*Adjusted for sex, age, education, comorbidities, type of surgery and work tasks; ^ p<0.2; *p<0.05; OR, odds ratio; CI, confidence intervals; OP, occupational physician; GP, general practitioner.*

Table 3: Preoperative and three months postoperative univariate and multivariate logistic regression analyses of perceived social support variables on return to work (RTW) status among subsamples of THA and TKA patients

	Univariate			Multivariate		
Variables	**OR**	**95% CI**	**P**	**OR**	**95% CI**	**P**
Preoperative						
THA (n=77)						
Support from home	1.03	0.88 – 1.20	0.76			
Support from co-workers (ref=no)	2.04	0.35 – 11.90	0.43			
Support from supervisor (ref=no)	2.79	0.55 – 14.07	0.21			
Support from OP (ref=no)	3.33	0.81 – 13.69	0.10^			
Support from GP (ref=no)	1.15	0.34 – 3.90	0.83			
Support from other caregivers (ref=no)	0.67	0.19 – 2.33	0.53			
TKA (n=113)						
Support from home	1.05	0.94 – 1.18	0.38			
Support from co-workers (ref=no)	1.10	0.32 – 3.76	0.88			
Support from supervisor (ref=no)	1.25	0.45 – 3.48	0.67			
Support from OP (ref=no)	2.06	0.76 – 5.57	0.15^			
Support from GP (ref=no)	1.64	0.64 – 4.21	0.31			
Support from other caregivers (ref=no)	1.64	0.60 – 4.49	0.33			
Three months postoperative						
THA (n=77)						
Support from home	1.09	0.93 – 1.27	0.29			
Support from co-workers (ref=no)	3.13	0.55 – 17.80	0.20			
Support from supervisor (ref=no)	1.90	1.12 – 21.53	0.04^	1.90	1.12 – 21.53	0.04*
Support from OP (ref=no)	1.85	0.51 – 6.81	0.35			
Support from GP (ref=no)	3.24	0.77 – 13.61	0.11^			
Support from other caregivers (ref=no)	0.65	0.18 – 2.39	0.52			
TKA(n=113)						
Support from home	0.97	0.87 – 1.08	0.60			
Support from co-workers (ref=no)	1.26	0.46 – 3.43	0.66			
Support from supervisor (ref=no)	2.65	0.87 – 8.07	0.09^			
Support from OP (ref=no)	5.14	1.84 – 14.36	0.00^	5.14	1.84 – 14.36	0.00*
Support from GP (ref=no)	2.40	0.94 – 6.11	0.07^			
Support from other caregivers (ref=no)	2.32	0.91 – 5.90	0.08^			

*Adjusted for sex, age, education, comorbidities, and work tasks; ^ p<0.2; *p<0.05; OR, odds ratio; CI, confidence intervals; OP, occupational physician; GP, general practitioner.*

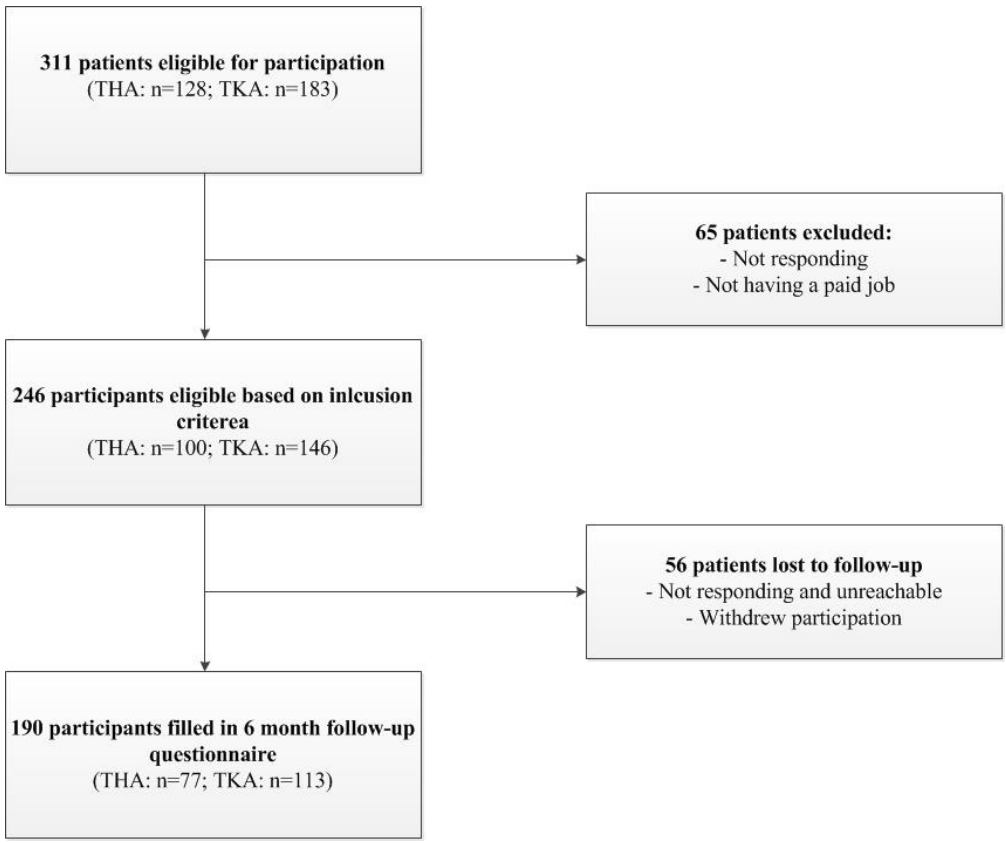

Fig. 1 Flowchart study enrolment and follow-up

225x188mm (96 x 96 DPI)

Supplementary table 1: Descriptive information on social support

Variables*		
Total (N=190)	***Preoperative***	***Postoperative (3 months)***
Support from home, median (IQR)	25 (21 – 27)	25 (22 – 28)
Support from co-workers, n (%)	139 (73)	139 (73)
Support from supervisor, n (%)	119 (63)	115 (61)
Support from OP, n (%)	57 (30)	78 (41)
Support from GP, n (%)	73 (38)	75 (40)
Support from other caregivers, n (%)	73 (38)	66 (35)

**All numbers are represented as median with interquartile range (IQR), or numbers (n) and percentages (%).*

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	5-6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	7-8
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	11
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	10-11
		(*c*) Explain how missing data were addressed	10-11
		(*d*) If applicable, explain how loss to follow-up was addressed	10-11
		(*e*) Describe any sensitivity analyses	10-11
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	11
		(c) Consider use of a flow diagram	11
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11-12 - -
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.