Return to work after total hip or total knee arthroplasty

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General introduction

1

Osteoarthritis

Osteoarthritis (OA), also known as arthrosis deformans, is an age-related progressive chronic degenerative disease of the cartilage. OA embodies an imbalance of degenerative and reparative processes involving the total joint and its surroundings, secondarily leading to inflammatory changes in the synovium and cartilage (1). Patients experience pain and stiffness in the affected joints, resulting in functional limitations in daily life (2). Besides the negative influence on physical health, OA also negatively affects mental health (2). Well-known risk factors for developing OA are older age, overweight or obesity, sports-/non-sports-related joint injuries, and probably a physically inactive lifestyle (2,3).

OA is highly prevalent and results in one of the most common reasons for chronic musculoskeletal pain and disability, affecting about one in eight adults worldwide (4).

Although OA may affect any joint, it is most commonly seen in the hip or knee (5). Currently, roughly 80% of OA patients in the Netherlands suffer from hip or knee OA, with a clear increase observed: in 10 years (2011-2020) prevalence increased by 45%, from 550,000 to 1,223,000 (6). This prevalence is expected to further increase in the coming decades, and is predicted to increase the fastest of all chronic disorders between 2018-2040. OA is expected to be the most common chronic disorder in the Netherlands by 2040 (6–8). Concomitantly, the group of working-age individuals with OA is also growing (6). This may be due to an ageing society, leading to a higher retirement age, more sports-/non-sports-related injuries, and unhealthy lifestyles (2,9,10). Such lifestyles result in a growing population of overweight or obese and physically inactive people (2,3,9). Working-age individuals with OA are at risk of decreased work productivity, sick leave, work disability, and consequently premature exit from paid employment (11). Hence OA is a substantial source of disability with significant costs to society (11,12).

There is currently no cure for OA. The goals of OA management are therefore to optimise function and eliminate pain (13). OA management consists of conservative treatment, which is followed by surgical treatment if insufficiently effective (1). According to the multidisciplinary Dutch guidelines 'Conservative treatment of hip or knee osteoarthritis' (from the Federation Medical Specialists), conservative treatment of hip and knee OA follows several steps (14). The first step is self-care, which consists of education and lifestyle advice (14). The second step involves exercise therapy (14). The third step includes pain medication, starting with paracetamol, if insufficiently effective switching to non-steroidal anti-inflammatory drugs (NSAIDs) or even opioid analgesics (14). If complaints persist, the next step involves intra-articular injections or a brace (14). When conservative treatments fail to alleviate pain and dysfunction, total joint replacement (i.e.

arthroplasty) is considered the most medically and cost-effective treatment, for end-stage hip or knee OA, to relieve pain, improve physical function and ultimately restore quality of life (4,15,16).

Increasing incidence of arthroplasties

Historically THA and TKA used to be limited to elderly (mostly retired) patients, as surgery was postponed for as long as possible, but the context has changed (17,18). On the one hand, due to the negative consequences of lifestyle, people experience OA symptoms at an earlier age, resulting in more younger (working-age) patients undergoing THA or TKA (2,3,9). Second, orthopaedic surgeons tend to perform arthroplasties earlier in younger (working-age) patients as a result of improved surgical techniques, longer prosthetic survivorship, and wider experience with arthroplasties (19,20). Third, patients are more demanding and request arthroplasties at an earlier age (21). On the other hand, due to an ageing society the retirement age increases, leading to even more working-age patients (10).

Between 2010 and 2019 the number of THA procedures in the Netherlands rose by 38%, from 23,913 to 33,076; for TKA this rose by 45%, from 17,887 to 25,885 (22). Considering the aforementioned factors for the increase in OA and THAs or TKAs, it is comprehensible that the largest increase in THAs and TKAs is seen in patients of working-age (9,19,23). In 2010-2019 in the Netherlands, the number of procedures among working-age patients rose from 11,110 to 15,000 and from 9,619 to 12,628 for TKA (22). Similar trends are also seen in the United States and in other Western countries (24–28). In the United States it is anticipated that by 2030 over 50% of the procedures will be performed on patients of working-age (25). Accordingly, the pressure on healthcare systems and the associated financial strain of the growing demand will presumably increase further.

Working-age THA and TKA patients

Work is an important aspect of participation in daily life (29), from which we derive not only an income, but also social interaction and relationships (29). Being employed is a major determinant of health and well-being (30), and induces the feeling of belonging to a group, being needed, and boosted self-esteem (31).

The ongoing increase of working-age patients induces a shift in rehabilitation and recovery demands. Traditionally, rehabilitation and recovery after THA or TKA has aimed to reduce stiffness and pain, and to improve muscle-strength and range-of-motion, since patients were mostly elderly for whom low-level activities were sufficient to participate in daily life (17,18). Working-age patients have higher needs in terms of rehabilitation and recovery, to eventually facilitate and

support participation in daily activities (32,33). For this patient group, return to work (RTW) and the ability to participate in work after surgery is becoming an increasingly important treatment goal (32,33).

Previous studies determining work-related outcomes mainly examined first time to RTW and found variation in RTW rates of 68%-95% after THA and 71%-83% after TKA within 1-2 years postoperatively (34,35). With the increasing number of working-age THA or TKA patients, the absolute number of patients not returning to work is substantial. Moreover, time to RTW after THA or TKA seems to be variable, with reported ranges of 1-17 weeks after THA and 8-17 weeks after TKA (34,35).

From a societal perspective the speed of rehabilitation and recovery of working-age patients, enabling RTW and work participation, is also important (36). Hence the rise in working-age THA and TKA patients results in an increasing social and economic burden in the Netherlands, in Europe and worldwide (9,24,27).

Determinants that may influence the RTW process are discussed below: system-related factors and work-related factors.

System-related factors

System-related factors influence a country's RTW policy and practices, and may affect recovery, available time to recover, and consequently RTW and time to RTW (37,38). System-related factors include characteristics of healthcare systems, social security systems, policies, clinical guidelines, incentives, and practices of healthcare professionals working within these systems (39,40).

The increase in procedures among working-age patients is a trend seen in the Netherlands as well as in other Western countries, like the United States (9,19,20,22,24–28). Countries may organise RTW guidance for the working-age THA or TKA population in different ways, depending on their healthcare and social security systems. For example, in the Netherlands both orthopaedic surgeons and occupational physicians should play a significant role in the RTW process, making optimal use of their respective expertise. Nevertheless, care in this process is fragmented and active communication between these two specialisms is typically not addressed in usual care (41). A recent study revealed that German patients RTW 2.3 weeks earlier than Dutch patients (12.2 vs 14.5 weeks) (36). This raises questions, such as whether German healthcare professionals collaborate more closely, or whether other cross-country differences like variance in work practices, welfare, social care, healthcare, pension arrangements, and cultural attitudes towards work account for this difference.

Insight into system-related factors and different RTW policy and practices may help understand differences in RTW outcomes between countries and learn from best practices.

Work-related factors

There is a large body of longitudinal research among working populations examining factors influencing RTW (42–45). However, work-related factors affecting work participation after THA or TKA have only been investigated in a limited number of studies (34,35). Most studies among THA or TKA patients have so far focused on personal factors and found that sociodemographics (higher age, female gender, lower educational level), more comorbidities, and limited joint function are associated with postoperative delayed RTW (46).

Work-related factors influencing RTW can be roughly subdivided into four domains: workplace characteristics (e.g. working hours, type of contract, tasks, job type), physical working conditions (e.g. standing, walking, sitting), psychosocial working conditions (e.g. work pace, role clarity, job satisfaction), and work adjustments (e.g. lighter duties, shorter hours, different workstation) (47–51).

The few available studies focused mainly on the impact of physical working conditions such as kneeling, bending, and getting to and from work, which were associated with delayed RTW (34,35). Few of the aforementioned studies took into account the influence of psychosocial working conditions, suggesting that workplace support and flexible working conditions may be positively associated with RTW (34,35). However, there is still insufficient knowledge about the association between psychosocial working conditions and RTW after THA or TKA.

Most studies among THA and TKA patients classify work into mainly physical or mainly mental (52–55), so uncertainties exist about the association between occupation and RTW. The limitation of that classification is that it does not distinguish between different levels of occupations based on educational level, as well as types of occupations (56). Classifying occupations into different occupational classes (high/low-skilled, blue/white-collar) may help gain better insight into occupational factors (56). The International Standard Classification of Occupations 2008 (ISCO-08) is a tool for organising occupations that takes educational level and type of work into account, resulting in occupational classes (56). Studies among working populations have shown that occupational class has a strong independent association with sickness absence (57,58) and RTW (59,60) – for example, workers in lower occupational classes tend to have strenuous working conditions (61) and higher levels of work stress (62), while workers in higher occupational classes tend to have more control and autonomy (63). Psychosocial determinants like strenuous working conditions on the one hand and autonomy

on the other might influence the extent to which workers can adjust their work according to their needs, potentially obstructing or facilitating the RTW process (47).

Fulfillment of patient expectations

Being returned to work does not inevitably mean that patients experience good work functioning and thus have fulfilled expectations about paid employment. To gain better understanding of a successful RTW process it is important to also look beyond the first time to RTW and focus on fulfilment of expectations towards paid employment as well as factors associated with fulfilment. Research suggests that THA and TKA patients of working-age tend to have high expectations about work and RTW (32,33). In general, patient expectations of medical care and their fulfilment are linked to assessments of outcome and satisfaction (64,65). Although patient expectations about paid employment after THA or TKA are high, 11-43% of patients still have unfulfilled expectations (66–68).

Aim and outline of the thesis

Based on the aforementioned thoughts, the overall aim of this thesis is to expand our knowledge on the role of system-related factors (i.e. healthcare- and social security systems, clinical guidelines and practices) and work-related factors (i.e. workplace characteristics, physical- and psychosocial working conditions, and work adjustments) on RTW, as well as to identify factors associated with fulfilment of patient expectations towards paid employment in order to optimise employment outcomes for the growing group of working-age THA and TKA patients.

The specific research aims are:

1. To gain insight into national and international RTW policy and practices used and conducted by healthcare professionals treating working-age THA and TKA patients;
2. To study the association between work-related factors and (time to) RTW among working-age THA and TKA patients;
3. To identify factors associated with fulfilment of patient expectations towards paid employment among working-age THA and TKA patients.

Context in which this thesis was conducted

The initiative for this thesis arose as a result of the research agenda 2019-2022 compiled by the Dutch Orthopaedic Association (NOV). The NOV aims to strengthen the scientific basis of orthopaedics and improve the effectiveness, efficiency and safety of patient care. Together with the stakeholders, the association determined

which care evaluation and innovation questions should be tackled. One of the formulated questions concerned the effect of referral to an occupational physician upon RTW after THA or TKA. This thesis does not directly answer the question, but it helps expand our knowledge about RTW after THA or TKA.

The research within this thesis is conducted under the umbrella of the "Consortium Orthopaedic Research (CORE)". Data of two longitudinal cohorts was used: "Work participation In Patients with Osteoarthritis" (WIPO) and "Longitudinal Leiden Orthopaedics Outcomes of Osteo-Arthritis study" (LOAS). WIPO is a multi-centre, longitudinal prospective cohort study, an initiative of the departments of Orthopaedics and Health Sciences, Community and Occupational Medicine of University Medical Center Groningen (UMCG). Patients were recruited between March 2012 and July 2014 at the departments of Orthopaedics of four Dutch hospitals in the northern region of the Netherlands: Röpcke-Zweers Hospital Hardenberg (general hospital), Medical Center Leeuwarden (general hospital), Martini Hospital Groningen (large teaching hospital), and UMCG (tertiary university hospital). Patients with hip or knee OA on the waiting list to undergo a THA or TKA and aged 18-63 were included. Excluded were patients with insufficient knowledge of the Dutch language and those having undergone a unicompartimental knee arthroplasty or revision THA or TKA. Data was gathered via questionnaires preoperatively and at 6 weeks and 3, 6, 12 and 24 months postoperatively

LOAS is an ongoing multicentre, longitudinal prospective cohort study, an initiative of the Department of Orthopaedics of Leiden University Medical Center (LUMC). Data collection started in 2012 and patients were recruited at the orthopaedic departments of eight Dutch medical centres (one university hospital and seven regional hospitals): LUMC, Leiden; Alrijne Hospital, Leiden/Leiderdorp; Groene Hart Hospital, Gouda; LangeLand Hospital, Zoetermeer; Reinier de Graaf Gasthuis, Delft; Albert Schweitzer Hospital, Dordrecht; Waterland Hospital, Purmerend; and OCON Orthopaedic Clinic, Hengelo. General inclusion criteria for LOAS were a diagnosis of osteoarthritis, age 18 years or older, being listed for THA or TKA, and sufficient Dutch-language skills to complete the questionnaires. Data is gathered via questionnaires preoperatively; 6, 12 and 24 months postoperatively; and 4, 6, 8 and 10 years postoperatively.

Outline of the thesis

In **Chapters 2 and 3** insight was gathered into national and international RTW policy and practices. **Chapter 2** aimed to identify facilitators and barriers experienced by orthopaedic surgeons and occupational physicians in guiding the RTW process of patients with a THA or TKA in the Netherlands. **Chapter 3**

describes a cross-country exploration of RTW policies and practices between Denmark, Germany and the Netherlands. An overview of the healthcare- and social security systems, the availability and content of national RTW guidelines, and actual RTW practices and perceptions by orthopaedic surgeons with regard to patients undergoing THA or TKA were explored.

In **Chapters 4-6** the associations between work-related factors and (time to) RTW among working-age THA and TKA patients were studied. **Chapter 4** aimed to identify the influence of work-related factors on time to RTW. The work-related factors were measured within four domains: workplace characteristics, physical working conditions, psychosocial working conditions, and work adjustments. **Chapter 5** presents the influence on RTW of work-related social support from three different sources: home, work and healthcare professionals. **Chapter 6** investigated the association between occupational class and time to RTW. Occupational class was categorised, according to the ISCO-08, to create four groups: high-skilled white-collar, low-skilled white-collar, high-skilled blue-collar and low-skilled blue-collar.

Factors associated with fulfilment of patient expectations towards paid employment were examined in **Chapter 7**. The influence of sociodemographic-, health-related, and work-related characteristics on fulfilment were investigated.

Finally, **Chapter 8** presents the general discussion, elaborating on the main findings of this thesis, addressing methodological considerations, and presenting future perspectives and recommendations for research among working-age THA and TKA patients.

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Return to work after total hip or knee arthroplasty:

Opportunities to improve the cooperation between orthopaedic surgeon and occupational physician.

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2

Abstract:

Purpose

To explore orthopaedic surgeons' and occupational physicians' barriers and facilitators for guiding the RTW process of working-age patients with a total hip or knee arthroplasty (THA/TKA).

Methods

An online expert meeting was conducted according to a semi-structured guide and lasted two hours. The experts (orthopaedic surgeons and occupational physicians) were invited through the relevant professional associations.

Results

In total, 3 orthopaedic surgeons and 3 occupational physicians participated. The findings revealed that both orthopaedic surgeons and occupational physicians experience the following barriers in RTW guidance: 1. inadequate expectation management; 2. a mismatch between the occupation to be performed and the physical limitations remaining after THA or TKA; 3. consulting an occupational physician only in later phase; and 4. differences in vision between physician and patient regarding the possibilities in functioning. Based on these findings the orthopaedic surgeons and the occupational physicians concluded that to optimize the RTW process several changes are needed, namely: more intensive and structural cooperation between both healthcare professionals, preoperative contact between patient and occupational physician, advice from the orthopaedic surgeon regarding RTW, and adequate expectation management.

Conclusion

More intensive and structural contact between orthopaedic surgeon and occupational physician in a well-connected care chain is the challenge for the future to improve counselling throughout the RTW process of patients with a THA or TKA.

Introduction

Due to an ageing population, the rising retirement age and the increasing number of overweight individuals, the percentage of working-age people with hip or knee osteoarthritis has grown in recent years (1). Accordingly, the number of working-age people undergoing a total hip arthroplasty (THA) or total knee arthroplasty (TKA) has also increased significantly and is expected to stay on the rise (2). Because of these developments, in addition to other outcome measures, outcomes regarding RTW and functioning at work are relevant for both patients and society. In general the surgeries are technically successful, yet 7-34% of patients with a THA and 2-29% of patients with a TKA do not RTW (3,4). It is therefore important to optimise the RTW process, with a focus on returning to work but also providing support to maintain sustainable employability. Here both the orthopaedic surgeon and the occupational physician should play an important role, making optimal use of the expertise of both. Currently, care in this process is fragmented and hardly any consultation between healthcare providers takes place. In addition, to date neither orthopaedic nor occupational physicians' associations have comprehensive guidelines on guidance or advice regarding RTW after THA or TKA. Therefore, the aim of this study was to explore orthopaedic surgeons' and occupational physicians' barriers and facilitators for guiding the RTW process of working-age patients with a THA or TKA.

Methods

Study design

An online expert meeting was conducted. Participants gave their written informed consent prior to the start of the focus groups.

Participants and procedure

The experts (orthopaedic surgeons and occupational physicians) were invited through the relevant professional associations (NOV, Dutch Orthopaedic Association/NVAB, Dutch Association for Occupational Medicine). The meeting was led by an experienced moderator, who had no prior relationship with any of the participants nor was involved in THA/TKA treatment or research. In addition, two researchers were present but did not actively participate in the discussion (TK, CR). The meeting started with a short introduction to explain the context of the study. The expert meeting was conducted according to a semi-structured guide (see Box 1) and lasted two hours. The meeting was transcribed verbatim

afterwards (TK) and checked for accuracy (CR). A transcript summary was sent to the participants to check if there were any comments and/or additions.

Box 1. Semi-structured questions during the expert meeting

Please write down at least two barriers for you as a healthcare professional in guiding the return-to-work process.

- You could think of:
  - oFactors that make it difficult for you as a healthcare professional to promote/ influence return to work
  - o Reasons for you as a healthcare professional not to promote/influence return to work
  - o Reasons why there is no focus on promoting/influencing return to work from the healthcare professional's perspective

As a healthcare professional, what do you need in order to better advise patients with hip and/or knee arthroplasties about work (orthopaedic surgeons) or better guide them to return to work (occupational physicians)?

- o Are there any differences in this among patients with hip or knee arthroplasties?

Are there any other issues that you as a healthcare professional need in terms of promoting work resumption in patients with hip and/or knee arthroplasties?

Results

In total, 3 orthopaedic surgeons and 3 occupational physicians participated in the expert meeting. All of them had at least 10 years of working experience as medical specialist. During the meeting, a word cloud of barriers for RTW guidance of THA and TKA patients was formed (see Figure 1). The larger the font, the more often the factor was mentioned by the experts.

Figure 1: Word cloud of barriers for the healthcare professional (both orthopaedic surgeon and occupational physician) in guiding the return-to-work process after total hip or knee arthroplasty.

Hampering factors from the perspective of orthopaedic surgeons and occupational physicians

Inadequate expectation management from orthopaedic surgeon to patient can be a barrier for occupational physicians. Patients may have the idea that a THA or TKA is a new beginning and do not realise that physical limitations may persist even after surgery. Some patients want to return to 'normal' functioning and work quickly after surgery, which may be driven by financial motives, for example among the self-employed. For both orthopaedic surgeons and occupational physicians, slowing down those patients is difficult.

On the other hand, some patients wait for the check-up appointment with the orthopaedic surgeon and/or the X-ray before taking up daily activities. There is a perception that little or nothing should be done until the check-up, despite the orthopaedic surgeon's advice on responsible loading in the weeks after surgery and further. This may be due to insufficient or unclear communication, which can hinder the RTW process. Orthopaedic surgeons experience this as an impeding factor.

A mismatch between the occupation to be performed and the physical limitations remaining after a THA or TKA can also hinder the RTW process. This can include someone with a THA or TKA who can no longer (deeply or fully) perform flexion. This is especially an impeding factor if the patient expects that

returning to the original work with the same tasks is possible. Here expectation management by the healthcare professional (both orthopaedic surgeon and occupational physician) plays an important role too.

If a patient only comes to the occupational physician in a later phase, multiple advice has already been given by others, often well-meaning but sometimes with the wrong result. For example, specific advice is given about certain activities and/or loads that should and, more importantly, should not be done. The occupational physician has the difficult task of figuring out which advice to follow and possibly straightening out what has been said before.

Another impeding factor is differences in vision between physician and patient regarding the possibilities in functioning, as when a patient continues to experience complaints or restrictions while the orthopaedic surgeon indicates that technically all is well and medically speaking there are no physical restrictions anymore. These are often the patients the occupational physician would want to discuss with the orthopaedic surgeon. If the occupational physician inquires with the orthopaedic surgeon, usually in writing, the orthopaedic surgeon may feel as if the patient is seeking him/her as an ally. In such cases, the patient requests the orthopaedic surgeon to indicate that there are still restrictions in functioning as an explanation for not being able to work yet. Both orthopaedic surgeons and occupational physicians experience this as a hampering factor.

What do both healthcare professionals need in order to provide optimal support?

The healthcare professionals discussed what they need in guiding the RTW process of a patient with a THA or TKA, see box 2 for an overview of the findings.

From the orthopaedic surgeon's viewpoint, structural preoperative contact between occupational physician and patient would be desirable to provide advice and possibly delay a prosthesis through work adjustments. This helps with the patient's expectation management towards work, which should also be sufficiently addressed during the orthopaedic surgeon's consultation. A referral to an occupational physician could structurally establish this preoperative contact. Cooperation between orthopaedic surgeon and occupational physician could help align advice to the patient: the occupational physician could support the orthopaedic surgeon's message that a patient with osteoarthritis can and may work, possibly helped by, for example, painkillers until surgery. This also puts the patient 'in the picture' before surgery, avoiding any delays by waiting for a consultation with the occupational physician.

If there are problems in the RTW process or if there is uncertainty about restrictions or the rehabilitation, the orthopaedic surgeon needs a specific question

from the occupational physician. Furthermore, work, RTW and work functioning as outcome measures for quality of care provided and treatment success will have to be included as standard for working people with a THA or TKA. Orthopaedic surgeons currently focus on pain, wound healing, function and the position of the prosthesis as success factors of the THA or TKA.

From the occupational physician's viewpoint, there is a need for shorter lines and mutual coordination with the orthopaedic surgeon. This will make it easier to contact the surgeon in time in case of abnormal developments in the RTW process and to avoid delays. Approachable and simple telephone consultation between orthopaedic surgeon and occupational physician after patient consent could be a suitable way. To date, however, this is laborious due to factors like the need for authorisation and limited accessibility of orthopaedic surgeons. Telephone consultation with other practitioners such as physiotherapists would also add value and is easier to arrange in practice. It is also suggested that every patient receives a standard letter from the orthopaedic surgeon after the last check-up, indicating whether everything went according to plan and whether any peculiarities need to be considered. There is likewise a need for additional knowledge in order to provide more tailored care. Knowledge about patient characteristics that influence RTW would be valuable for occupational physicians, to identify patients at risk for a hampered RTW process. Attention to patient expectations is also very important. Patient expectations should be a structural topic during the consultation, which preferably already takes place preoperatively.

Box 2. What do both healthcare professionals need in order to provide optimal return to work support?

- Expectation management about possibilities and limitations of patients with a THA or TKA by both orthopaedic surgeon and occupational physician is very important.
- Ensure timely preoperative consultation with both orthopaedic surgeon and occupational physician with attention to postoperative functioning in daily life and work.
- Work should become a standard topic in the orthopaedic surgeon's consultation room.
- Mutual coordination between orthopaedic surgeon and occupational physician is of added value and should be facilitated.

Discussion and conclusion

In practice, there is hardly any contact between Dutch orthopaedic surgeons and occupational physicians throughout the guidance of the RTW process of patients undergoing a THA or TKA. If there is contact, it is almost always initiated by the occupational physician, but this happens sporadically. This study found several barriers and facilitators that orthopaedic surgeons and occupational physicians experience in guiding the RTW process of working-age THA or TKA patients.

Our findings are consistent with previous research on influencing factors on the RTW process from the patient perspective (5,6), and fit with the care pathway for TKA patients being investigated (7). Preoperative contact with the occupational physician, positive advice from the orthopaedic surgeon regarding RTW, and adequate expectation management are also important in the RTW process from the patient's perspective (5,6).

More intensive and structural contact between orthopaedic surgeon and occupational physician in a well-connected care chain is the challenge for the future to improve counselling throughout the RTW process of patients with a THA or TKA. This cooperation will help create realistic expectations among patients, avoid delays in counselling, and ensure that both specialists are on the same page. The development of a guideline aimed at integral guidance for RTW of patients with a THA or TKA might be a valuable tool. This has only been a field consultation with a limited group of healthcare professionals, but does provide some starting points for additional research that is desirable and needed.

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Return to work policies and practices after total hip or knee arthroplasty in Denmark, Germany, and the Netherlands: an exploratory study among orthopaedic surgeons

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3

Abstract

Purpose

To explore return-to-work (RTW) policies and practices for total hip arthroplasty (THA) and total knee arthroplasty (TKA) patients in three European countries.

Materials and methods

An exploratory study in Denmark, Germany, and the Netherlands consisting of three aspects: (1) description of the healthcare and social security systems; (2) identification of national RTW guidelines; (3) a survey to gain insight into RTW practices and perceptions of orthopaedic surgeons, including barriers, facilitators, and needs.

Results

Healthcare and social security systems differed (e.g., fast-track vs longer postoperative stay; coverage of rehabilitation costs). National guidelines were available in Germany (THA, TKA) and the Netherlands (TKA), containing limited RTW information. The survey was completed by 168 orthopaedic surgeons (Denmark n=51; Germany n=39; the Netherlands n=78). Overall, orthopaedic surgeons reported being in need of more knowledge and better collaboration with other healthcare practitioners.

Conclusion

We found considerable variation in healthcare and social security systems. When available, national guidelines contained limited information. In all three countries surgeons need more knowledge and better collaboration with other healthcare practitioners. We advise that RTW multidisciplinary recommendations post THA/TKA be established by the national associations of the healthcare practitioners involved.

Introduction

In end-stage hip or knee osteoarthritis (OA), total hip arthroplasty (THA) and total knee arthroplasty (TKA) are effective in reducing pain and improving function (1). Recent decades have witnessed an increase in working-age patients who require a THA or TKA, and this trend is expected to increase further because of several developments (2–4). From a societal perspective, we are confronted with an ageing society. Since ageing is recognised as a major OA risk factor, the prevalence of OA is on the rise (2). Furthermore, due to the obesity epidemic and a physically inactive lifestyle, OA symptoms develop at an earlier age, resulting in more younger (working-age) people suffering from OA (2,5,6). Moreover, people in Western Europe are supposed to work longer due to an increasing retirement age (7,8), raising the number of working-age patients even further. Adding to this, from the orthopaedic surgeons' perspective there is more willingness to perform arthroplasties on younger (working-age) patients thanks to improved surgical techniques, longer prosthetic survivorship, and increased surgical experience with arthroplasties (3,9); and from the patients' perspective this surgeons' willingness also induces patients to be more demanding and request arthroplasties at a younger age (10).

Within the context of these developments, return-to-work (RTW) after THA or TKA is an important rehabilitation goal today (2,11–14). Postoperatively, patients may perceive difficulties returning to work and in the ability to perform their work (15,16). This may lead to lower productivity, more sick leave, work disability, and early retirement (17,18). These consequences are highly undesirable for patients and society. To prevent these consequences and guide patients in achieving this important rehabilitation goal, guidelines could be helpful for healthcare professionals.

Countries may organise RTW guidance for the working-age THA or TKA population in different ways, depending on their respective healthcare and social security systems. Consequently, it can be hypothesised that the organisation of healthcare might influence treatment and rehabilitation, and ultimately may influence health outcomes and return to daily activities such as work (19). Social security systems regulate income substitution to prevent poverty due to work disability and early labour market exit (20). However, social security systems are not identical, and here too it can be hypothesised that this will influence differences in work outcomes (21). Previous research among patients with musculoskeletal disorders suggests that cross-country differences in policy (healthcare and social security) may contribute to different RTW outcomes and might mediate employment outcomes more than medical factors (22,23) – for example, results

for THA patients reveal that German patients return to work 2.3 weeks earlier than Dutch patients (24). Scandinavian countries like Denmark are considered frontrunners in healthcare and the development of RTW policies (25,26). An exploratory study can thus be useful in unravelling RTW policies and practices across countries with different healthcare and social security systems, and the results could potentially be used to learn from each other.

In this context, the overall aim of the present study was to give an overview of current RTW policies and practices for THA or TKA patients in three European countries with their own specific healthcare and social security system, i.e., Denmark, Germany, and the Netherlands. The objectives were: (1) to provide an overview of key characteristics of the healthcare and social security systems, (2) to explore the availability and content of national RTW guidelines, and (3) to map the actual RTW practices and perceptions by orthopaedic surgeons, including barriers, facilitators, and needs they experience.

Methods

Study design

An exploratory study conducted in Denmark, Germany, and the Netherlands, consisting of three aspects: (1) description of the healthcare and social security systems based on desk research; (2) identification of national RTW guidelines through expert consultations; and (3) a web-based survey to gain insight into RTW practices and perceptions of orthopaedic surgeons, including barriers, facilitators and needs they experience. The Medical Ethics Review Board of University Medical Center Groningen assessed the used methods and waived further approval requirements (METc no. 2022.250).

Description of the healthcare and social security systems

A description of the key characteristics of the healthcare and social security systems of each country was made based on desk research by the first author (TK). Information was gathered on the following aspects of the healthcare system: type of system, type and source of coverage, private health insurance, outpatient care, inpatient care; and on the following aspects of the social security system: income compensation, coordinating bodies, reintegration plan, authorisation of short-term absence or sickness benefit. The Organization for Economic Cooperation and Development (OECD) Health System Characteristics online database and country health profiles were consulted first (27–30). If further information was needed, additional literature was gathered via an exploratory search on PubMed.

In case of ambiguity, a local expert (SB, GHS, SO) was asked to check the collected information and provide additional information if necessary.

Identification of RTW guidelines

To identify RTW guidelines of each country, one representative of the authors (TK, GHS, SO) with a background in orthopaedics was asked to check the availability of national RTW guidelines for THA or TKA patients. They were specifically instructed to explore not only guidelines from the national orthopaedic associations but also whether multidisciplinary guidelines were available. If available, a summary of the guideline was prepared by the first author (TK).

RTW practices and perceptions

To gain insight into RTW practices and perceptions, a web-based survey focussing on orthopaedic surgeons was developed by the authors based on their clinical (TK, GHS, SO) and methodological expertise (SB, MGJG, MS). Representatives from the three countries (TK, GHS, SO) were asked to help finetune the survey in order to create a survey appropriate for use in all three countries. Full content of the survey can be found in Supplemental File 1 (English version). Surveys were available in the native language of each country. Participants were explicitly asked for their informed consent. The survey consisted of (1) characteristics of the respondents; (2) daily practice of RTW management; and (3) barriers, facilitators, and future needs with regard to the RTW process. There was a minimum of 15 and a maximum of 40 questions, depending on the type of surgery the responders performed and their actual RTW practices. The survey had both closed and open questions, and space was provided to add remarks. The section on daily practice of RTW management consisted of seven items asking participants about who guides the RTW process, the availability of guidelines at their practice setting, the structural discussion of work/RTW, information used for this discussion, collaboration with other healthcare professionals, and recommended time to RTW. The section on barriers, facilitators, and needs consisted of three open-ended questions asking participants about their three most important barriers and three most important facilitators in guiding the RTW process, and their three most important needs to adequately support the RTW process in the future.

Procedure

Data from the survey were collected and managed via Research Electronic Data Capture (REDCap) tools hosted at University Medical Center Groningen (31,32). The survey was pilot-tested by three orthopaedic surgeons on technical aspects, content, and formulation of the questions. From September 2022, a public link to

the survey was distributed to potential participants in various ways. Orthopaedic surgeons were approached as potential participants via the electronic newsletter and social media of their country's respective orthopaedic association [Danish Society for Orthopaedic surgery (DOS), Professional Association for Orthopaedics and Trauma Surgery e.V. (BVOU, Germany), Dutch Society for Orthopaedic surgery (NOV)]. A brief invitation and a hyperlink to the survey were included. Personal contacts of the research group and respondents were asked to distribute the survey to colleagues in order to create a "snowball" sampling method (33). Among the invited participants, orthopaedic surgeons actually treating patients undergoing THA and/or TKA were asked to participate by filling out the online survey. In February 2023, the survey link was deactivated and data collection was ended. Prior to data collection, no formal sample size calculation was performed as a result of the exploratory nature of this study.

Data analyses

For statistical analyses all data from the online survey were exported from REDCap and converted into IBM SPSS statistics (IBM corp. released 2021, v28 Windows) or ATLAS.ti Scientific Software Development GmbH (v22 Windows). First, all records within the database were screened for completeness to assess whether they could be included. All records providing an answer for at least one question in the second (daily practice of RTW management) or third section (barriers, facilitators, future needs) were included. Records with no answers given in those sections (i.e., the participant stopped filling out the survey during or after the first section) were excluded. Danish and German responses to the open-ended questions were translated into English with the help of DeepL translator (34).

Descriptive statistics – mean (SD), n (%) – were used to describe individual responder characteristics and RTW practices. The responses to the open-ended qualitative questions were analysed, separately per country, using conventional content analysis (35). An inductive approach to data analysis was used, in which the themes emerged from the data without using a pre-existing coding frame (35). The responses were repeatedly and systematically read and organised, resulting in codes. After open-coding data of one country, the preliminary codes were used to code the data of the other two countries and new codes were added when data did not fit the existing codes. Next, all data within a code was examined, resulting in some codes being combined and others split. The final codes were subsequently classified into broader subthemes and themes (35). This was done both independently (TK) and collectively, by discussing and reviewing the data with three other authors (SB, MGJG, MS) in several meetings.

Results

First, relevant characteristics of the healthcare systems (type of system, type and source of coverage, treatment after THA or TKA, associated costs) and the social security systems (authorisation of short-term absence from work, income compensation, responsibilities of actors and coordinating bodies in the RTW process) are outlined. In-depth information can be found in supplemental Table 1. Second, the availability and content of national RTW guidelines are reported. Last, RTW practices and perceptions (barriers and facilitators) and needs of orthopaedic surgeons are described.

Key characteristics of the healthcare and social security systems

Healthcare systems

All three countries have tax-funded basic health insurance, albeit with variations in the type of coverage. In Denmark, all citizens are covered by the national healthcare system; German insurance is linked to a specific contribution based on individuals' income or professional group (27–29); Dutch citizens have a free choice of multiple insurance companies (30).

In Denmark and the Netherlands, patients generally undergo fast-track surgery, aiming for early discharge within three days after surgery (36–40), whereas German patients stay in the hospital for about eight days postoperatively (39,40). Unlike Denmark and the Netherlands, where all orthopaedic physicians perform some kind of surgery, in Germany physicians specialised in orthopaedics can, for example, work in a hospital or have their own practice seeing patients before and after their surgery and not necessarily perform surgery themselves.

In Denmark and Germany, the public health care system's basic medical or pension insurance covers the costs for rehabilitation, while in the Netherlands rehabilitation is essentially not covered by basic health insurance (41–43). Danish patients will receive a rehabilitation plan, which can be home-based or guided at municipality rehabilitation centres, depending on the region (42); German patients may choose between inpatient and outpatient rehabilitation at a specialised rehabilitation centre (43,44); and Dutch patients need additional insurance to cover, for example, a chosen amount of postoperative physiotherapy sessions (41).

Social security systems

In Denmark and Germany, the orthopaedic surgeon is authorised to certify short-term absence from work (45,46). In addition, in Denmark a physician working for a public or private insurance company, and in Germany a general practitioner, are

authorised to certify short-term absence from work (i.e., with a prospect to return to the same workplace after recovery (45,46). This is unlike the Netherlands, where this task can only be fulfilled by the occupational physician (47).

Income loss for individuals who report sick leave is prevented in all three countries where the employer is initially responsible for income replacement (25). Therefore, employers are incentivised to implement and guide RTW trajectories of their employees. However, the length of income replacement by the employer differs (25): it is the shortest in Denmark and Germany, where employers pay income during absence due to sickness for a maximum of 30 days and 6 weeks, respectively (25,28,29), whereas in the Netherlands employers pay sickness absence compensation from a minimum of 70% of the salary up to a maximum of 2 years (25,30). In all three countries, after the period of employer-paid income compensation , the social security system provides income to the sick-listed individual for a predefined period (25,28–30).

In all countries, the employer has a responsibility to make a reintegration or RTW plan, but the presence of coordinating bodies differs. Coordinating bodies link the vocational, medical, and social rehabilitation with the actual RTW (25). They ensure that workers have a "one-stop shop" instead of taking multiple steps (25). Both Denmark and Germany have coordinating bodies supporting the RTW process (25): in Denmark the municipality and Germany the statutory accident insurance (DGUV) and statutory pension insurance (DRV) schemes (25). In the Netherlands, no single coordinating body exists to link the medical aspect of the rehabilitation process with the actual RTW process (25), and the role of coordinator can be fulfilled by either the health insurance or the occupational physician (25).

National RTW guidelines

Country representatives indicated that national RTW guidelines were not available in Denmark (for either THA or TKA patients) or in the Netherlands (for THA patients), neither from the orthopaedic association nor a multidisciplinary guideline. Limited information was available in German guidelines (for both THA and TKA patients) and Dutch guidelines for TKA patients (37,48). In Germany, the post-treatment recommendations ("Nachbehandlungsempfehlungen, 2022") from the German Society for Orthopaedics and Trauma (DGOU) advise that patients may return to light working duties 12 weeks after THA or TKA and to medium-to-heavy work 16 weeks postoperatively (48). The Dutch multidisciplinary national guideline "total knee prosthesis" from the Federation of Medical Specialists (dated 31 August 2021) recommends aiming for work resumption within three months postoperatively, possibly in phases and preferably supervised by an occupational

physician (37), stating that returning to work does not seem to cause complications and earlier revision surgeries, and therefore should not be a reason to avoid physical labour (37).

Table 1. Characteristics of survey responders (orthopaedic surgeons)

Characteristics	Denmark (n=51)	Germany (n=39)	The Netherlands (n=78)
Sex, n (%)			
- Male	50 (98%)	31 (80%)	70 (90%)
- Female	1 (2%)	8 (20%)	68 (10%)
Type of arthroplasty performed, n (%)			
- Hip arthroplasties	22 (43%)	0 (0%)	13 (17%)
- Knee arthroplasties	17 (33%)	1 (3%)	19 (24%)
- Both hip and knee arthroplasties	12 (24 %)	13 (33%)	46 (59%)
- No surgery	0 (0%)	25 (64%)	0 (0%)
Experience, n (%)			
- 0-5 years	3 (6%)	1 (3%)	12 (15%)
- 6-10 years	8 (16%)	2 (5%)	19 (24%)
- 11-15 years	6 (12%)	8 (21%)	19 (24%)
- 16-20 years	5 (10%)	8 (21%)	11 (14%)
- > 20 years	29 (57%)	20 (51%)	17 (22%)
Practice stetting, n (%)			
- Non-academic hospital without residents	0 (0%)	0 (0%)	27 (35%)
- Non-academic hospital with residents	10 (20%)	2 (5%)	25 (32%)
- Academic hospital	35 (69%)	4 (10%)	8 (10%)
- Private clinic	5 (10%)	14 (36%)	18 (23%)
- Rehabilitation clinic	0 (0%)	19 (49%)	0 (0%)

Return to work practices and perceptions of orthopaedic surgeons

Sample description

In total, 168 orthopaedic surgeons completed the survey (Table 1). Most of the respondents were male (>80%). For the most part, Danish respondents worked at an academic public hospital, German respondents at a rehabilitation clinic, and Dutch respondents at a non-academic hospital (see Table 1).

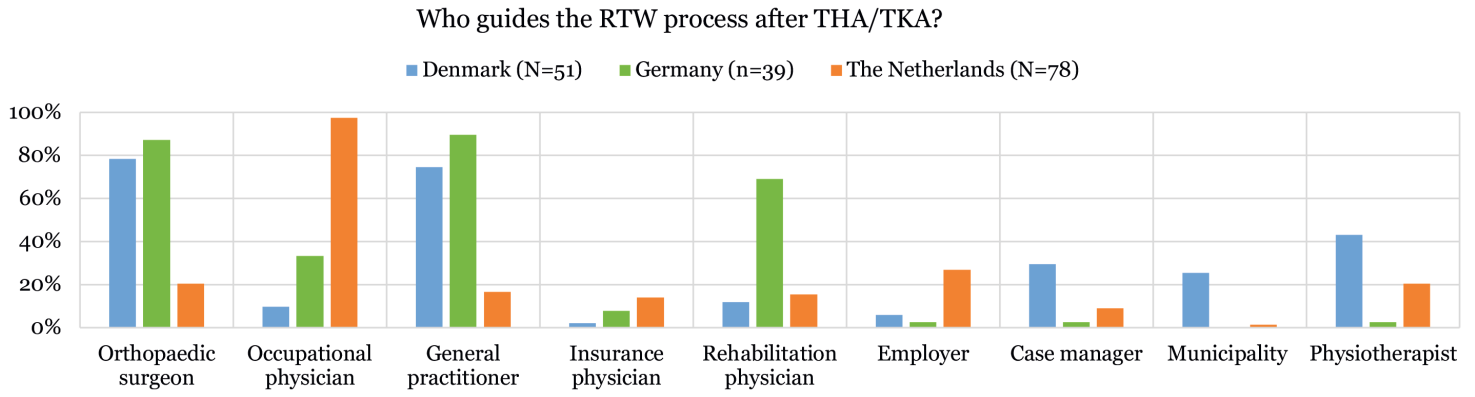

Figure 1. Actors in guiding the RTW process after THA or TKA

RTW practices

In Denmark, the majority answered that the orthopaedic surgeon and the general practitioner guide the RTW process. Additionally, the physiotherapist, case manager, and municipality play a role. In Germany the orthopaedic surgeon, the general practitioner, and the rehabilitation physician guide the RTW process. In the Netherlands, the majority replied that the occupational physician guides the RTW process and a minority indicated that the employer plays a role (Figure 1).

Table 2. Daily practice of return to work management of orthopaedic surgeons

Aspects	Denmark (n=51)	Germany (n=39)	The Netherlands (n=78)
Availability of local RTW guidelines, n (%)			
- Yes	6 (12%)	10 (26%)	0 (0%)
- No	37 (73%)	19 (49%)	57 (73%)
- Not that I am aware of	5 (10%)	7 (18%)	20 (26%)
Is work/RTW structurally discussed (yes), n (%)	47 (92%)	32 (82%)	60 (77%)
Timing of discussion on work/RTW			
- Preoperatively	17 (33%)	3 (8%)	16 (21%)
- Postoperatively	0 (0%)	14 (36%)	5 (6%)
- Both pre- and postoperatively	30 (59%)	15 (39%)	39 (50%)
Advice regarding RTW is based on, n (%)			
- Guidelines	2 (4%)	1 (3%)	11 (14%)
- Experience	43 (84%)	26 (67%)	42 (54%)
- Other	2 (4%)	5 (13%)	7 (9%)
Collaboration with another healthcare professional regarding work/RTW? (yes) n (%)*	5 (10%)	9 (23%)	23 (30%)
If affirmative, collaboration with … regarding work/RTW?, (yes) n (%)*			
- Occupational physician	1 (20%)	4 (44%)	22 (96%)
- General practitioner	3 (60%)	7 (78%)	10 (43%)
- Insurance physician	1 (20%)	3 (33%)	4 (17%)
- Rehabilitation physician	0 (0%)	5 (56%)	14 (61%)
- Physical therapist	5 (100%)	6 (67%)	17 (74%)
- Employer	1 (20%)	4 (44%)	4 (17%)

**Collaboration also includes referring to and asking for advice from another physician or healthcare professional.*

The majority in all three countries answered that local RTW guidelines are absent. However, in Denmark (12%) and Germany (26%) surgeons do have a RTW guideline at their practice setting, compared to none in the Netherlands. Most orthopaedic surgeons in all three countries structurally discuss work/RTW, both pre- and postoperatively, based on their clinical expertise (Table 2). The few orthopaedic surgeons not discussing RTW with their patients stated that it was not part of their duties and/or expertise and thus should be done by another (specialised) physician. Several Dutch respondents also answered that they only discussed RTW if patients explicitly asked about it.

In all three countries, a minority of orthopaedic surgeons refer to, collaborate with, or ask advice from other physicians or professionals regarding work/RTW (DK, 10%; DE, 23%; NL, 30%). If they collaborate, at the minimum collaboration with physical therapists takes place in all three countries. In addition, orthopaedic surgeons in Denmark collaborate with general practitioners, in Germany with general practitioners and rehabilitation physicians, and in the Netherlands mostly with occupational physicians (Table 2).

Although recommended time to RTW differed between the three countries, it was shortest in all countries for THA patients doing white-collar work (i.e., office work) and longest for TKA patients doing blue-collar work (i.e., manual work); it was longest in Germany and shortest in the Netherlands (Figure 2).

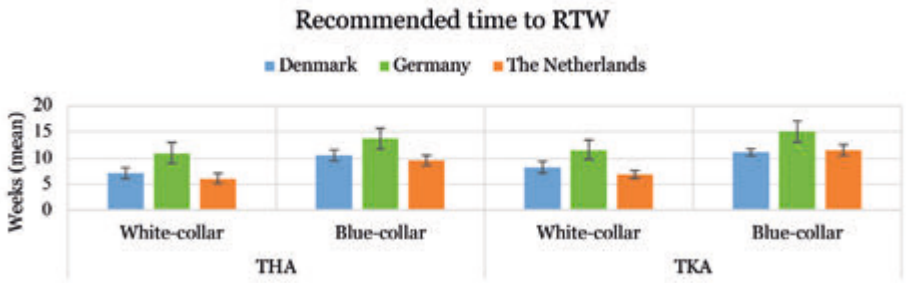

Figure 2. Recommended time to RTW of white-collar and blue-collar THA or TKA patients per country by orthopaedic surgeons.
The error bars resemble the 95% confidence interval.

RTW perceptions

For each factor, the proportion of participants mentioning a factor as "barrier" and as "facilitator" are presented in Table 3. Needs to adequately support the RTW process are presented next (Table 4).

Table 3. Barriers and facilitators for orthopaedic surgeons in guiding the return to work process after THA or TKA

		Denmark		Germany		The Netherlands	
Theme	**Subtheme/factor**	**Facilitators (+) (n=20)**	**Barriers (-) (n=26)**	**Facilitators (+) (n=20)**	**Barriers (-) (n=26)**	**Facilitators (+) (n=53)**	**Barriers (-) (n=62)**
Patient	Physical functioning	40%	31%	28%	85%	49%	48%
	Psychosocial factors	30%	15%	40%	33%	43%	19%
Individual professional	Accessible postoperative check-up	5%	8%	8%	11%	4%	8%
	Knowledge	50%	54%	8%	22%	51%	55%
	Adequate information provision / educational materials	15%	8%	0%	4%	9%	0%
	Collaboration with healthcare practitioner	5%	0%	20%	4%	25%	13%
	Collaboration with employer	0%	0%	4%	0%	2%	3%
	Collaboration with public sector or social services	10%	0%	8%	4%	0%	0%
	Referral option	5%	4%	0%	0%	0%	0%
Organisational context	Time/reward	0%	19%	4%	0%	8%	19%
	Not part of tasks	0%	0%	4%	0%	2%	23%
Work	Type of work/working conditions	5%	8%	32%	52%	9%	15%
	Work accommodations	15%	8%	44%	22%	11%	5%
	Type of contract	0%	0%	0%	0%	8%	0%
	Support from employer	0%	20%	0%	30%	4%	16%
System	Social security (rules /organisation)	0%	12%	0%	7%	0%	0%

Physical functioning included "functioning", "comorbidities", "pain", "rehabilitation"; psychosocial factors included "expectations and satisfaction", "motivation", "anxiety"; Type of contract included "self-employed or salaried employment", "job security", "income"; Support from the employer included "acceptance of decrease in performance", "facilitating role".

Barriers and facilitators in guiding RTW

In all three countries, limited physical functioning of the patient was among the top three barriers (range 31-85%). Limited knowledge of the orthopaedic surgeon was one of the top-3 barriers in Denmark and the Netherlands. In Denmark, the top-3 barriers were limited knowledge of the orthopaedic surgeon (54%), limited physical functioning of the patient (31%), and lack of support from the employer (20%). In Germany, the top-3 barriers were limited physical functioning of the patient (85%), mainly physical or repetitious work (52%), and adverse psychosocial factors related to the patient (33%). In the Netherlands, the top-3 barriers were limited knowledge of the orthopaedic surgeon (55%), limited physical functioning of the patient (48%), and orthopaedic surgeons not perceiving RTW guidance as a part of their tasks (23%). Regarding responsibilities, Dutch orthopaedic surgeons mainly mentioned that RTW guidance is a duty of the occupational physician.

Among the top-3 facilitators in all three countries were psychosocial factors related to the patient (i.e., expectations, satisfaction, motivation, absence of anxiety). The same top-3 were found in Denmark and the Netherlands: more knowledge of the orthopaedic surgeon (DK, 50%; NL, 51%), better physical functioning of the patient (DK, 40%; NL, 49%), and psychosocial factors related to the patient (DK, 30%; NL, 43%). In Germany, the top-3 facilitators were work accommodations (44%), psychosocial factors related to the patient (40%), and no physical or repetitious work (32%).

Dissimilarities in barriers and facilitators existed in terms of lack of time and collaboration with healthcare practitioners. Lack of time was identified as a barrier to guide work resumption by 19% of Danish and Dutch respondents, compared to 0% of German respondents. Collaboration with healthcare practitioners was a facilitator for 20% of German and 25% of Dutch respondents, compared to 5% of Danish respondents. Other than that, no major differences were found.

Table 4. Needs of orthopaedic surgeons to adequately support the return to work process after THA or TKA

Theme	Subtheme	Denmark (n=17)	Germany (n=23)	The Netherlands (n=57)
Patient	Physical functioning	6%	9%	11%
	Psychosocial factors	12%	9%	5%
Individual professional	Accessible Postoperative check-up	18%	17%	0%
	Knowledge	76%	65%	75%
	Adequate information provision/educational materials	6%	0%	7%
	Collaboration with healthcare practitioner	12%	35%	49%
	Collaboration with employer	0%	35%	4%
	Collaboration with public sector or social services	6%	13%	2%
	Referral option	18%	0%	2%
Organisational context	Time/reward	6%	4%	19%
	Not part of tasks	0%	0%	11%
Work	Work accommodations	6%	26%	5%
	Support from employer	0%	17%	2%

Physical functioning included "functioning", "comorbidities", "pain", "rehabilitation"; psychosocial factors included "expectations and satisfaction", "motivation", "anxiety"; Knowledge included "scientific evidence", "guidelines", "expertise with work/RTW"; Support from the employer included "acceptance of decrease in performance", "facilitating role".

Future needs to adequately support the RTW process

Among the top-3 needs in all countries was a need for more knowledge, which included "scientific evidence", "guidelines", and "expertise with work/RTW". In Germany and the Netherlands, professionals also reported a need for better or increased collaboration with healthcare practitioners. In Germany, respondents mentioned a variety of healthcare practitioners with whom better or increased collaboration is needed (i.e., general practitioner, rehabilitation physician, physiotherapist, company doctor). In the Netherlands, respondents specifically stressed the need for collaboration with an occupational physician.

In Denmark the top-3 needs were more knowledge (76%), more postoperative follow-ups of patients (18%), and referral options (18%). In Germany the top-3 needs were more knowledge (65%), better or increased collaboration with healthcare practitioners (35%), and increased collaboration with employers (35%). In the Netherlands the top-3 needs were more knowledge (75%), better or increased collaboration with healthcare practitioners (49%), and additional time or reward (19%). Dissimilarities in needs existed at the work level, since mainly German respondents mentioned that work accommodations (26%) and support from the employer (17%) are needed, compared to a small proportion of orthopaedic surgeons (<6%) in Denmark and the Netherlands.

Discussion

To our knowledge, this is the first study to explore RTW policies and practices after THA or TKA in three European countries: Denmark, Germany, and the Netherlands. The results show that treatment and rehabilitation differ between the three countries. However, overall it can be concluded that orthopaedic surgeons are in need of more knowledge, including "guidelines", "scientific evidence", and "expertise with work/RTW". Additionally, there is a need for better collaboration with other healthcare practitioners.

As a result of different structures in the healthcare and social security systems of the three countries, the RTW policies and practices can be characterised differently. In Denmark this is a multidisciplinary approach (orthopaedic surgeon, general practitioner, case manager), organised mainly locally (role of the municipality), and work-oriented. In Germany this is a medical orientation with a leading role for physicians specialised in orthopaedics, rehabilitation physicians, and general practitioners. In the Netherlands RTW guidance is characterised by the central role of the occupational physician guiding the patient back to work.

Treatment and rehabilitation differences may be the result of differences in rehabilitation cost coverage by healthcare systems or insurance. In Denmark and

Germany, rehabilitation is covered by the public health care system or basic health or pension insurance, and is standardised. This is in contrast with the Netherlands, where rehabilitation is essentially not covered by basic health insurance, hence standardised rehabilitation is absent (41). Nevertheless, most Dutch citizens have an additional insurance package that includes a number of physiotherapy sessions (49). Consequently, variations in rehabilitation practices may have the potential to induce differences in the recovery process and eventually may cause differences in RTW practices (50,51). For example, work participation has been established as one of the quality indicators for rehabilitation, according to a panel of clinicians, researchers, and patients (52). Accordingly, countries with standardised (high-quality) rehabilitation may focus more on work participation as a treatment goal compared to countries without standardised rehabilitation.

Regarding the social security system, orthopaedic surgeons in Denmark and Germany have a gatekeeping role, as they authorise sickness absence. Previous studies show that a majority of orthopaedic surgeons experience problems authorising sickness absence, such as assessing work ability (53). Ultimately, this has the potential to induce different RTW practices (54). Compare this with the Netherlands, where instead of orthopaedic surgeons it is occupational physicians who focus on keeping individuals well at work and assess aspects such as work ability (55).

According to our study, none-to-limited national or local RTW guidelines were available. Within the limited national German and Dutch guidelines, recommendations on time to RTW varied between 12-16 weeks and only distinguished between light and medium-to-heavy work duties. The recommendations did not distinguish between types of arthroplasty or consider specific work-related activities such as kneeling or lifting. In contrast to a recent study showing that 18/43 Dutch hospitals provided local recommendations on work, no local RTW guidelines were available according to the Dutch respondents (56). We could not compare our findings about Danish or German national or local RTW guidelines to other studies due to lack of research investigating those guidelines.

Despite the lack of guidelines, our study shows that most of the orthopaedic surgeons in all three countries discuss work/RTW with patients, which due to lack of guidelines is based on their expert opinion. The differences in work-oriented or medical-oriented RTW guidance might influence aspects like recommended time to RTW.

Regardless of the aforementioned differences, all orthopaedic surgeons encountered roughly the same barriers with regard to RTW guidance and are in need of similar changes to improve it. These barriers were lack of knowledge of

the orthopaedic surgeon, patient-related factors (limited physical functioning or adverse psychosocial factors), and work-related factors (physical or repetitious work and absent support from the employer) which hamper RTW. Our findings are consistent with previous research on factors influencing the RTW process after THA and TKA, from both the patient's and the employer's perspective (57–59).

To overcome these barriers and to adequately support RTW, orthopaedic surgeons are mainly in need of modifications in knowledge and collaboration with healthcare practitioners. The reported need for knowledge, such as an evidence-based guideline, is in line with a recent study showing that large variations existed between local recommendations of Dutch hospitals on return to daily life activities (56). Besides the need for knowledge, a substantial proportion of German and Dutch respondents are in need of better collaboration with other healthcare practitioners involved in RTW guidance, as currently only a minority engages in such collaboration. This need aligns with new conceptual models of healthcare, which encourage healthcare practitioners to work more closely together (both interprofessionally and cross-sector) to improve coordination of patient care in order to achieve better health and work outcomes (60,61). Strong evidence shows that healthcare practitioners play a key role in the RTW process, and poor communication between healthcare practitioners may even affect the RTW process negatively (59,62).

Strengths and limitations

To our knowledge, this is the first cross-country study exploring RTW policies and practices of THA and TKA patients, thereby bridging the gap in the extant literature. Although we have made efforts to include a diverse range of orthopaedic surgeons from three countries, it is important to acknowledge that the snowball sampling could have led to a potential limited representativeness. Also, as we used a public survey link we could not obtain information on response rates or non-responders. Still, in our opinion the study provides a first valuable insight into RTW policies and practices in different countries. The distribution of practice settings is not completely representative for each country and may affect the transferability of our findings (63–67): mostly academic hospitals for Danish respondents, rehabilitation clinics for German respondents, and non-academic hospitals for Dutch respondents. Nevertheless, a recent international comparative study shows there is no standard definition of an academic hospital, revealing considerable differences in academic settings between countries (64). Focussing on case-mix and complexity of treated patients (e.g., those with multimorbidity, polypharmacy, or anatomical deviations) instead of type of work practice might be better to assess transferability. Unfortunately, we did not collect that type of data.

Also, our methods did not allow us to explore barriers and facilitators in depth. Future qualitative studies may help further exploration, for which our study could serve as starting point.

Conclusion

We found considerable variation in healthcare and social security systems. In Denmark and Germany rehabilitation is covered and standardised, in contrast to the Netherlands. In terms of the social security system, orthopaedic surgeons in Denmark and Germany have a gatekeeping role, as opposed to the Netherlands, where occupational physicians fulfil this task. These differences have the potential to induce different RTW practices. Additionally, national guidelines were available in Germany (THA and TKA) and the Netherlands (TKA) but contained only limited information. Regarding actual practices, RTW guidance in Denmark can be characterised by a multidisciplinary approach, in Germany by medical orientation, and in the Netherlands by the central role of the occupational physician. Overall, orthopaedic surgeons are in need for modifications in knowledge.

In perspective, there seems to be a need for multidisciplinary RTW recommendations after THA/TKA which should be made by the national associations of the involved healthcare practitioners. Last, this will also help to fulfil the need for better collaboration with other healthcare practitioners.

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Supplement 1.

Survey

Part 1. General questions: First, some general questions about your background.		
1.1	In which country do you work as an orthopaedic surgeon:	□ Denmark □ Germany □ The Netherlands
1.2	What is your gender?	□ Male □ Female □ Other □ Prefer not to disclose
1.3	What type of arthroplasty do you perform?	□ Hip arthroplasties □ Knee arthroplasties □ Both hip and knee arthroplasties □ No surgery
1.4	How many years of experience do you have as an orthopaedic surgeon?	□ 0-5 □ 6-10 □ 11-15 □ 16-20 □ >20
1.5	What describes best your current work environment? (If several responses apply, please select your main work environment only)	□ Non-academic hospital WITHOUT residents □ Non-academic hospital WITH residents □ Academic hospital □ Private orthopaedic practice/clinic/ hospital □ Rehabilitation clinic □ Other (please specify): …….
Part 2. Daily practice of return-to-work (RTW) management by the orthopaedic surgeon for hip and knee arthroplasty patients: Focussing on your actual daily practice and role regarding RTW management. Aim is to gain insight into the actual work/RTW advice and guidance provided by orthopaedic surgeons in the different countries.		
Terminology: **Occupational physician:** In the Netherlands there are occupational physicians who diagnose and treat occupational diseases, work-related illnesses, and injuries of employees; justify sick leave; and play an explicit role in the RTW process of sick-listed workers. We are aware that occupational physicians working in this context are a typical Dutch setup. Therefore, in your country someone like a GP or case manager may be performing these tasks.		

2.1	Who guides the RTW process of patients after hip or knee arthroplasty in your country? (multiple options possible)	□ Orthopaedic surgeon/orthopaedic specialist □ Occupational physician □ General practitioner (GP) □ Insurance physician (working for public or private insurer) □ Rehabilitation physician □ Employer □ Municipality □ Physical therapist □ Case manager □ Other (please specify): .....
2.2a	Does your practice setting (main work environment) have specific protocols/guidelines for the RTW management of hip or knee arthroplasty patients?	□ Yes *(go to item 2.2b)* □ No *(go to item 2.3a)* □ Not that I am aware of/don't know
2.2b	Please elaborate on the background of the guideline (e.g. is it a specific orthopaedic guideline or an interdisciplinary guideline?). You may add the guideline here:	
2.3a	Do you structurally discuss, pay attention to and/or give advice about work/RTW when hip or knee arthroplasty patients are still working?	□ Yes *(go to item 2.4a)* □ No *(go to item 2.4b)*
2.4a	If the answer for 2.2a was affirmative: When do you discuss this?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively (*go to item 2.5*)
2.4b	If the answer for 2.2a was negative: Why do you not structurally discuss work/RTW when patients are still working?	..... (*go to item 2.6*)
2.5	Your advice given on RTW is based on (multiple answers possible):	□ Guidelines □ Experience □ Other (please specify):

2.6	Do you refer to, collaborate with, or ask advice from another (specialised) physician or healthcare professional regarding work/RTW when a hip or knee arthroplasty patient is still working?	□ No *(go to item 2.14)* □ Yes
2.7a	Do you refer to, collaborate with, or ask advice from an occupational physician?	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.8a)* □ Not applicable *(go to item 2.8a)*
2.7b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively
2.7c	This is based on…	□ Protocol/ guidelines □ Ad hoc
2.8a	Do you refer to, collaborate with, or ask advice from an occupational physician	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.9a)* □ Not applicable *(go to item 2.9a)*
2.8b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively
2.8c	This is based on…	□ Protocol/ guidelines □ Ad hoc
2.9a	Do you refer to, collaborate with, or ask advice from an insurance physician (working for a public or private insurer)?	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.10a)* □ Not applicable *(go to item 2.10a)*
2.9b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively
2.9c	This is based on…	□ Protocol/ guidelines □ Ad hoc
2.10a	Do you refer to, collaborate with, or ask advice from a rehabilitation physician?	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.11a)* □ Not applicable *(go to item 2.11a)*
2.10b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively

2.10c	This is based on…	□ Protocol/ guidelines □ Ad hoc
2.11a	Do you refer to, collaborate with, or ask advice from a physical therapist?	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.12a)* □ Not applicable *(go to item 2.12a)*
2.11b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively
2.11c	This is based on…	□ Protocol/ guidelines □ Ad hoc
2.12a	Do you refer to, collaborate with, or ask advice from an employer?	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.13a)* □ Not applicable *(go to item 2.13a)*
2.12b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively
2.12c	This is based on…	□ Protocol/ guidelines □ Ad hoc
2.13a	Do you refer to, collaborate with, or ask advice from others (please specify)……..?	□ Yes, always □ Yes, sometimes □ No, never *(go to item 2.14a)* □ Not applicable *(go to item 2.14a)*
2.13b	When do you refer/collaborate/ ask for advice?	□ Preoperatively □ Postoperatively □ Both preoperatively and postoperatively
2.13c	This is based on…	□ Protocol/ guidelines □ Ad hoc

Terminology:
Work-related factors may influence RTW time after hip or knee arthroplasty. The following two concepts provide background information for questions 2.13 and 2.14:
Blue-collar worker: person who performs manual work, e.g. agriculture, construction, mining.
White-collar worker: person who works in an office or other administrative setting, performing e.g. desk, managerial, or administrative work.

2.14a	What is your general advice concerning RTW time (part-time or full-time) after **hip** arthroplasty?	For blue-collar workers: … weeks

2.14b	What is your general advice concerning RTW time (part-time or full-time) after **hip** arthroplasty?	For white-collar workers: … weeks
2.15a	What is your general advice concerning RTW time (part-time or full-time) after **knee** arthroplasty?	For blue-collar workers: … weeks
2.15b	What is your general advice concerning RTW time (part-time or full-time) after **knee** arthroplasty?	For white-collar workers: … weeks

Part 3. Barriers and facilitators with regard to RTW policy and practices: The following questions focus on perceived hampering and facilitating factors for you as an orthopaedic surgeon with regard to RTW guidance of hip and knee arthroplasty patients. For barriers, you could think about hampering factors you encounter or bottlenecks in advising or supporting RTW. We also want to know about your needs and thoughts in relation to possible improvements of RTW policy and practices.

3.1	What are currently the three most important barriers for you as an orthopaedic surgeon in guiding the RTW process for hip or knee arthroplasty patients? (open question)	i ii iii.	…… …… ……
3.2	What are currently the three most important facilitating factors for you as an orthopaedic surgeon in guiding the RTW process for hip or knee arthroplasty patients? (open question)	i. ii. iii.	…… …… ……
3.3	What would you need as an orthopaedic surgeon, and from whom, to be able to adequately support the RTW process and give advice regarding work after hip or knee arthroplasty? Name the three most important things. (open question)	i. ii. iii.	…… …… ……

Supplement 2.

Overview of relevant healthcare and social security system characteristics

Healthcare system			
Aspects	**Denmark**	**Germany**	**The Netherlands**
Healthcare system (28–30)	- Regulated by government - Tax-funded	- Majority insured under statutory health insurance - Decentralised - Tax-funded	- Regulated by government - Tax-funded
Primary healthcare coverage (27)	Automatic (i.e., based on residence)	Compulsory: It is linked to payment of a specific contribution or premium (by individuals or households). Compulsory insurance includes public funds (used by 88% of the population) and private health insurance (used by 12% of the population). Citizens can withdraw from public statutory insurance and enrol in private health insurance if their income is above a fixed threshold or if they belong to specific professional groups (e.g., civil servants or self-employed).	Compulsory: It is linked to payment of a specific contribution or premium (by individuals or households). The compulsory basic insurance policy covers a benefits package predefined by the government.
Main source of basic healthcare coverage (27)	A national health system exists, covering the country as a whole.	Multiple insurance funds or companies exist, with free choice of insurer.	Multiple insurance funds or companies exist, with free choice of insurer.
Premiums are modulated according to (27)	Not relevant	Social health insurance contributions, which are dependent on income and not risk.	Benefit design. Premium differentiation and risk selection are forbidden.

Healthcare system			
Aspects	**Denmark**	**Germany**	**The Netherlands**
Is private health insurance a secondary source of coverage for some of the population? (27)	Yes	Yes	Yes
Do primary care physicians control access to specialist care? (27)	Patients have financial incentives to obtain a primary care physicians' referral (e.g., reduced co-payments), but direct access is always possible.	There is no need or incentive to obtain primary care physician referral.	Primary care physician referral is mandatory to access most types of specialist care (except in case of emergency).
Outpatient specialist care is predominantly provided in (27)	1. Outpatient clinics of public hospitals, paid via global budget (and thus publicly employed) 2. Private solo practices, paid via fee-for-service	1. Privately owned solo practices, paid via fee-for-service 2. Privately owned group practices, paid via fee-for-service	1. Private group practices 2. Outpatient departments of private hospitals Both paid via payment scheme with "DTCs", diagnosis-treatment combinations. 70% of DTC products concern free tariffs, where insurers and providers negotiate on the price and quality of these DTC products. For the remainder, the NZA (Dutch Healthcare Authority) sets the price.

Are patients usually free to choose hospitals for inpatient care? (27)	Patients are free to choose among all public hospitals, but have limited choice among private providers. Access to private hospitals without financial consequences for the patient requires that public hospitals have an agreement with the private provider or the patient obtains the extended free choice of hospital.	Patients are free to choose any hospital but have financial incentives to choose some providers.	Patients are free to choose any hospital but have financial incentives to choose some providers. Insurers are allowed to selectively contract hospitals, meaning that some treatments are not fully covered in all hospitals for patients with insurance plans that do not cover all providers.
Social security system			
Aspects	Denmark	Germany	The Netherlands
Income loss when reporting sick leave (financial incentive) (28–30)	No	No	No
Responsible for income replacement (28–30)	Employers pay income during sickness absence for at least 30 days.	Employers pay sickness absence compensation for 100% of the salary for at least 6 weeks.	Employers pay sickness absence compensation up to a minimum of 70% of the salary during first 2 years of sickness absence.
Compensation after employer period (68)	By social security system for a maximum of 22 weeks in 9 months. Compensation degree is calculated from the hourly wage.	Via health insurer for a maximum of 78 weeks in 3 years. Compensation degree is a minimum of 70% and a maximum of 90% of the initial income.	Not relevant, after the 2-year employment period individuals may be entitled to disability benefit.
Compensation in case of continuing sickness after maximum duration (68)	Work assessment benefit	Unemployment benefit	Disability benefit

Social security system			
Aspects	Denmark	Germany	The Netherlands
Coordinating body for RTW process (28–30)	Municipality coordinates and leads the RTW and rehabilitation process.	Statutory accident insurance (DGUV) and statutory pension insurance (DRV) schemes.	None
Reintegration plan (28–30)	Within 4 weeks of sickness absence the employer is obliged to discuss RTW. A reintegration plan is requested by the municipality before the worker starts vocational rehabilitation. Work capacity assessments are performed after 8 and 22 weeks of sickness absence, aiming to support RTW and determine work capacity. The assessment of work capacity is performed by a GP and a municipality case manager. The GP assesses health-related functional limitations, prognosis, and treatment options. The municipality case manager focuses on social circumstances and evaluates the possible reduction of barriers. Work adjustments to enhance work capacity are implemented by a doctor from the department of social medicine, who is also part of the rehabilitation team. If RTW is not possible after 22 weeks, sickness benefits are not extended. The next step is to discuss the case in the rehabilitation team, consisting of different experts from the municipality and the departments of work, social, health, and education. This process can continue up to 5 years.	Within 6 weeks of sickness absence the employer has a legal obligation to prepare an individual work plan, which is not required by authorities. A programme focussing on medical-occupational rehabilitation has been constructed by the statutory pension insurance scheme (DRV), aiming to accommodate the medical rehabilitation to the work-related needs of the employee.	After a maximum of six weeks sickness absence the occupational physician (either employed by the company or working at a private occupational health service) has to provide a problem analysis and describe the employee's abilities/disabilities. Within 8 weeks of sickness absence the employer draws a follow-up plan for reintegration of the employee, formulated jointly by employer, employee, and occupational physician. The employer is obliged to create this supportive personal reintegration plan. If reintegration is not successful after one year, RTW outside the company must also considered. The employee can apply for long-term disability benefits from the social security instance if reintegration remains unsuccessful after two years.

Social security system			
Aspects	Denmark	Germany	The Netherlands
The orthopaedic surgeon is authorised to certify short-term absence from work (28–30,69)	Yes	Yes	No
Rehabilitation efforts are obligatory before a patient can be assessed for long-term disability (69)	Yes	No	Yes
Medical certificate needed for a sickness benefit (28–30)	No	Yes	No

Psychosocial working conditions play an important role in the return-to-work process after total knee and hip arthroplasty

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Abstract

Purpose:
Both personal and work-related factors affect return to work (RTW) after total knee arthroplasty (TKA) and total hip arthroplasty (THA). Little is known about work-related factors associated with the recovery process. This study aimed to determine which work-related factors are associated with time to RTW for both TKA and THA patients.

Methods:
A prospective multicentre survey study was conducted that included patients aged 18–63, had a paid job and were scheduled to undergo primary TKA/THA. Surveys were completed preoperatively, 6 weeks, and 3, 6, and 12 months postoperatively, and included four domains of work-related factors: work characteristics, physical working conditions, psychosocial working conditions and work adjustments. Control variables included age, sex, education, and comorbidity. Time to RTW was defined as days from surgery until RTW. Multivariate linear regression analyses were conducted separately for TKA/THA patients. *Results:* Enrolled were 246 patients (n = 146 TKA, n = 100 THA, median age 56 years, 57% female). Median time to RTW was 79 days (IQR 52.0–146.0). Mainly physical tasks (TKA: B 58.2, 95%CI 9.5–106.8; THA: B 52.1, 95%CI 14.1–90.2) and a combination of physical and mental tasks (TKA: B 50.2, 95%CI 6.4–94.0; THA B 54.0, 95%CI 24.2–83.7) were associated with longer time to RTW after both TKA and THA. More possibilities for personal job development (B – 12.8, 95%CI – 25.3–0.4) and more work recognition (B – 13.2, 95%CI – 25.5 to – 0.9) were significantly associated with shorter time to RTW after TKA. Higher quality of supervisor leadership (B – 14.1, 95%CI – 22.2 to – 6.0) was significantly associated with shorter time to RTW after THA.

Conclusion:
The findings of this study stress the importance of psychosocial working conditions, besides type of job tasks, in RTW after TKA/THA. Further research on work-related factors is needed, as arthroplasty is being performed on an increasingly younger population of knee and hip OA patients for whom participating in work is of critical importance.

Introduction:

Osteoarthritis (OA) is one of the most common reasons for chronic musculoskeletal pain (1). It is a highly prevalent chronic joint disease that affects about one in eight adults worldwide (2). Among working-age individuals OA is one of the leading causes of disability (3), and is strongly associated with reduced productivity among working individuals (4). Due to aging and the rise in obesity in Western countries, OA's burden and the associated disability among the working-age population will become substantial in the coming years (5,6).

Total knee arthroplasty (TKA) and total hip arthroplasty (THA) are effective procedures to reduce pain and improve function in patients with hip or knee OA (7,8). In the Netherlands 25,566 primary TKAs and 31,594 primary THAs were performed in 2019 (9), and an expected 57,900 and 51,680 patients will undergo TKA or THA, respectively, by 2030. The greatest spike in TKA and THA is seen in patients of working age. The number of TKA and THA patients below age 65 already tripled between 1995 and 2003 in the Netherlands, and this number is expected to rise further (10).

Due to the increasing numbers of TKAs and THAs among working-age patients and the rising retirement age, more patients have to return to work (RTW) after surgery (10–17). While the majority of patients do return to work (71%-83% after TKA, 68%-95% after THA), time to RTW varies (18). Both personal and work-related factors associated with (time to) RTW after TKA or THA have been found (18–20). However, most studies focus on personal factors (21–23) and only a limited number have aimed to investigate how work-related factors may affect the RTW process in TKA or THA patients (20,24,25).

Work-related factors influencing RTW can be roughly subdivided into four domains: workplace characteristics (e.g. working hours, type of contract, tasks, job type), physical working conditions (e.g. standing, walking, sitting), psychosocial working conditions (e.g. work pace, role clarity, job satisfaction) and work adjustments (e.g. lighter duties, shorter hours, different workstation). Adverse physical and psychosocial working conditions are generally associated with premature exit from the labor force (26). Work adjustments have been mentioned as a successful strategy to accommodate workers in returning to work and successfully perform their job tasks (27,28).

In the orthopedic literature some studies found that physically demanding jobs may hinder RTW after TKA or THA (20,21,24). It was also found that being self-employed facilitated RTW (20), that workers who perform knee-burdening work and identify their knee symptoms as work-related have high chances of not returning to work (24), and that workplace support and adaptation of the job role

had a positive impact when patients did RTW (29,30). Moreover, job flexibility has been associated with earlier RTW (31). Successful RTW after TKA or THA may benefit from workplace adaptations and accommodations (29) as well as handicap accessibility (20).

These results stress the importance of considering work-related factors in the timely referral to work-directed care of patients at risk for not returning to work after TKA or THA. However, given that those studies only include a limited number of work-related factors and mainly focus on a specific domain, relatively little is known about the influence of work-related factors on time to RTW taking into account all four work domains. Hence the aim of this study was to determine which work-related factors are associated with time to RTW after TKA or THA.

Material and methods

Design and procedure

A prospective multicenter survey study was conducted among patients who underwent TKA or THA for primary OA. This study was part of the "Work participation In Patients with Osteoarthritis" cohort (WIPO, Trial-ID NTR3497) (32–34). Patients were recruited between March 2012 and July 2014 at the orthopedic departments of four Dutch medical centers: University Medical Center Groningen (tertiary university hospital), Martini Hospital Groningen (large teaching hospital), Medical Center Leeuwarden (large teaching hospital) and Röpcke-Zweers Hospital Hardenberg (general hospital), all in the northern Netherlands. Patients who were on a waiting list for TKA or THA were contacted by phone and invited to participate in the study. Preoperative questionnaires were filled in approximately one month before surgery. Postoperative follow-up data were collected at 6 weeks and 3, 6, and 12 months. If applicable, missing answers were added later to the questionnaire after contacting the patients by phone. Informed consent was obtained at baseline.

Participants

Patients with knee or hip OA undergoing TKA or THA, preoperatively employed and aged 18-63 were included. Excluded were patients with insufficient knowledge of the Dutch language, those having undergone a unicompartimental knee arthroplasty or revision TKA or THA. A dropout was defined as a patient leaving the study preterm by not filling in one of the postoperative questionnaires for any reason.

Measures

Time to return to work
Time to return to work was the outcome measure, defined as length of time (days) from surgery to RTW. RTW was defined as the first time participants partially or fully returned to work after surgery. RTW (yes/no) and the specific date was asked in the follow-up questionnaires at 6 weeks and 3, 6 and 12 months postoperatively.

Work-related factors
Work 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 working conditions were measured with a self-structured questionnaire by asking whether patients had to perform physical activities like standing, sitting, walking, kneeling or squatting (yes/no), and whether they perceived difficulties in performing physical work demands (9 items) due to impairing knee or hip problems (yes/no).

Psychosocial working conditions were measured using three domains from an adapted version of the short version of the Copenhagen Psychosocial Questionnaire II (COPSOQ-II). The domains included 1. demands at work, 2. work organization and job contents, and 3. interpersonal relations and leadership. The first domain included the dimensions quantitative demands, work pace and emotional demands, the second domain included the dimensions influence at work, possibilities for development, meaning of work and commitment to the workplace, and the third domain included the dimensions predictability, recognition (reward), role clarity, quality of leadership, social support from supervisor and social support from colleagues. Each dimension consisted of two questions.

All questions were scored on a five-point scale, ranging from never (1) to always (5), thus a higher score indicated a higher exposure. The total dimension score was calculated as the sum of scores of the questions within each dimension, thus scores could range from 2 to 10. The short version of the COPSOQ-II has been proven to be valid and reliable (35).

Work adjustments were assessed by asking "Were adjustments made to your work since your complaints?" (yes/no) and the follow-up question "Which adjustments have been made to your work since your complaints?", with the following answer

options: shorter working hours, fewer contractual hours, change of function, change of tasks, changed working hours, cessation of managerial duties, less demanding work, more frequent breaks, flexible schedule, workplace adjustments, additional employee who fulfills the tasks I cannot do, ergonomic adjustments. Multiple answers were allowed. We calculated a percentage of the total accommodations made and also created a dichotomous variable (yes/no). Patients receiving one or more work accommodations were coded as yes.

Covariates

Data on the following sociodemographic data were collected: age, sex, living alone or with a partner, educational level (categorized into elementary, secondary and higher), being a wage earner (yes/no). Disease-related information was gathered by asking about type of arthroplasty (TKA or THA), body mass index (BMI) divided into normal (<25) and overweight/obese (>25), and comorbidity measured with a 27-item chronic conditions questionnaire (36). Number of comorbidities was categorized into having no, one and two, or more than two comorbidities.

Statistics

Descriptive statistics – mean (SD), n (%) – were used to describe baseline characteristics of the study population. Kaplan-Meier survival analysis was performed to calculate median time to RTW for the entire group and the subgroups (TKA and THA). Linear regression analysis was used to study the prognostic factors for time to RTW. First the association between time to RTW and each potential prognostic factor was univariately assessed. Age, sex, educational level and number of comorbidities were included as control variables (18,25). All prognostic factors with a p-value ≤0.20 in the univariate analyses were included in the model and analyzed using a backward stepwise selection method. Next, multiple regression analyses were performed in two models. For model 1 the analyses were performed in blocks: in block 1 workplace characteristics were added, in block 2 physical working conditions, in block 3 psychosocial working conditions and in block 4 work adjustments. For every block the factors were removed through backward stepwise selection until only variables below the cut-off value (p≤0.20) remained. For model 2, the final model, all factors of the separate multivariate regressions that were below the cut-off value (p≤0.20) were included, then removed through a backward stepwise selection method until a statistically significant final model remained. A p-value <0.05 was considered statistically significant. Statistical analyses were performed with IBM Statistical Package for the Social Sciences (SPSS) version 25.0.

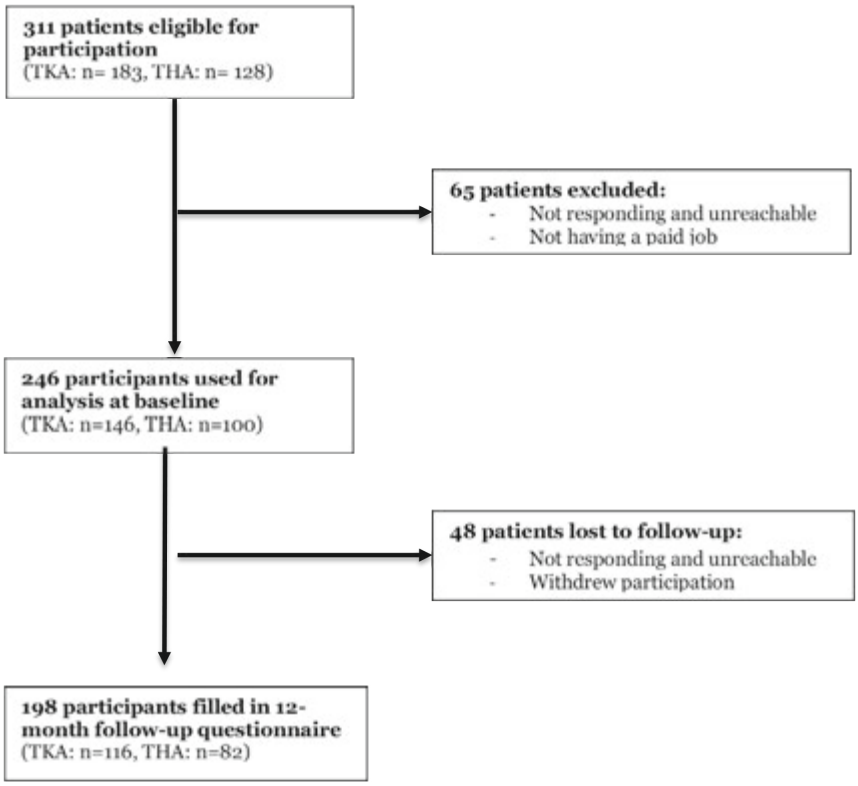

Figure 1: Flowchart study enrolment and follow-up

Table 1. Baseline study sample characteristics

Characteristics	Total (N=246)	TKA (N=146)	THA (N=100)
Age (median, IQR)	56 (51–59)	56 (52 – 59)	56 (50 – 60)
Male/female, n (%)	107 (43) / 139 (57)	61 (42) / 85 (58)	46 (46) / 54 (54)
BMI (kg/m2), n (%)			
- <25	54 (22)	23 (16)	31 (31)
- >25	187 (76)	120 (82)	67 (67)
TKA/THA, n (%)	146 (59) / 100 (41)	-	-
Highest educational level, n (%)			
- Lower (elementary school, vocational education)	81 (33)	48 (33)	33 (33)

Table 1. *Continued.*

Characteristics	Total (N=246)	TKA (N=146)	THA (N=100)
- Secondary (high school, intermediate vocational education)	105 (43)	67 (46)	38 (38)
- Higher (higher professional education, university)	52 (21)	27 (19)	25 (25)
Partner, n (%)	224 (91)	132 (90)	92 (92)
Number of comorbidities, n (%)			
- None	20 (8)	8 (6)	12 (12)
- One or two	138 (56)	77 (53)	61 (61)
- More than two	87 (35)	61 (42)	26 (26)
Wage earner, n (%)	133 (54)	75 (51)	58 (59)
Self-employed, n (%)	31 (13)	19 (13)	12 (11)
Time to return to work (median, IQR	79.0 (52.0–146.0)[a]	82.0 (55.0 – 172.5)[b]	76.5 (49.0–113.5)[c]

All numbers are represented as mean with standard deviation (SD) or numbers (n) and percentages (%).
a N=198; b N=116; c N=82

Results

Of the 311 patients who had undergone a primary TKA or THA, 246 (n=146 TKA, n=100 THA; response rate 79.1%) were included. Figure 1 is a flow chart 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 of the total patient group was 56 years (interquartile range (IQR) 51-59 years). The sample consisted of 43% (n=107) men and 57% (n=139) women, 59% (n=146) TKA patients and 41% (n=100) THA patients; 76% of workers had completed lower or secondary education and 21% higher education. Median time to RTW was 79 days (IQR: 52.0–146.0) (Fig. 2a, b). Follow-up data at 12 months was available for 198 (80.5%) of the 246 patients enrolled. Patients who dropped out during the study did not differ from the study sample on any covariates. In total, 90.4% (9.6% partial, 80.8% full-time) of the patients returned to work within 12 months of surgery.

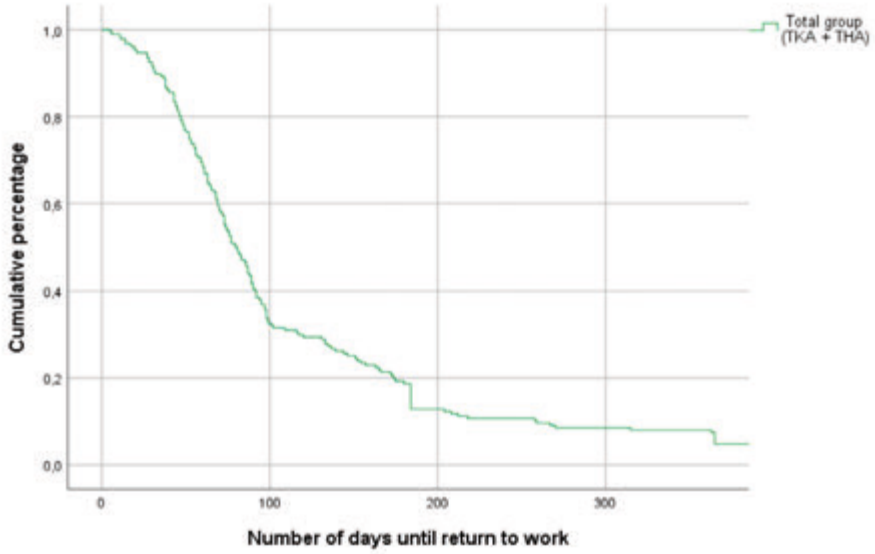

Fig. 2A Kaplan-Meier curve – cumulative percentage of RTW of the total group (TKA and THA)

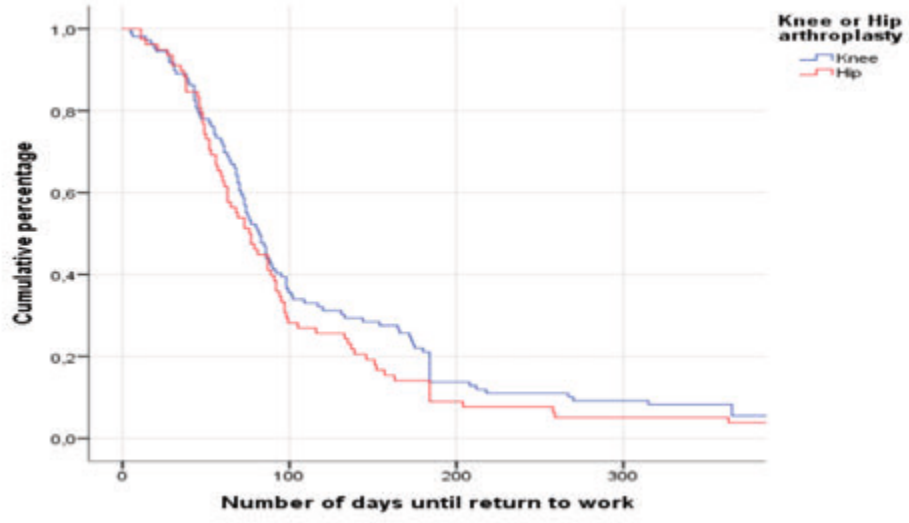

Fig. 2B Kaplan-Meier curve – cumulative percentage of RTW of the subgroups TKA and THA

Univariate and multivariate analyses among TKA patients

In the univariate analyses five work characteristics (self-employment, contractual hours, working hours, type of job, type of tasks) and six physical working conditions (standing, sitting, walking, difficulty with sitting, difficulty moving more than 20kg, difficulty with driving) were below the cut-off value and therefore used in the first multivariate analysis (Appendix). Of the psychosocial working conditions four variables were below the cut-off value (influence at work, possibilities for development, predictability, recognition). There was no association between receiving a work adjustment and time to return to work.

In the multivariate analysis two work characteristics (job type, type of tasks), two physical working conditions (work that demands walking, difficulty with sitting) and three psychosocial working conditions (influence at work, possibilities for development, recognition) were below p≤0.20 (model 1). In the final model mainly physical tasks (B 58.2, 95%CI 9.5–106.8) and a combination of physical and mental tasks (B 50.2, 95%CI 6.4–94.0) were associated with longer time to RTW. More possibilities for development (B 12.8, 95%CI 25.3–0.4) and more recognition (B 13.2, 95%CI -25.5– 0.9) were significantly associated with shorter time to RTW (model 2).

Univariate and multivariate analyses among THA patients

In the univariate analyses the work characteristics company size and type of tasks were below the cut-off value and therefore used in the first multivariate analysis (Appendix). Of the physical working conditions four variables (sitting, kneeling or squatting, difficulty working in an uncomfortable position, difficulty working in the same position for an extended period) were below the cut-off value (Appendix). Of the psychosocial working conditions four variables were below the cut-off value (quantitative demands, work pace, possibilities for development, quality of leadership; Appendix). There was no association between receiving a work adjustment or percentage of work adjustments and time to RTW.

In the multivariate analysis type of job tasks, two physical working conditions (kneeling or squatting and difficulty working in an uncomfortable position) and three psychosocial working conditions (possibilities for development, tempo work pace, quality of leadership) were below p≤0.20 (model 1). In the final model mainly physical tasks (B 52.1, 95%CI 14.1–90.2) and a combination of physical and mental tasks (B 54.0, 95%CI 24.2–83.7) were significantly associated with longer time to RTW; higher quality of leadership (B 14.1, 95%CI 22.2– 6.0) was significantly associated with shorter time to RTW (model 2).

Table 2. Multivariate regression analyses for the outcome RTW (days) after total knee arthroplasty (TKA) and total knee arthroplasty (THA)

	TKA						THA					
	Model 1			Model 2			Model 1			Model 2		
Variables	**B**	**95% CI**	**P-value**	**B**	**95% CI**	**P-value**	**B**	**95% CI**	**P-value**	**B**	**95% CI**	**P-value**
Workplace characteristics												
Job type												
Executive (ref=Policy)	38.6	-18.2–95.5	0.18	NS	NS	NS	NS	NS	NS	NS	NS	NS
Administrative (ref=Policy)	0.44	-73.1–74.0	0.99	NS	NS	NS	NS	NS	NS	NS	NS	NS
Advisory (ref=Policy)	-11.1	-118.6–96.6	0.84	NS	NS	NS	NS	NS	NS	NS	NS	NS
Management (ref=Policy)	52.1	-14.5-118.6	0.12	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tasks												
Physical (ref = mental)	38.4	-14.0–90.76	0.15	58.2	9.5–106.8	0.02*	54.4	13.5–95.3	0.01	52.1	14.1–90.2	0.01*
Both (ref = mental)	36.2	-11.62–84.06	0.14	50.2	6.4–94.0	0.03*	49.7	17.2–82.3	0.00	54.0	24.2–83.7	0.00*
Physical working conditions												
Work demands walking (ref=no)	47.2	11.9–82-6	0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS
Work demands kneeling/ squatting (ref=no)	NS	NS	NS	NS	NS	NS	42.1	3.0–81.1	0.04	NS	NS	NS
Difficulty sitting (ref = no)	30.0	-3.5–63.4	0.08	NS	NS	NS	NS	NS	NS	NS	NS	NS
Difficulty working in uncomfortable position (ref=no)	NS	NS	NS	NS	NS	NS	39.0	5.0–73.0	0.03	NS	NS	NS
Psychosocial working conditions												
Influence at work	-7.3	-17.9–3.2	0.17	NS	NS	NS	NS	NS	NS	NS	NS	NS
Possibilities for development	-10.7	-24.1–2.7	0.12	-12.8	-25.3–0.4	0.04*	-7.3	-17.5–2.9	0.16	NS	NS	NS

Table 2. *Continued.*

	TKA						THA					
	Model 1			Model 2			Model 1			Model 2		
Variables	**B**	**95% CI**	**P-value**	**B**	**95% CI**	**P-value**	**B**	**95% CI**	**P-value**	**B**	**95% CI**	**P-value**
Recognition	-15.6	-27.4--3.8	0.01	-13.2	-25.5--0.9	0.04*	NS	NS	NS	NS	NS	NS
Tempo work pace	NS	NS	NS	NS	NS	NS	9.9	1.3–18.5	0.02	NS	NS	NS
Quality leadership	NS	NS	NS	NS	NS	NS	-12.7	-21.4--4.1	0.01	-14.1	-22.2--6.0	0.00*

Model 1 = blocks (workplace characteristics and physical working conditions, psychosocial working conditions, work adjustments)
Model 2 = total
*Adjusted for age, sex, education and number of comorbidities. * $p<0.05$. NS = not significant.*

Discussion

This study aimed to investigate which work-related factors influence time to RTW after TKA or THA. We found that besides type of job tasks, the key factors were psychosocial working conditions for both groups, with some additional differences between TKA and THA patients in the type of psychosocial working conditions associated with time to RTW within 12 months of surgery.

Our findings about the role of psychosocial working conditions in RTW could not be compared to other studies on TKA or THA due to a lack of research investigating this influence. We found that possibilities for personal job development, more work recognition and high quality of supervisor leadership resulted in a significant shorter time to RTW. Comparison with other studies among workers with chronic diseases exposed similar findings (37–39).

Quality of leadership from the supervisor showed to enhance the likelihood to accommodate workers with back injuries and prevent prolonged work disability (38). Possibilities for development, i.e. job control (including work autonomy), was evidenced as a strong facilitator of RTW among different population groups (37). In line with our results, the importance of recognition, appreciation, good communication and genuine concern from the supervisor for RTW outcomes has been shown in different population groups (40,41).

Although some studies among TKA or THA patients suggest that social support may result in better postoperative outcomes (30), we did not find a significant association between work-related social support from the supervisor and/or colleagues and time to RTW. Previous research indicates that supervisors' support and leadership quality were effective in reducing sickness absenteeism and may play an important role in the RTW process (42).

Our findings showed that THA and TKA patients who perform mainly physical tasks and a combination of physical and mental tasks have a longer time to RTW compared to those in jobs with mental tasks. Other studies also found jobs with mainly physical tasks as an impeding factor for RTW (20,21,24,43). However, in contrast to a previous study among TKA patients (21) we did not find an association between physical working conditions and time to RTW in the multivariate model. This may suggest that psychosocial working conditions are more important for RTW after TKA or THA than physical working conditions.

We did not find an association between preoperative work adjustments and time to RTW either. In our study population only 27.3% of workers received work adjustments. Even though the number of work accommodations received is slightly higher than in previous research among TKA or THA patients (20%) (18), this may have influenced our outcome as we only investigated preoperative

work accommodations. More accommodations can be expected to be made postoperatively. It has nonetheless been reported that workers who modified their responsibilities preoperatively are more likely to do so postoperatively (20).

In our study the majority of patients (89.7% TKA, 91.5% THA) returned to work postoperatively, which is in line with previous studies (20,21,44). Furthermore, approximately half of our sample returned to work partially or fully within the first three months postoperatively, with a median RTW of 79 days (11.3 weeks), which is similar to the median time to RTW reported in literature (7,20,23,45,46).

Strengths and limitations

A strength of this study is the prospective design with its relatively large number of patients, multiple follow-up moments and outcome measures up to 12 months postoperatively. This gave us the opportunity to examine specific time to RTW. Another strength is the representative sample of patients and therefore the generalizability of the results.

This study has also some limitations. Measurements were self-reported, therefore generally susceptible to the effects of reporting bias. Another limitation was a 20% (48/246 patients) dropout rate at 12 months follow-up. Comparison of non-responders at 12 months follow-up with responders revealed no significant differences in baseline characteristics. We only focused on the first time workers partially or fully returned to work, therefore not taking into account whether work absences recurred after the first RTW.

Implications

Changing workforce dynamics and trends toward surgery at younger ages mean that these are important outcomes for clinicians to assess besides those of pain and function that are usually reported following TKA or THA. Information about the role of the work environment is also important for occupational and health practitioners as well as for employers toward understanding workers' continued participation in employment after TKA or THA. So far most studies have focused on the impact of physical work-related factors on RTW (18): our study shows that psychosocial working conditions may also play an important role in the RTW process after TKA or THA. The results of this study provide a number of factors (i.e. possibilities for personal job development, work recognition, quality of supervisor leadership) to facilitate RTW after TKA or THA that can be built into the design and implementation of effective RTW intervention programs. Previous studies among other populations (i.e. workers with mental disorders, back injuries, cardiovascular diseases and cancer) reported that these interventions should in particular target the employer to enhance RTW support for sick listed workers (37,38,41). For

example, supervisor training programs aiming to improve leadership (38) and interventions addressing organizational culture to facilitate employee's needs (e.g. increase job control and recognition) (37,41). To our knowledge, this is the first quantitative study to extensively examine the role of psychosocial working conditions among this specific population. Further research is needed to confirm our findings. Additional research is needed to enrich future understandings of the contribution of work-related social support in TKA and THA patients and to explore whether work absences recur after the first RTW.

Conclusion

The present study showed that, besides type of job tasks, psychosocial working conditions may play a key role in facilitating time to RTW after primary TKA or THA. Although some differences in factors were found between TKA and THA patients, our findings suggest overall that possibilities for personal job development, work recognition and quality of supervisor leadership are important factors toward RTW after arthroplasty. Further research on the role of physical and psychosocial working conditions as well as work adjustments is needed, as arthroplasty is being performed on an increasingly younger population of knee and hip OA patients for whom participating in work is of critical importance.

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Appendix

Table 3. Univariate regression analyses for the outcome RTW (days) after total knee arthroplasty (TKA) and total hip arthroplasty (THA)

	TKA			THA		
Variables	**B**	**95% CI**	**p-value**	**B**	**95% CI**	**p-value**
Workplace characteristics						
Salaried (ref=Self-employed)	45.7	6.0 to 85.4	0.024*	25.9	-18.5 to 70.3	0.25
Company size						
0-9 employees (ref=>100)	-4.4	-44.2 to 35.4	0.83	-35.0	-74.5 to 4.5	0.081*
10-99 employees (ref=>100)	10.6	-21.7 to -42.9	0.52	1.10	-36.1 to 38.3	0.95
Contractual hours	-1.1	-2.8 to 0.6	0.19*	0.98	-0.77 to 2.7	0.27
Working hours	-1.36	-2.6 to -0.1	0.03*	-0.4	-1.8 to 1.0	0.55
Job type						
Executive (ref=Policy)	34.9	-11.8 to 81.6	0.14*	17.0	-38.1 to 72.0	0.54
Administrative (ref=Policy)	-6.5	-62.9 to 50.0	0.82	-18.5	-86.6 to 49.6	0.59
Advisory (ref=Policy)	-11.1	-92.9 to 70.7	0.79	-17.1	-92.5 to 58.4	0.65
Management (ref=Policy)	32.1	-25.3 to 89.5	0.27	18.7	-48.7 to 86.2	0.58
Tasks						
Physical (ref= mental)	35.7	-2.7 to -74.1	0.068*	57.5	15.5 to 99.4	0.008*
Both (ref= mental)	31.7	-2.5 to 65.8	0.069*	54.0	19.2 to 88.8	0.003*
Physical working conditions						
Work demands						
standing (no=ref)	27.1	-0.22 to 54.5	0.05*	14.9	-17.1 to 47.0	0.36

Table 3. *Continued.*

	TKA			THA		
Variables	**B**	**95% CI**	**p-value**	**B**	**95% CI**	**p-value**
sitting (no=ref)	-23.7	-50.7 to 3.2	0.084*	-27.5	-60.2 to 5.3	0.10*
walking (no=ref)	41.3	12.7 to 69.9	0.005*	14.5	-18.8 to 47.8	0.39
kneeling/squatting (no=ref)	9.6	-22.3 to 41.4	0.55	67.9	33.4 to 102.5	0.00*
Difficulty standing (no=ref)	7.3	-27.3 to 41.9	0.68	10.8	-26.8 to 48.4	0.57
Difficulty sitting (no=ref)	-24.1	-52.1 to 4.0	0.092*	-19.4	-52.1 to 13.3	0.24
Difficulty moving >5kg (no=ref)	-0.12	-28.7 to -28.5	0.99	13.7	-22.6 to 49.9	0.45
Difficulty moving >20kg (no=ref)	-34.9	-75.4 to 5.6	0.091*	-7.4	-58.2 to 43.5	0.77
Difficulty using power with arm/hand (no=ref)	14.1	-26.1 to 54.3	0.49	-8.5	-53.1 to 36.1	0.71
Difficulty using vibrating/tamping work tools (no=ref)	0.77	-32.1 to 33.6	0.96	8.0	-34.0 to 50.0	0.71
Difficulty driving (no=ref)	-26.8	-64.1 to 10.3	0.16*	8.4	-28.2-45.0	0.65
Difficulty working in uncomfortable position (no=ref)	-18.1	-49.8 to 13.7	0.26	-37.4	-74.8 to 0.05	0.05*
Difficulty w lengthy work in same position (no=ref)	-13.6	-42.4 to 15.3	0.35	-37.8	-69.4 to 6.2	0.02*
Psychosocial working conditions						
Quantitative demands	-3.8	-13.0 to 5.4	0.41	6.7	-1.6 to 14.9	0.11*
Tempo work pace	-1.0	-9.1 to 7.0	0.80	6.2	-2.9 to 15.2	0.18*
Emotional demands	-0.28	-7.1 to 6.5	0.94	3.5	-5.8 to 12.8	0.50
Influence at work	-10.3	-18.1 to -2.4	0.011*	-2.5	-9.5 to 4.5	0.48
Possibilities for development	-13.8	-23.3 to -4.4	0.004*	-10.0	-20.0 to -0.0	0.05*
Meaning of work	-7.2	-18.7 to 4.5	0.23	3.3	-6.3 to 12.9	0.49

Table 3. *Continued.*

	TKA			THA		
Variables	**B**	**95% CI**	**p-value**	**B**	**95% CI**	**p-value**
Commitment to workplace	-3.4	-12.1 to 5.4	0.45	-2.63	-12.8 to 7.6	0.61
Predictability	-10.0	-18.3 to -1.8	0.02*	-6.0	-15.3 to 3.4	0.21
Recognition	-7.5	-17.0 to 1.9	0.12*	-0.9	-10.0 to 8.3	0.85
Role clarity	2.9	-8.8 to -14.7	0.62	-0.8	-13.0 to 11.5	0.90
Quality of leadership	1.1	-7.9 to -10.1	0.81	-8.5	-17.9 to 1.0	0.08*
Social support of supervisor	-3.4	-12.4 to 5.7	0.46	-4.4	-12.9 to 4.1	0.31
Social support of colleagues	-2.3	-12.3 to 7.8	0.65	-2.3	-11.5 to 7.0	0.63
Work adjustments						
Work adjustments (% out of 12)	1.5	-0.84 to 3.9	0.21	-0.003	-0.008 to -0.002	0.29
Work adjustments (no=ref)	64.6	-44.2 to 173.5	0.23	-26.8	-227.2 to 173.6	0.77

*Adjusted for sex, age, education and number of comorbidities. * p≤0.20*

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

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5

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.

Introduction

Adequate social support is known to have positive effects on health status and health behaviours (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 on 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, unicompartimental 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.

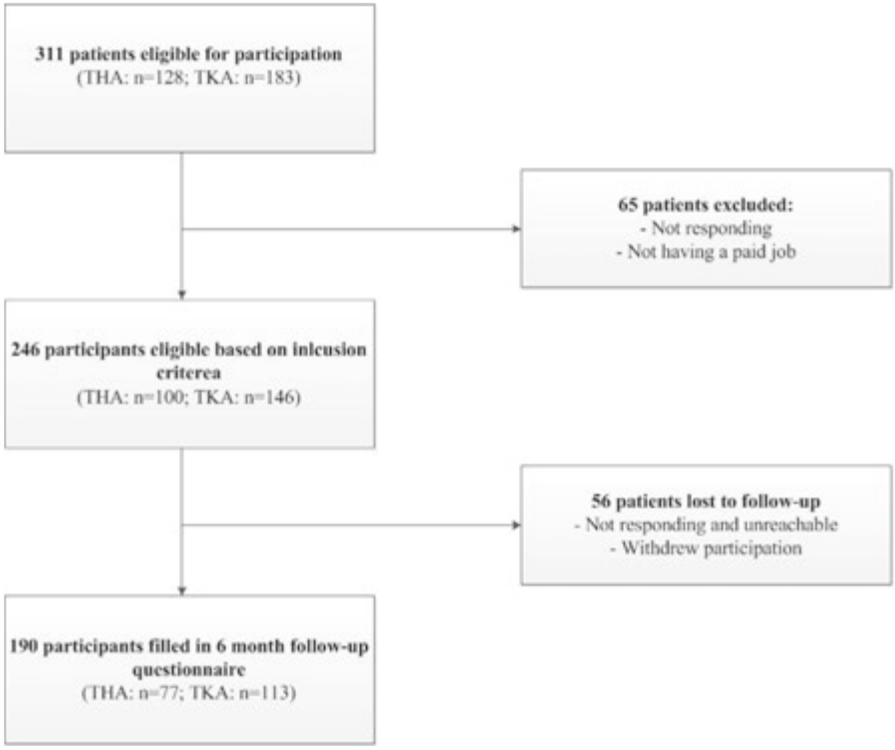

Fig. 1 Flowchart study enrolment and follow-up

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 online supplemental 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.

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 to 37)
Working hours (median, IQR)	32 (22 to 40)
Job type, n (%)	
- Executive	105 (55)
- Administrative	22 (12)
- Advisory	11 (6)
- Management	27 (14)
- Policy	23 (12)
Work tasks n (%)	

Table 1: *Continued.*

Variables	Total (N=190)
- 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 (%).

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).

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 to 1.14			
Support from co-workers (ref=no)	1.26	0.64	0.48 to 3.31			
Support from supervisor (ref=no)	1.57	0.30	0.68 to 3.62			
Support from OP (ref=no)	2.53	0.02*	1.15 to 5.54			
Support from GP (ref=no)	1.46	0.30	0.71 to 2.98			
Support from other caregivers (ref=no)	1.24	0.57	0.59 to 2.63			
Three months postoperative						
Support from home	1.01	0.92	0.92 to 1.10			
Support from co-workers (ref=no)	1.28	0.56	0.56 to 2.93			
Support from supervisor (ref=no)	2.71	0.02†	1.18 to 6.23	2.56	0.03*	1.08 to 6.06
Support from OP (ref=no)	3.17	0.00†	1.51 to 6.66	3.04	0.00*	1.43 to 6.47
Support from GP (ref=no)	2.51	0.02†	1.19 to 5.29			
Support from other caregivers (ref=no)	1.64	0.17†	0.81 to 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.*

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).

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 to 1.20	0.76			
Support from co-workers (ref=no)	2.04	0.35 to 11.90	0.43			
Support from supervisor (ref=no)	2.79	0.55 to 14.07	0.21			
Support from OP (ref=no)	3.33	0.81 to 13.69	0.10†			
Support from GP (ref=no)	1.15	0.34 to 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 to 1.18	0.38			
Support from co-workers (ref=no)	1.10	0.32 to 3.76	0.88			
Support from supervisor (ref=no)	1.25	0.45 to 3.48	0.67			
Support from OP (ref=no)	2.06	0.76 to 5.57	0.15†			
Support from GP (ref=no)	1.64	0.64 to 4.21	0.31			
Support from other caregivers (ref=no)	1.64	0.60 to 4.49	0.33			
Three months postoperative						
THA (n=77)						
Support from home	1.09	0.93 to 1.27	0.29			

Table 3: *Continued.*

	Univariate			Multivariate		
Variables	**OR**	**95% CI**	**P**	**OR**	**95% CI**	**P**
Support from co-workers (ref=no)	3.13	0.55 to 17.80	0.20			
Support from supervisor (ref=no)	1.90	1.12 to 21.53	0.04†	1.90	1.12 to 21.53	0.04*
Support from OP (ref=no)	1.85	0.51 to 6.81	0.35			
Support from GP (ref=no)	3.24	0.77 to 13.61	0.11†			
Support from other caregivers (ref=no)	0.65	0.18 to 2.39	0.52			
TKA(n=113)						
Support from home	0.97	0.87 to 1.08	0.60			
Support from co-workers (ref=no)	1.26	0.46 to 3.43	0.66			
Support from supervisor (ref=no)	2.65	0.87 to 8.07	0.09†			
Support from OP (ref=no)	5.14	1.84 to 14.36	0.00†	5.14	1.84 to 14.36	0.00*
Support from GP (ref=no)	2.40	0.94 to 6.11	0.07†			
Support from other caregivers (ref=no)	2.32	0.91 to 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.*

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.

Finally, 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. Finally, 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.

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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 (%).*

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

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6

Abstract

Background

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

Methods

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

Results

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

Conclusion

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

Introduction

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are highly effective treatments for end-stage hip or knee osteoarthritis (OA) (1). In recent years, the number of patients undergoing THA or TKA has risen rapidly in Western societies, and is expected to increase in the coming decades due to ageing populations, increasing prevalence of overweight and obesity, improved longevity of arthroplasties, and more sports-related joint-injuries (2,3). The greatest increase in THAs and TKAs is seen in patients aged 45 to 65 years, and it is anticipated that by 2030 at least 52% of THAs and 55% of TKAs will be performed in the working-age population (4). This trend coincides with a delayed retirement age (5), raising the number of working-age patients even further. For working patients, it is crucial to return to work (RTW) after surgery, for personal and societal reasons (6,7). RTW after surgery is thus becoming an increasingly important treatment goal (7,8).

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

Previous studies among working populations have shown that occupational class has a strong independent association with sickness absence and RTW (19–22). This can be illustrated by studies showing that workers in lower occupational classes tend to have more strenuous working conditions and higher levels of work stress than workers in higher occupational classes, who tend to have more control

and autonomy (23–25). Psychosocial determinants, such as strenuous working conditions on the one hand and autonomy on the other hand, might influence the extent to which workers can adjust their work according to their needs, which could obstruct or facilitate the RTW process (26). Knowledge of the association between occupational class and time to RTW among THA and TKA patients may help researchers to gain more insight into the variability of time to RTW between individual patients. Ultimately, this could help to move towards tailored patient-specific advice in orthopaedic surgery and RTW guidance. Therefore, the aim of this study is to investigate the association between occupational class and time to RTW.

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

Methods

Study design and participants.

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

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

Occupational class.
All patients were asked preoperatively about their occupation and the main tasks related to their occupation with the open questions "What is your occupation?" and "How would you describe your work tasks?". If data regarding occupation were incomplete or missing, additional information was gathered by phone. Patients whose occupation-related data were still incomplete, were excluded. Occupations were classified in accordance with the International Standard Classification of Occupations 2008 (ISCO-08) by two independent researchers. The ISCO-08 is an international classification tool for organizing occupations that takes educational level and type of work into account (18). If the assessors disagreed on the classification of a specific patient's occupation, a third researcher (TK) was consulted to act as a tie-breaker. The classification resulted in nine major occupational classes, which we redefined into four hierarchical categories: 1. High-skilled white-collar workers (i.e. managers, professionals, technicians, associate professionals); 2. Low-skilled white-collar workers (i.e. clerical support workers, service and sales workers); 3. High-skilled blue-collar workers (i.e. skilled agricultural, forestry and fishery workers, craft and related trades workers); and 4. Low-skilled blue-collar workers (i.e. plant and machine operators, assemblers, elementary occupations).

Covariates.
Data on age (years), sex, BMI, comorbidities, physical functioning, and self-employment (yes/no) were collected preoperatively. BMI was calculated from preoperative self-reported body height and weight. Comorbidities were measured preoperatively using a 19-item chronic conditions questionnaire developed by the Dutch Central Bureau of Statistics. Comorbidities were dichotomized as present (one or more comorbidity) or absent (no comorbidities). Preoperative self-reported physical functioning was measured with the validated and responsive Hip or Knee Injury and Osteoarthritis Outcome Score-Physical function Short form (HOOS-PS/KOOS-PS) (31). The HOOS-PS consists of five items and the KOOS-PS consists of seven items (scale 0 to 100, where higher scores indicate better functioning).

Statistical analysis.

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

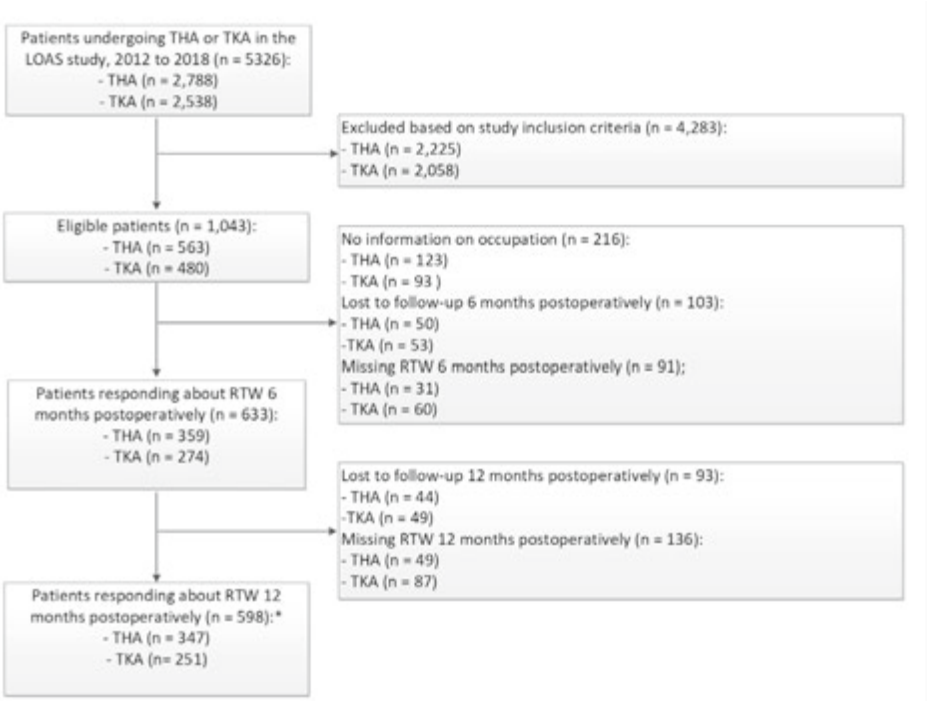

Fig. 1 Flowchart study enrolment and follow-up.
**For some patients, data at six months postoperatively were missing, but data at 12 months postoperatively were available. RTW, return to work; THA, total hip arthroplasty; TKA, total knee arthroplasty.*

Results

In total, 636 out of 1043 (61%) patients were included in the study (n = 360 THA; n = 276 TKA; Figure 1). Patients without information about their occupation (n = 216, 21%), patients lost to follow-up (six months postoperatively, n = 106 (10%); 12 months postoperatively, n = 123 (12%)) or patients with missing RTW data (six months postoperatively, n = 88 (8%); 12 months postoperatively, n = 106 (10%)) were excluded. Excluded patients had a significantly worse physical functioning score and a higher proportion reported to be self-employed (Supplementary Table ii).

Table 1: Baseline characteristics. Patients were included if return to work data were available at six or 12 months' follow-up.

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

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

Distribution of occupational class.
Patients undergoing THA or TKA were mainly high-skilled (THA 57%; TKA 41%) or low-skilled white-collar workers (THA 24%; TKA 38%). A minority were high-skilled (THA 10%; TKA 11%) or low-skilled blue-collar workers (THA 9%; TKA 10%). The majority of low-skilled white-collar workers (both THA and TKA) were female, and the majority of high-skilled blue-collar workers (THA and TKA) were male. Sex distribution within the other occupational classes was equal. A higher proportion of high-skilled blue-collar workers (THA, 34%; TKA, 19%) were self-employed compared to the other occupational classes (Table 1).

Table 2: Median time to return to work in days and proportion within first six months postoperatively

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

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

THA. Six months postoperatively, 78% of low-skilled blue-collar workers returned to work compared to 83-89% in the other occupational classes (Table 2). Median time to RTW of high-skilled white-collar workers was the shortest (60 days (IQR 35 to 85)). Low-skilled blue-collar workers needed the longest time to RTW (94 days (IQR 60 to 128); Table 2 and Figure 2A). At 12 months postoperatively, a similar percentage of patients within all occupational classes returned to work (range 87 to 90%; Supplementary figure 1A).

Cox regression analyses showed that, after correction for potential confounders (model 2), high-skilled white-collar workers had a significantly higher probability to RTW within 6 months postoperatively relative to low-skilled blue-collar workers (HR 2.12 (95% CI 1.32 to 3.40); Table 3). At 12 months postoperatively, our models yielded similar results (Table 3).

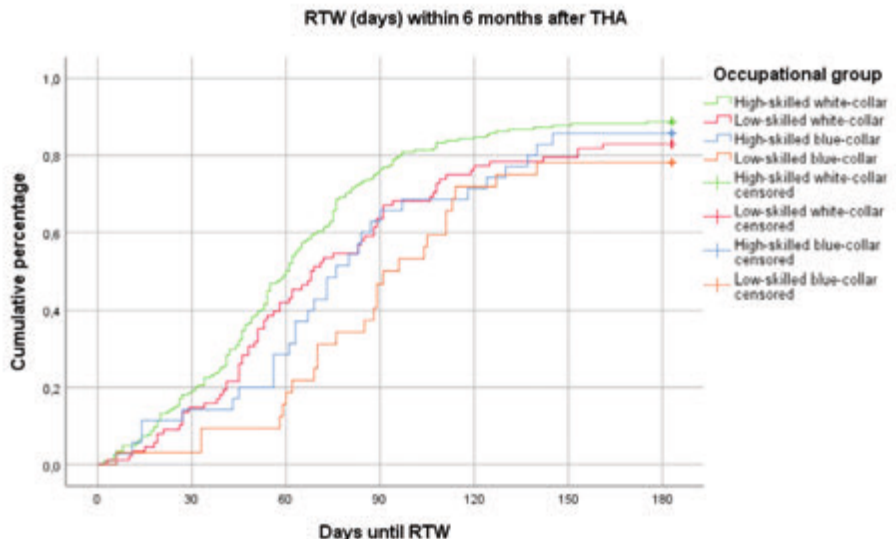

Fig. 2A Kaplan-Meier curve – cumulative percentage of RTW within first 6 months after THA

TKA. Six months postoperatively, 58% of high-skilled blue-collar and 64% of low-skilled blue-collar workers had returned to work compared to 80 to 89% of white-collar workers (Table 2). High-skilled white-collar workers had the shortest median time to RTW (69 days (IQR 45 to 93)). Blue-collar workers needed the longest time to RTW (high-skilled: 127 days (IQR 72 to 183); low-skilled: 120 days (IQR 70 to 171); Table 2 and Figure 2B). At 12 months postoperatively, 79% of low-skilled blue-collar workers returned to work compared to 87 to 92% in the other occupational classes (Supplementary figure 1B).

Cox regression analyses showed that, after correction for potential confounders (model 2), high-skilled white-collar (HR 2.31 (95% CI 1.34 to 4.00)) and low-skilled white-collar workers (HR 1.82 (95% CI 1.04–3.18)) had a significantly higher probability to RTW within six months postoperatively compared to low-skilled blue-collar workers (Table 3). At 12 months postoperatively, our models yielded similar results.

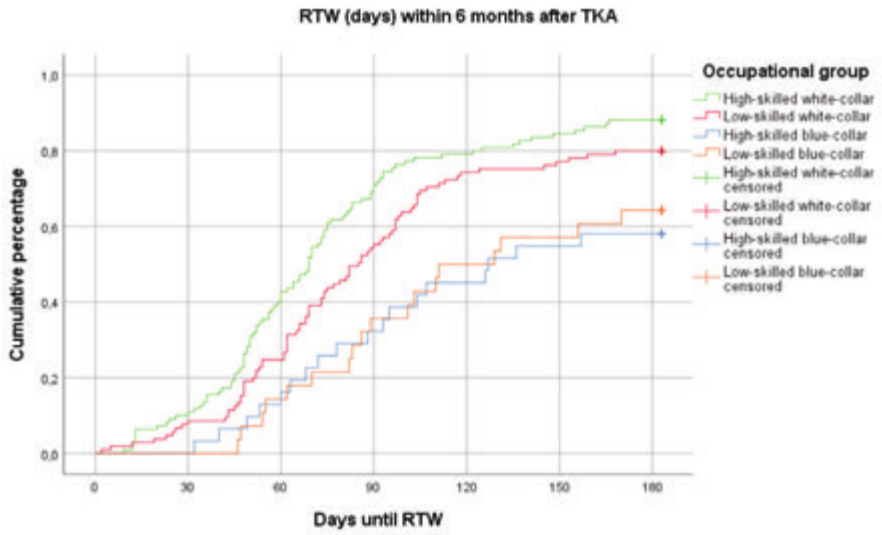

Fig. 2B Kaplan-Meier curve – cumulative percentage of RTW within first 6 months after TKA

Table 3. Cox regression for the outcome time to return to work. Model 1 is unadjusted; Model 2 is adjusted for age, sex, BMI, and comorbidity. Low-skilled blue-collar was the reference for both models.

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

**Statistically significant.*

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

Discussion

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

The low percentage of low-skilled blue-collar workers in our sample was unexpected (THA: n=32, 9%; TKA: n=28, 10%). In other cohort studies the percentage of blue-collar workers or workers with physical demanding jobs ranged between 9% and 30% (15,32–34). To explore the generalizability of our findings, we compared the occupational class distribution of our sample with the general Dutch population (see Supplementary Table 1): the THA sample consisted of more professionals (high-skilled white-collar) and the TKA sample consisted of more service and sales workers (low-skilled white-collar). Both patient groups consisted of less skilled agricultural, forestry, and fishery workers (high-skilled blue-collar). The cause for the differences in distribution between our sample and the Dutch population could be the result of the geographical location of the participating hospitals, which is the western region of the Netherlands, as more blue-collar workers live in the northern and southern regions (35). The differences could also result from the exclusion of preoperatively unemployed patients, or because patients with more physically demanding jobs and less secure employment would be less likely to submit to an arthroplasty while still of working age. Among the general working population, blue-collar workers are at risk for early involuntary exit from paid employment thanks to the availability of unemployment or disability benefits, despite strict Dutch social laws protecting employees from being fired due to disability (36). Thus, blue-collar patients in our LOAS subsample could have already been unemployed preoperatively because of such problems, and consequently been excluded from the analyses.

The findings on RTW concord with previous studies among other patient groups (21,22,37,38). A systematic review among individuals following acute orthopaedic traumas showed that blue-collar work was associated with longer time to RTW (37). Among patients with various cardiovascular diseases, blue-collar workers were less likely to RTW than white-collar workers (63 vs 76%) (38). We were unable to compare our results with previous studies among THA or TKA patients, as they used mainly a crude classification for work, i.e. physically or mentally demanding work tasks (14–17). However, low occupational class (blue-collar

work) has been linked to lower socioeconomic status, unhealthy lifestyle, obesity, and poorer physical health (39,40), factors which have also been mentioned to negatively influence (time to) RTW in both THA and TKA patients (13).

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

Comparing time to RTW between THA and TKA patients showed that, overall, TKA patients need more time to RTW, which is in line with previous studies (10,11). Differences in time to RTW between occupational classes were larger among TKA patients that among THA patients. These differences may exist because post-TKA rehabilitation takes more time (i.e. prolonged postoperative discomfort) than post-THA rehabilitation (41). RTW might also take longer for TKA patients performing knee-demanding work (e.g. construction, cleaning, agricultural), since work-related knee-demanding activities (e.g. deep knee flexion) are known to remain difficult after TKA (42).

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

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

Our findings may have important implications for policy and clinical practice. The findings that blue-collar workers in particular need more time to RTW may

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

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

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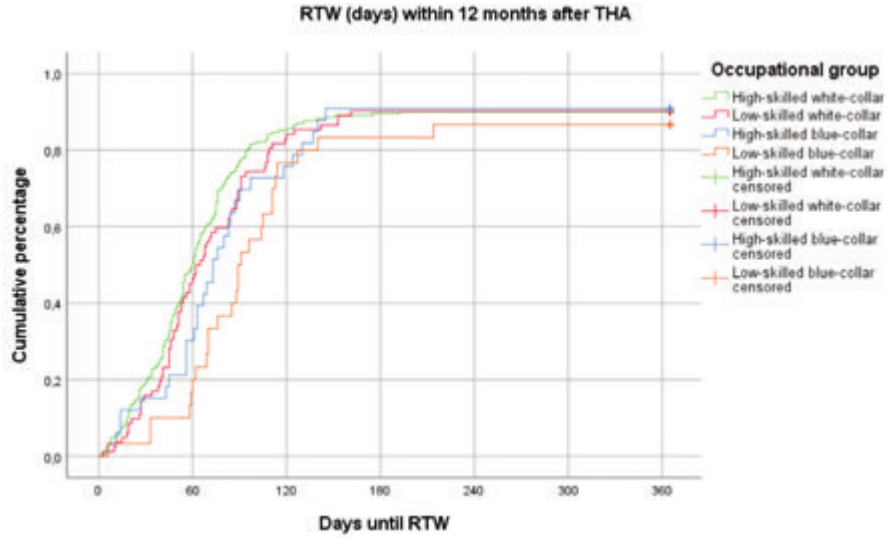
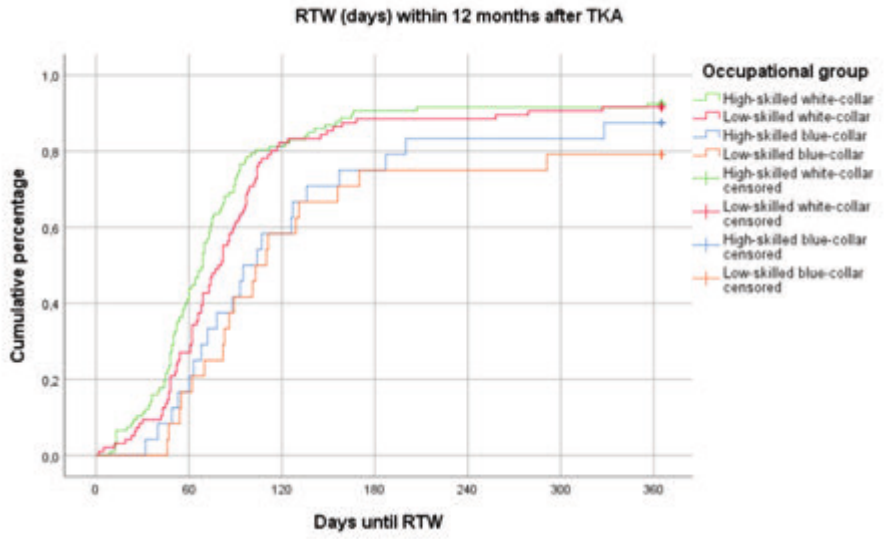
Appendices



Supplementary Fig. 1A Kaplan-Meier curve – cumulative percentage of RTW within first 12 months after THA



Supplementary Fig.1B Kaplan-Meier curve – cumulative percentage of RTW within first 12 months after TKA

Supplementary table 1: Occupational class distribution of study sample and general Dutch population

Major occupational class, n (%)	**THA (n = 360)**	**TKA (n = 276)**	**Dutch population[a]**
High-skilled white-collar			
- Managers	15 (4%)	6 (2%)	7%
- Professionals	115 (32%)	47 (17%)	16%
- Technicians and associate professionals	74 (21%)	59 (21%)	20%
Low-skilled white-collar			
- Clerical support	37 (10%)	35 (13%)	13%
- Service and sales	52 (14%)	70 (25%)	13%
High-skilled blue-collar			
- Skilled agricultural, forestry and fishery workers	11 (3%)	5 (2%)	15%
- Craft and related trades workers	24 (7%)	26 (9%)	8%
Low-skilled blue-collar			
- Plant and machine operators, assemblers	15 (4%)	12 (4%)	5%
- Elementary occupations	17 (5%)	16 (6%)	3%

[a]*Based on data from the Dutch Central Bureau of Statistics in 2015, standardized according to our study population based on age and gender.*

Supplementary Table 2: Comparison of study population and patients not included

Variables	THA		TKA	
	Study population (n=360)	Not included (n = 204)	Study population (n=360)	Not included (n =206)
Age [years], median (IQR)	57 (8)	57 (10)	58 (6)	58 (7)
Sex [number of females], n (%)	171 (48)	108 (53)	151 (55)	104 (51)
BMI [kg/m^2], median (IQR)	27 (6)	27 (5)	29 (6)	30 (6)
Comorbidities [yes], n (%)	259 (72)	144 (71)	204 (74)	155 (76)
HOOS-PS/KOOS-PS[a], median (IQR)	**49 (24)**	**38 (29)**	**46 (16)**	**42 (23)**
Self-employed [yes], n (%)	**39 (11)**	**37 (18)**	**18 (7)**	**24 (12)**

Data are represented as median with interquartile range (IQR), or numbers (n) and percentages (%). Significant differences are shown in bold.
[a] Scales ranged from 0 to 100; higher scores indicated better outcomes.
BMI = body mass index; HOOS-PS = Hip disability and Osteoarthritis Outcome Score Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score Physical function Short form.

Three out of four working-age patients have fulfilled expectations towards paid employment six months after total hip or knee arthroplasty: a multicentre cohort study

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Rheumatology International, 2023

7

Abstract

Objective

To investigate factors associated with fulfilment of expectations towards paid employment after total hip/knee arthroplasty (THA/TKA)

Methods

Cohort study including preoperatively employed patients aged 18-64 scheduled for THA/TKA. Expectations were collected preoperatively, and 6 and 12 months postoperatively with the paid employment item of the Hospital-for-Special-Surgery Expectations Surveys (back-to-normal=1; large improvement=2; moderate improvement=3; slight improvement=4; not applicable=5). Patients scoring not applicable were excluded. Fulfilment was calculated by subtracting preoperative from postoperative scores (<0: unfulfilled; ≥0: fulfilled). Multivariable logistic regression analyses were conducted separately for THA/TKA at 6 and 12 months postoperatively.

Results

Six months postoperatively, 75% of THA patients (n=237/n=316) and 72% of TKA patients (n=211/n=294) had fulfilled expectations. Older age (TKA: OR 1.08, 95%CI 1.01–1.15) and better postoperative physical functioning (THA: OR 1.10, 95%CI 1.06–1.14; TKA: OR 1.03, 95%CI 1.01–1.06) increased the likelihood of fulfilment. Physical work tasks (THA: OR 0.12, 95%CI 0.03–0.44), preoperative sick leave (TKA: OR 0.33, 95%CI 0.17–0.65), and difficulties at work (THA: OR 0.10, 95%CI 0.03–0.35; TKA: OR 0.41, 95%CI 0.17–0.98) decreased the likelihood of fulfilment. Twelve months postoperatively similar risk factors were found.

Conclusion

Three out of four working-age THA/TKA patients had fulfilled expectations towards paid employment at 6 months postoperatively. Preoperative factors associated with fulfilment were older age, mental work tasks, no sick leave, postoperative factors were better physical functioning, and no perceived difficulties at work.

Introduction

Work is a key element of participation and an important determinant of general health, well-being, and quality of life [1]. Studies measuring work-related outcomes have mainly examined first-time return to work (RTW) [2–4], and found that RTW rates varied between 25%-122% after total hip arthroplasty (THA) and 40%-98% after total knee arthroplasty (TKA) within 1-2 years postoperatively [2,3]. RTW is an important treatment goal for an expanding group of patients undergoing a THA or TKA [2,3,5], as 45% of THA and 49% of TKA patients in the Netherlands are of working age [6]. Similar trends are seen in other Western countries [7,8]. Patients are also confident in reaching this goal, as patients of working-age tend to have high expectations about (returning to) work [5,9].

Although patient expectations towards paid employment after THA or TKA are high, 11-43% of patients have unfulfilled expectations [9–12]. The few studies investigating fulfilment of expectations among THA or TKA patients suggest that expectations towards paid employment are among the least fulfilled [10,11]. However, as these studies did not focus on working-age patients [10–12], uncertainties remain about such expectation fulfilment. Moreover, research investigating factors solely associated with fulfilment towards paid employment is so far lacking. The existing studies only incorporate fulfilment towards paid employment as one of multiple factors in their total fulfilment scores [10,11]. Investigating which factors influence fulfilment of expectations towards paid employment will aid in the design of future target strategies to appropriately address those prone to unfulfillment.

Looking beyond the first time of RTW and focussing on fulfilment of patient expectations towards paid employment is important to gain better understanding of preoperative and postoperative factors associated with a successful RTW process. Therefore, the aim of this study was to identify factors associated with fulfilment of patient expectations towards paid employment for THA or TKA patients at both 6 and 12 months postoperatively. Potential factors include sociodemographic and preoperative/postoperative health- and work-related factors that have previously been linked to RTW [2,3,13]. We focussed on fulfilment of expectations towards paid employment at both 6 and 12 months postoperatively, as previous studies indicated that general recovery and recovery of work participation occurs between 6 and 12 months postoperatively [14,15].

Methods

Design and procedure

The study was part of the "Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study" (LOAS), an ongoing, multicentre cohort study [16,17]. Data collection started in 2012 and patients were recruited at the orthopaedic departments of eight Dutch medical centres (one university hospital and seven regional hospitals). Informed consent was obtained from all patients prior to the study in conformity with the Declaration of Helsinki [18]. For the current study we used data collected preoperatively and at 6 and 12 months postoperatively between 2012-2018. Ethical approval was obtained from the Medical Ethics Committee of Leiden University Medical Center (registration no. P12.047; Trial ID NTR3348).

Population

General inclusion criteria for the LOAS were a diagnosis of osteoarthritis, age 18 or older, being listed for THA/TKA, and sufficient Dutch-language skills to complete the questionnaires. For the current study we selected a subgroup: patients preoperatively employed, aged 18-64, listed for primary THA or TKA, and who completed the preoperative and postoperative item on paid employment.

Measures

Sociodemographic factors

Data were collected preoperatively for the following sociodemographic factors: age (years), sex, and living status (with/without partner).

Health-related factors

Health-related factors were gathered by inquiring about body mass index (BMI), comorbidities, ASA-classification, self-reported physical functioning, and health-related quality of life. BMI was derived from preoperative self-reported body height and weight. Comorbidities were measured preoperatively using a 19-item chronic conditions questionnaire developed by the Dutch Central Bureau of Statistics [19]. Comorbidities were categorized as musculoskeletal or non-musculoskeletal (yes/no) [16,20]. Self-reported osteoarthritis related physical functioning was measured both preoperatively and postoperatively with the validated Hip/Knee Osteoarthritis Outcome Score-Physical function Short form (HOOS-PS/KOOS-PS) [21–23]. The HOOS-PS consists of five items and the KOOS-PS consists of seven items (scale 0-100, higher scores indicating better perceived functioning). Health-

related quality of life was measured preoperatively with the Short Form-12 Mental and Physical Component Summary (SF-12 MCS/SF-12 PCS, scale 0-100, higher scores indicating a better health-related quality of life) [24].

Work-related factors

Work-related factors, preoperatively collected, were self-employment (yes/no), working hours (h), type of tasks (physical/mental/combination), sick leave one month preoperatively due to hip/knee complaints (yes/no), and expected time to RTW (weeks). Actual time to RTW (weeks) was collected postoperatively. Difficulties at work caused by hip/knee complaints (yes/no) were measured both preoperatively and postoperatively.

Preoperative expectations and postoperative fulfilment of expectations towards paid employment

Preoperative expectations towards paid employment were measured using a single question from the validated Hospital for Special Surgery (HSS) hip/knee replacement expectations survey, translated into Dutch [25]. The HSS is an 18-item (THA) or 17-item (TKA) self-administered survey, measuring expectations in the domains of pain, function, activities, and psychological wellbeing. We focused on the "What are your expectations towards paid employment after surgery" item. On a Likert scale, five options were possible: 1 (back to normal), 2 (large improvement), 3 (moderate improvement), 4 (slight improvement), 5 (does not apply). For baseline characteristics of the study population (Table 1), we divided preoperative expectations into "back to normal" (score 1) and "not back to normal" (score 2-4). Patients answering not applicable (score 5) were excluded from the study.

Postoperative fulfilment of expectations towards paid employment was used as primary outcome measure. To measure expectation fulfilment, the preoperative HSS questionnaire was modified for use in the LOAS and was composed of the same 5-point Likert scale. The heading of the questionnaire was the only difference: asking to report the "actual status" of the function/activities. Patients were not reminded of their preoperative responses. Postoperative fulfilment of expectations was measured after 6 and 12 months. Fulfilment of expectations was calculated by subtracting preoperative from postoperative HSS scores (≤1: unfulfilled; 0: fulfilled, ≥1: exceeded).

Statistical analyses

Descriptive statistics (mean (SD), n (%)) were used to describe baseline characteristics, for preoperative expectations ("back to normal", "not back

to normal"), separately for THA and TKA patients. Postoperative expectation fulfilment was dichotomized ("unfulfilled" and "fulfilled/exceeded"). The "fulfilled" and "exceeded" groups were combined because the "exceeded" group was very small. Analyses were conducted for fulfilment at both 6 and 12 months postoperatively. The characteristics of patients with unfulfilled and fulfilled expectations were compared using Pearson's chi-square tests (nominal categorical variables), independent T-tests (continuous variables), and chi-square trend tests (ordinal categorical variables; Table S1 and S2).

To select covariates in the multivariate logistic regression, we performed an univariate test on age, sex, comorbidities, preoperative HOOS-PS/KOOS-PS, postoperative HOOS-PS/KOOS-PS, work tasks, preoperative sick leave and postoperative difficulties at work due to hip or knee complaints (Table S3 and S4). All variables with a p-value ≤0.15 in the univariate analyses were included in the multivariable regression analyses [26]. Variables were omitted via backward selection, depending on their level of statistical significance ($p<0.05$). Preoperative patient expectation was included as control variable. Odds ratios were calculated, including 95% confidence intervals (Tables 3 and 5). All analyses were stratified for THA and TKA. IBM Statistical Package for the Social Sciences (SPSS) version 25.0 was used for analyses.

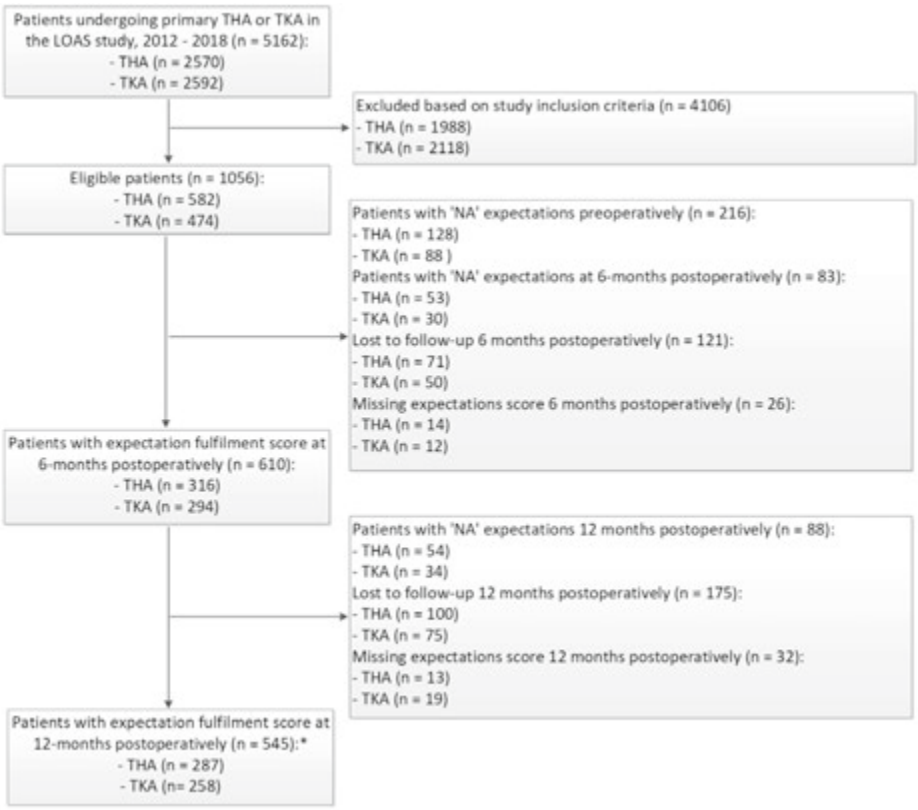

Figure 1: Flowchart study enrolment and follow-up.
From n=29 THA and n=36 TKA patients data at 6 months postoperatively was missing, but data at 12 months postoperatively was available.
THA = total hip arthroplasty; TKA = total knee arthroplasty; LOAS = Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study; NA = not applicable.

Results

In total, 1056 working-age patients (n=582 THA, n=474 TKA) were eligible. Patients answering "not applicable" to the preoperative (n=128 THA; n=88 TKA) or postoperative expectation question were excluded (6 months postoperatively: n=53 THA; n= 30 TKA; 12 months postoperatively: n=54 THA; n= 34 TKA). The majority of these excluded patients were male (60%) and performed mainly mental work tasks (50%). Eventually, n=368 THA and n=326 TKA patients were included. Figure 1 shows a flowchart of the study enrolment and follow-up. Baseline characteristics of the study sample are presented in Table 1.

Baseline characteristics of THA patients

The THA group consisted of 49% females, mean age 57 years (SD 7). Preoperatively, 94% (n=345) expected a "back to normal" and 6% (n=23) expected a "not back to normal" paid employment.

Baseline characteristics of TKA patients.

The TKA group consisted of 56% females, mean age 58 years (SD 5). Preoperatively, 84% (n=275) expected a "back to normal" and 16% (n=51) expected a "not back to normal" paid employment.

Table 1: Baseline study population characteristics of total hip arthroplasty (THA) and total knee arthroplasty (TKA) patients

	THA		TKA	
	Expectation towards paid employment		Expectation towards paid employment	
Variables	**Back to normal (N=345)**	**Not back to normal (N=23)**	**Back to normal (N=275)**	**Not back to normal (N=51)**
Sociodemographic factors				
Age (years), mean (SD)	57 (6)	56 (7)	58 (5)	57 (6)
Sex (number of female), % (n)	50% (172)	44% (10)	56% (154)	53% (27)
Partner (yes), % (n)	79% (273)	78% (18)	78% (213)	77% (39)
Health-related factors				
BMI (kg/m^2), mean (SD)	27 (4)	28 (3)	30 (5)	30 (5)
Comorbidity, % (n)				
- Musculoskeletal (yes)	48% (165)	61% (14)	42% (116)	45% (23)
- Non-musculoskeletal (yes)	52% (180)	61% (14)	63% (173)	61% (31)
ASA classification, % (n)				
- ASA-1	31% (107)	30% (7)	15% (42)	18% (9)
- ASA-2	63% (218)	57% (13)	77% (211)	73% (37)
- ASA-3	5% (18)	13% (3)	7% (20)	4% (2)
HOOS -PS / KOOS-PS, mean (SD)[a]	45 (17)	43 (19)	41 (16)	38 (17)
Health related QOL, mean (SD)[a]				
- SF12 PCS	32 (9)	30 (8)	31 (9)	31 (8)
- SF12 MCS	54 (10)	46 (12)	55 (10)	52 (10)

Table 1: *Continued.*

	THA		TKA	
	Expectation towards paid employment		Expectation towards paid employment	
Variables	**Back to normal (N=345)**	**Not back to normal (N=23)**	**Back to normal (N=275)**	**Not back to normal (N=51)**
Work-related factors				
Self-employed (yes), % (n)	16% (55)	17% (4)	9% (25)	8% (4)
Working hours preop (per week), mean (SD)	32 (12)	32 (12)	31 (11)	29 (14)
Work tasks % (n)				
- Physical	19% (65)	17% (4)	23% (64)	22% (11)
- Mental	37% (126)	17% (4)	26% (70)	22% (11)
- Both	44% (152)	65% (15)	51% (140)	57% (29)
Sick leave 1 month preop (yes), % (n)	26% (88)	30% (7)	30% (83)	35% (18)
Difficulties at work due to hip/knee (yes), % (n)	84% (289)	96% (22)	91% (250)	94% (48)

Data are represented as mean with standard deviation (SD) or percentages (%) and numbers (n).
Patients were included if they had specified their preoperative expectation and specified either their 6- or 12-month expectation fulfilment question.
[a]All scales ranged from 0 to 100; higher scores indicated better outcomes.
BMI = body mass index; HOOS-PS = Hip injury and Osteoarthritis Outcome Score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score – Physical function Short form; QOL= quality of life; SF-12= short form-12; PCS = Physical Component Summary; MCS= Mental Component Summary; preop = preoperatively

Expectation fulfilment of THA patients

Six months p ostoperatively, 75% (n=237) of patients had fulfilled expectations and 3 % (n=7) of them exceeded their expectations, increasing 12 months postoperatively to 83% (n=239) and 4% (n=10), respectively. Six months postoperatively, 82% of patients with unfulfilled and 96% of patients with fulfilled expectations actually returned to work, increasing 12 months postoperatively to 88% and 98%, respectively. Preoperatively, mean expected time to RTW was 11 weeks for patients with unfulfilled and 7 weeks for patients with fulfilled expectations. Actual mean time to RTW was 12 weeks for patients with unfulfilled and 9 weeks for patients with fulfilled expectations.

Potential risk factors stratified for fulfilment are shown in Tables S1 and S2. Six months postoperatively, five factors were below the cut-off value in the univariate analyses and were therefore used in the multivariate analyses (preoperative HOOS-PS, postoperative HOOS-PS, work tasks, preoperative sick leave, postoperative difficulties at work due to hip complaints; Table S3). Better postoperative physical functioning (HOOS-PS) scores increased the likelihood of fulfilment at 6 months postoperatively (OR 1.10, 95%CI 1.06 – 1.14). Physical work tasks (reported in 23%; OR 0.12, 95%CI 0.03–0.44) and postoperative difficulties at work due to hip complaints (reported in 41%; OR 0.10, 95%CI 0.03–0.35) decreased the likelihood of fulfilment (Table 2).

Twelve months postoperatively, seven factors were below the cut-off value in the univariate analyses (age, musculoskeletal comorbidity, preoperative HOOS-PS, postoperative HOOS-PS, work tasks, preoperative sick leave, postoperative difficulties at work due to hip complaints; Table S4). Higher age (OR 1.08, 95%CI 1.02–1.15) and better postoperative physical functioning (OR 1.11, 95%CI 1.07–1.14) increased the likelihood of fulfilment. Physical work tasks (OR 0.15, 95%CI 0.04–0.60) and a combination of work tasks (OR 0.14, 95%CI 0.04–0.46) decreased the likelihood of fulfilment (Table 3). Sensitivity analyses showed that a lower proportion of patients aged ≤55 had fulfilled expectations compared to those aged ≥56.

Table 2: Multivariable logistic regression analyses for the outcome postoperative fulfilment of expectations towards paid employment 6 months after total hip arthroplasty (THA) and total knee arthroplasty (TKA)

	THA		TKA	
Variables	**OR**	**95% CI**	**OR**	**95% CI**
Age (years)	-	-	1.08	1.01–1.15
HOOS-PS/ KOOS-PS postop[a]	1.10	1.06–1.14	1.03	1.01–1.06
Work tasks				
- Physical (ref = mental)	0.12	0.03–0.44	-	-
- Both (ref = mental)	0.43	0.15–1.26	-	-
Sick leave preop (ref=no)	-	-	0.33	0.17–0.65
Difficulties at work due to hip/knee (ref=no)	0.10	0.03–0.35	0.41	0.17–0.98

Adjusted for preoperative expectation.
[a]Scales ranged from 0 to 100; higher scores indicated better outcomes
HOOS-PS = Hip injury and Osteoarthritis Outcome Score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score - Physical function Short form; ref = reference category; Preop = preoperatively; Postop = postoperatively.

Expectation fulfilment of TKA patients

Six months postoperatively, 72% (n=211) of patients had fulfilled expectations, with 8% (n=17) exceeding their expectations; this percentage increased to 79% (n=204) and 9% (n=18), respectively, at 12 months postoperatively. Six months postoperatively, 81% of patients with unfulfilled and 95% of patients with fulfilled expectations actually returned to work, increasing 12 months postoperatively to 85% and 98%, respectively. Preoperatively, mean expected time to RTW was 11 weeks for patients with unfulfilled and 9 weeks for patients with fulfilled expectations. Actual mean time to RTW was 13 weeks for patients with unfulfilled and 11 weeks for patients with fulfilled expectations.

Potential risk factors stratified for fulfilment are shown in Tables S1 and S2. Six months postoperatively, seven factors were below the cut-off value in the univariate analyses and therefore used in the multivariate analyses (age, musculoskeletal comorbidity, preoperative KOOS-PS, postoperative KOOS-PS, work tasks, preoperative sick leave, postoperative difficulties at work due to knee complaints; Table S3). Higher age (OR 1.08, 95%CI 1.01–1.15) and better postoperative physical functioning (KOOS-PS) scores (OR 1.03, 95%CI 1.01–1.06) increased the likelihood of fulfilment. Preoperative sick leave (reported in 31%; OR 0.33, 95%CI 0.17–0.65) and postoperative difficulties at work due to knee complaints (reported in 56%; OR 0.41, 95%CI 0.17–0.98) decreased the likelihood

of fulfilment (Table 2). Sensitivity analyses showed that a lower proportion of patients aged ≤55 had fulfilled expectations compared to those aged ≥56.

Twelve months postoperatively, six factors were below the cut-off value in the univariate analyses (musculoskeletal comorbidity, preoperative KOOS-PS, postoperative KOOS-PS, work tasks, preoperative sick leave, postoperative difficulties at work due to knee complaints; Table S4). Better postoperative physical functioning (OR 1.11. 95%CI 1.07–1.14) increased the likelihood of fulfilment. Physical work tasks (OR 0.20, 95%CI 0.06–0.69) decreased the likelihood of fulfilment (Table 3).

Table 3: Multivariable regression analyses for the outcome postoperative fulfilment of expectations towards paid employment 12 months after total hip arthroplasty (THA) and total knee arthroplasty (TKA)

		THA		TKA
Variables	**OR**	**95% CI**	**OR**	**95% CI**
Age (years)	1.08	1.02–1.15	-	-
HOOS-PS/ KOOS-PS postop[a]	1.11	1.07–1.14	1.11	1.07–1.14
Work tasks				
- Physical (ref = mental)	0.15	0.04–0.60	0.20	0.06–0.69
- Both (ref = mental)	0.14	0.04–0.46	0.64	0.20–2.30

Adjusted for preoperative expectation.
[a]Scales ranged from 0 to 100; higher scores indicated better outcomes
HOOS-PS = Hip injury and Osteoarthritis Outcome Score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score - Physical function Short form; Ref = reference category; Postop = postoperatively.

Discussion

This study investigated factors associated with fulfilment of patient expectations towards paid employment after THA or TKA at 6 and 12 months postoperatively. Six months after THA, 75% of patients had fulfilled expectations, increasing to 83% at 12 months postoperatively. Six months after TKA, 72% of patients had fulfilled expectations, increasing to 79% at 12 months postoperatively. Preoperative factors associated with fulfilment were older age, mental work tasks (compared to physical work tasks), and no sick leave due to knee complaints (only at 6 months postoperatively). Postoperative factors associated with fulfilment were better physical functioning, and no difficulties at work due to hip or knee complaints (only at 6 months postoperatively).

In our study, the majority of patients had high preoperative expectations towards paid employment, which is in line with the results of previous studies among THA and TKA patients [5,9,27]. The proportion of fulfilled expectations towards paid employment we found is also in line with previous literature among THA and TKA patients [10,11]. Patient-specific education might create more realistic expectations on outcome, resulting in satisfaction and better postoperative outcomes of THA/TKA patients, and thus fulfilment of preoperative expectations [9,28,29].

We found that older age was associated with fulfilment 6 months after TKA and 12 months after THA. In-depth analyses showed that a lower proportion of patients aged ≤55 had fulfilled expectations compared to those aged ≥56. Results on the association between age and fulfilment among arthroplasty patients are conflicting [11,30]. One study among TKA patients did not find an association [11], another study suggested that younger age of only THA patients, but not TKA patients, was associated with general fulfilment [30]. The contradictory results could be attributed to inclusion of all age groups, resulting in a different age distribution and also in a higher average age. Differences in methods (measurement of fulfilment and investigating overall or general fulfilment) and measurements at only 12 months postoperatively could also account for the contradiction.

Our results showing that better postoperative physical functioning after both THA and TKA was associated with fulfilled expectations, were in accordance with studies focusing on overall or general fulfilment after THA or TKA [10,30].

Our study showed that preoperative sick leave decreased the likelihood of fulfilment after TKA at 6 months postoperatively. Patients who performed mainly physical tasks were less likely to have fulfilled expectations (THA at 6 and 12 months postoperatively, TKA at 12 months postoperatively). Also, both THA and TKA patients with postoperative difficulties at work due to hip or knee complaints were less likely to have fulfilled expectations 6 months postoperatively. These results could not be compared to previous studies about expectation fulfilment, therefore further research is needed to confirm our results. Still, it is known that these factors also influence RTW outcomes after THA and TKA [31–35].

In a previous study on sex differences in expectations after THA and THA we found that both preoperative expectations and their fulfilment was higher in men then in women [36]. In our current study sex was not identified as a risk factor for fulfilment for paid employment. The conflicting results are probably due to the difference in study population, our study only included working-age patients with preoperative paid employment whereas the previous study also included older patients (age >64) and without preoperative paid employment.

Implications

Patients beliefs and expectations have been linked to RTW among THA and TKA patients [37–39]. However, being returned to work does not inevitably mean that patients experience good work functioning. Hence, it is important to also look beyond RTW and focus on fulfilment of expectations towards paid employment and associated factors. Orthopaedic surgeons could use the results in the shared-decision making process for THA/TKA, to preoperatively manage patient expectations, and to assess whether additional RTW guidance is necessary. Further research is needed to unravel fulfilment of expectations towards paid employment. Furthermore, the results show that some factors influencing fulfilment may be modifiable (i.e. work tasks, difficulties at work due to hip or knee complaints) and could be targeted by the occupational physician or the employer. Our results thus suggest that orthopaedic surgeons, occupational physicians and employers may contribute to address those patients prone to unfulfillment.

Strengths & limitations

A strength of this study is its design, with outcome measures at both 6 and 12 months postoperatively and a relatively large sample size. Also, our study population resembles the population in the Dutch Arthroplasty Register (LROI) based on ASA-classification and BMI [6]. The proportion of females in our study was lower compared to the Dutch Arthroplasty Register, which might be the result of fewer females having paid work in general. However, in the LOAS the proportion females is the same as in the Dutch Arthroplasty Register, therefore, generalizability of the results to the Dutch arthroplasty population is another strength.

Study limitations included the self-reported data used in the study. BMI was derived from self-reported body height and weight which may have introduced extra measurement error. The assessment of patient expectations and their fulfilment, which was measured with only one item of the validated HSS questionnaire. However, there is no questionnaire specifically focussing on expectations towards paid employment. The HSS questionnaire was originally developed to assess preoperative expectations [25], yet other studies have used the same approach to determine postoperative fulfilment [10,12,30]. The majority of patients who were lost to follow-up were male and performed mainly mental work tasks. Male sex has previously been linked to loss to follow-up [40]. The loss to follow-up of patients with mainly mental work tasks might have diluted our results to some extent. Last, it remains unknown why patients answered "not applicable", since they all were of working-age and had a paid job preoperatively. The majority of these patients performed mainly mental work tasks (THA 56%;

TKA 43%) and a lower proportion was preoperatively on sick leave (THA 9%; TKA 9%). It could be that these patients had no expectations or expected deterioration, or that their osteoarthritis complaints did not affect their work and therefore had no expectations.

Conclusions

This study illustrates that only three out of four THA or TKA patients have fulfilled expectations 6 months after surgery. Older age, mental work tasks, no preoperative sick leave, better postoperative physical functioning, and no postoperative difficulties at work were identified as factors that increased the likelihood of fulfilment of patient expectations towards paid employment after THA or TKA. Further quantitative and qualitative research is necessary to explore which factors influence patient expectation fulfilment towards paid employment, to eventually design and implement effective targeting strategies to appropriately address and support those prone to unfulfillment, and to better match preoperative expectations and postoperative fulfilment after THA or TKA.

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Table S1: Analyses for the outcome postoperative fulfilment of expectations towards paid employment 6 months after total hip arthroplasty (THA) or total knee arthroplasty (TKA)

	THA (N=316)			TKA (N=294)		
Expectations towards paid employment	**Unfulfilled (n=79, 25%)**	**Fulfilled/ exceeded (n=237, 75%)**	**P-value**	**Unfulfilled (n= 83, 28%)**	**Fulfilled/ exceeded (n=211, 72%)**	**P-value**
Sociodemographic factors						
Age (years), mean (SD)	56 (6)	57 (4)	0.22	57 (5)	58 (4)	0.00
Sex (female)	56%	47%	0.19	63%	55%	0.26
Health-related factors						
Comorbidity - Musculoskeletal (yes) - Non-musculoskeletal (yes)	56% 56%	47% 51%	0.19 0.47	51% 66%	39% 61%	0.07 0.35
HOOS-PS/KOOS-PS preop, mean (SD)	42 (16)	45 (18)	0.14	44 (8)	42 (16)	0.05
HOOS-PS/KOOS-PS 6 months postop[a], mean (SD)	68 (15)	86 (13)	0.00	57 (18)	68 (13)	0.00
Work-related factors						
Work tasks - Physical - Mental - Both	25% 19% 56%	17% 43% 39%	0.00	29% 13% 58%	19% 31% 51%	0.00
Sick leave 1month preop (yes)	42%	22%	0.00	45%	24%	0.00
Difficulties at work due to hip/knee 6 months postop (yes)	79%	35%	0.00	71%	55%	0.00
RTW (yes)	82%	96%	0.00	81%	95%	0.00
Expected time to RTW (weeks), mean (SD)	11 (7)	7 (5)	0.00	11 (5)	9 (6)	0.01

Table S1: *Continued.*

	THA (N=316)			TKA (N=294)		
Expectations towards paid employment	**Unfulfilled (n=79, 25%)**	**Fulfilled/ exceeded (n=237, 75%)**	**P-value**	**Unfulfilled (n= 83, 28%)**	**Fulfilled/ exceeded (n=211, 72%)**	**P-value**
Actual time to RTW (weeks), mean (SD)	12 (5)	9 (5)	0.00	13 (8)	11 (5)	0.06

Data are presented as mean with standard deviation (SD), or as percentages.
[a]Scales ranged from 0 to 100; higher scores indicated better outcomes.
HOOS-PS = Hip injury and Osteoarthritis Outcome Score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score – Physical function Short form; preop = preoperatively; postop = postoperatively; RTW = return to work.

Table S2: Analyses for the outcome postoperative fulfilment of expectations towards paid employment 12 months after total hip arthroplasty (THA) or total knee arthroplasty (TKA)

	THA (N=287)			TKA (N=258)		
Expectations towards of paid employment	**Unfulfilled (n=49, 17%)**	**Fulfilled/ exceeded (n=238, 83%)**	**P-value**	**Unfulfilled (n=54, 21%)**	**Fulfilled/ exceeded (n=204, 79%)**	**P-value**
Sociodemographic factors						
Age (years), mean (SD)	54 (7)	57 (6)	0.01	58 (4)	58 (5)	0.93
Sex (female)	53%	48%	0.46	51%	56%	0.60
*H*ealth-related *factors*						
Comorbidity	61%	45%	0.04	52%	40%	0.12
- Musculoskeletal (yes)	59%	51%	0.28	59%	60%	0.94
- Non-musculoskeletal (yes)						
HOOS-PS/KOOS-PS preop[a], mean (SD)	39 (19)	46 (17)	0.03	34 (18)	43 (15)	0.00
HOOS-PS/KOOS-PS 12 months postop[a], mean (SD)	70 (15)	89 (11)	0.00	56 (14)	73 (13)	0.00
Work-related factors						
Work tasks	25%	14%	0.00	37%	18%	0.01
- Physical	12%	43%		13%	24%	
- Mental	63%	42%		48%	58%	
- both						
Sick leave 1month preop (yes)	37%	21%	0.02	52%	25%	0.00
Difficulties at work due to hip/knee 12 months postop (yes)	67%	18%	0.00	44%	22%	0.00
RTW (yes)	88%	98%	0.00	85%	98%	0.00

Table S2: *Continued.*

	THA (N=287)			TKA (N=258)		
Expectations towards of paid employment	**Unfulfilled (n=49, 17%)**	**Fulfilled/ exceeded (n=238, 83%)**	**P-value**	**Unfulfilled (n=54, 21%)**	**Fulfilled/ exceeded (n=204, 79%)**	**P-value**
Expected time to RTW (weeks), mean (SD)	11 (7)	8 (4)	0.00	13 (10)	10 (6)	0.03
Actual time to RTW (weeks), mean (SD)	15 (13)	11 (12)	0.17	13 (5)	12 (6)	0.44

Data are presented as mean with standard deviation (SD) or as percentages.
[a]Scales ranged from 0 to 100; higher scores indicated better outcomes.
HOOS-PS = Hip injury and Osteoarthritis Outcome Score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score – Physical function Short form; preop = preoperatively; postop = postoperatively; RTW= return to work.

Table S3. Univariate regression analyses for the outcome postoperative fulfilment of expectations towards paid employment 6 months after total hip arthroplasty (THA) and total knee arthroplasty (TKA)

	THA			TKA		
Variables	**OR**	**95% CI**	**P-value**	**OR**	**95% CI**	**P-value**
Age (years)	1.03	0.99–1.07	0.21	1.09	1.03–1.15	0.00
Sex (ref = male)	0.71	0.43–1.19	0.20	0.74	0.44–1.26	0.27
Musculoskeletal comorbidity (ref = no)	0.72	0.43–1.21	0.22	0.62	0.37–1.03	0.06
Non-musculoskeletal comorbidity (ref = no)	0.85	0.51–1.42	0.52	0.77	0.45–1.32	0.35
HOOS-PS/ KOOS-PS preop[a]	1.01	1.00–1.03	0.14	1.02	1.00–1.03	0.05
HOOS-PS/ KOOS-PS postop[a]	1.10	1.07–1.13	0.00	1.05	1.03–1.07	0.00
Work tasks						
- physical (ref = mental)	0.31	0.14–0.66	0.00	0.27	0.12–0.62	0.00
- Both (ref = mental)	0.32	0.17–0.61	0.00	0.38	0.19–0.79	0.01
Sick leave preop (ref=no)	0.39	0.22–0.67	0.00	0.37	0.21–0.63	0.02
Difficulties at work due to hip/knee postop (ref=no)	0.06	0.02–0.14	0.00	0.22	0.10–0.47	0.00

Adjusted for preoperative expectation.
[a]All scales ranged from 0 to 100; higher scores indicated better outcomes
HOOS-PS = Hip injury and Osteoarthritis Outcome score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score - Physical function Short form; Ref= reference category; preop = preoperatively; postop = postoperatively.

Table S4. Univariate regression analyses for the outcome postoperative fulfilment of expectations towards paid employment 12 months after total hip arthroplasty (THA) and total knee arthroplasty (TKA)

	THA			TKA		
Variables	**OR**	**95% CI**	**P-value**	**OR**	**95% CI**	**P-value**
Age (years)	1.06	1.02–1.11	0.01	1.00	0.93–1.07	0.97
Sex (ref = male)	0.81	0.44–1.51	0.51	1.23	0.67–2.25	0.51
Musculoskeletal comorbidity (ref = no)	0.51	0.27–0.97	0.04	0.63	0.34–1.16	0.14
Non-musculoskeletal comorbidity (ref = no)	0.71	0.38–1.32	0.27	1.03	0.56–1.91	0.92
HOOS-PS/ KOOS-PS preop[a]	1.02	1.00–1.04	0.02	1.04	1.02–1.06	0.00
HOOS-PS/ KOOS-PS postop[a]	1.10	1.07–1.13	0.00	1.10	1.07–1.14	0.00
Work tasks						
- Physical (ref = mental)	0.17	0.06–0.48	0.00	0.27	0.10–0.70	0.01
- Both (ref = mental)	0.18	0.07–0.46	0.00	0.65	0.26–1.61	0.35
Sick leave preop (ref=no)	0.45	0.23–0.88	0.02	0.29	0.16–0.55	0.00
Difficulties at work due to hip/knee postop (ref=no)	0.06	0.03–0.16	0.00	0.17	0.06–0.48	0.00

Adjusted for preoperative expectation.
[a]All scales ranged from 0 to 100; higher scores indicated better outcomes
HOOS-PS = Hip injury and Osteoarthritis Outcome Score – Physical function Short form; KOOS-PS = Knee injury and Osteoarthritis Outcome Score - Physical function Short form; Ref = reference category; preop = preoperatively; postop = postoperatively.

General discussion

8

The overall aim of this thesis was to gain insight into the role of system-related factors (i.e. healthcare- and social security systems, clinical guidelines and practices) and work-related factors (i.e. workplace characteristics, physical- and psychosocial working conditions, work adjustments) on return to work (RTW), as well as to identify factors associated with fulfilment of patient expectations towards paid employment after total hip arthroplasty (THA) or total knee arthroplasty (TKA). This chapter summarises and reflects on the main findings, and presents methodological considerations. Implications for clinical practice and policy plus recommendations for research are provided.

System-related factors

The first part of this thesis (**Chapters 2 and 3**) explored the role of system-related factors in the RTW process of working-age THA and TKA patients. In **Chapter 2** we conducted a semi-structured expert meeting among a group of orthopaedic surgeons and occupational physicians and discussed the perceived barriers and facilitators in guiding the RTW process of working-age THA and TKA patients. The findings revealed that both orthopaedic surgeons and occupational physicians experience several barriers: inadequate expectation management; a mismatch between a patient's occupation and the physical limitations remaining after THA or TKA; consulting an occupational physician only in a later phase; and differences in vision between physician and patient regarding the possibilities in functioning. Based on these findings the orthopaedic surgeons and the occupational physicians concluded that to optimise the RTW process several changes are needed. More intensive and structural contact between both healthcare professional groups, preoperative contact between patient and occupational physician, advice from the orthopaedic surgeon regarding RTW, and adequate expectation management may help improve the RTW guidance of these patients. Hence, intensive and structural contact between orthopaedic surgeons and occupational physicians in a well-connected care chain is the challenge for the future to improve counselling throughout the RTW process of Dutch arthroplasty patients.

In **Chapter 3** we gave an overview of current RTW policies and practices in three European countries with their own specific healthcare and social security system: Denmark, Germany and the Netherlands. The study covered three aspects (1) description of the organisation of the healthcare systems and social security systems in the different countries based on desk research; (2) identification of national RTW guidelines through expert consultations; and (3) to gain insight into RTW practices and perceptions of orthopaedic surgeons, including barriers and facilitators they experience by conducting a web-based survey. The results illustrated considerable variation in the healthcare and social security systems

(e.g. fast track vs longer postoperative stay; coverage of rehabilitation costs). National RTW guidelines were only available in Germany (THA and TKA) and the Netherlands (TKA), and contained limited information. Overall, orthopaedic surgeons reported needing more knowledge and better collaboration with other healthcare practitioners to adequately guide the RTW process. Development of multidisciplinary guidelines for RTW after THA or TKA made by the national associations of the involved healthcare practitioners could be a first step towards helping fulfil the need of orthopaedic surgeons for more knowledge and better collaboration with other healthcare practitioners.

Work-related factors

In the second part of this thesis (**Chapters 4-6**) the associations between different work-related factors and RTW among working-age THA and TKA patients were studied. **Chapter 4** identified the influence of workplace characteristics (e.g. working hours, job tasks), physical working conditions (e.g. standing, walking), psychosocial working conditions (e.g. work pace, job satisfaction), and work adjustments (e.g. lighter duties, shorter hours) on time to RTW. It was found that, besides the workplace characteristic type of job tasks (mainly physical and a combination of physical and mental tasks), psychosocial working conditions were the key factors associated with time to RTW within 12 months postoperatively. The findings suggest overall that possibilities for personal job development, more work recognition and high quality of supervisor leadership are important factors towards RTW after arthroplasty for both THA and TKA patients. We did not find an association between physical working conditions and time to RTW, which may suggest that psychosocial working conditions are more important in the RTW process than physical working conditions.

Chapter 5 allowed for a more in-depth analysis on the influence of perceived work-related social support from home (friends, family), from work (co-workers, supervisors), and from healthcare professionals (occupational physician, general practitioner, other caregivers). Our findings showed that perceived social support from the supervisor and the occupational physician predicted RTW 6 months postoperatively. Social support from home was not associated with RTW. These results implicate the role of workplace support in the RTW process of TKA and THA patients, as both occupational physicians and supervisors are linked to the workplace.

In **Chapter 6** we investigated the distribution of occupational class and the association between occupational class and time to RTW among THA and TKA patients. Occupational class was categorised into four categories according to the International Standard Classification of Occupations 2008 (ISCO-08): high-skilled

white-collar, low-skilled white-collar, high-skilled blue-collar, and low-skilled blue-collar. It was found that low-skilled blue-collar THA workers needed about 50% longer time to RTW than high-skilled white-collar workers (median time of 94 versus 60 days). Time to RTW of high- and low-skilled blue-collar workers undergoing TKA was almost twice as high compared to high-skilled white-collar workers (median times of 120 and 127, respectively, versus 69 days). These results may suggest the importance of distinguishing between patients based on occupational class, given the clear differences in time to RTW.

Fulfilment of patient expectations

In the third part of this thesis (**Chapter 7**), we assessed the fulfilment of patient expectations towards paid employment and explored associated risk factors. Patients were asked to rate their expectations on a scale from back to normal to a slight improvement at three time points (preoperatively and 6 and 12 months postoperatively). Postoperative fulfilment of expectations (unfulfilled; fulfilled) was calculated by subtracting preoperative from postoperative scores. The results showed that patients had high expectations towards paid employment preoperatively, as almost all expected a back-to-normal paid employment. Six months after surgery, only three out of four patients had fulfilled expectations. The proportion of patients with fulfilled expectations slightly increased to approximately 80% at 12 months postoperatively. Preoperative factors associated with fulfilment were older age, mental work tasks (compared to physical work tasks), and less sick leave due to knee complaints (only at 6 months postoperatively). Postoperative factors associated with fulfilment were better physical functioning, and no difficulties at work related to the hip or knee (only at 6 months postoperatively). The results could be useful for orthopaedic surgeons, occupational physicians and employers to address those patients prone to unfulfillment.

Reflections on main findings

Despite the changing workforce dynamics and the increasing number of working-age THA and TKA patients, work is a relatively new topic in the field of orthopaedics. Over the past decades increased attention has been paid to this in scientific literature, as evidenced by the rise in publications, yet in contrast to other patient groups (e.g. workers with cancer or common mental disorders) the body of research is still limited (1,2). Increased attention has recently also been paid by orthopaedic surgeons in daily practice to this topic, given that it was considered as an evidence uncertainty in the 2019-2022 research agenda of the Dutch Orthopaedic Association (NOV). Nevertheless, the studies in this

thesis reveal that the attention currently being paid to RTW in orthopaedic practice is not yet sufficient (**Chapters 2 and 3**). Limited collaboration between orthopaedic surgeons and occupational physicians plus a lack of RTW guidelines (**Chapters 2 and 3**) stress that in terms of system-related factors opportunities exist for improvement of RTW guidance of the working-age group of THA and TKA patients. In line with our findings, another study reported that patients also experience a lack of collaboration between clinical healthcare professionals (such as orthopaedic surgeons) and occupational physicians, as they have not (yet) succeeded in complementing each other's expertise (3). To improve collaboration between professionals in RTW guidance of these patients, it may be necessary for orthopaedic surgeons and occupational physicians to work more closely together (e.g. with each other and/or physiotherapists) in order to enhance patientcare coordination and ultimately achieve better health and work outcomes (4). This aligns with the increasing focus on interprofessional collaboration aiming to deliver the highest quality of care (4,5). In the cohort studies (**Chapters 4-7**) we decided to analyse the data for both patient groups separately, since rehabilitation is faster and less complicated for THA patients than for TKA patients (6,7). Our findings showed different associations with RTW between the two patient groups for some factors. For example, higher quality of supervisor leadership was only associated with shorter time to RTW after THA, whereas more possibilities for personal job development and more work recognition were only associated with shorter time to RTW after TKA (**Chapter 4**). Differences in time to RTW between occupational classes were greater among TKA patients than among THA patients (**Chapter 6**). These differences in factors between THA and TKA patients might imply a need for a group-specific approach to RTW guidance.

Our findings showed that not only physical, but also psychosocial working conditions may affect time to RTW in both THA and TKA patients, stressing the importance of taking the latter into account too (**Chapters 4 and 5**). This is in line with various studies among other patient groups showing that psychosocial working conditions affect RTW (8–10). Our results indicate that in particular low-skilled blue-collar workers need a longer time to RTW (**Chapter 6**). These results confirm the importance of both physical- and psychosocial working conditions, as these workers tend to have strenuous working conditions, low job control and low job autonomy (11,12). Studies among general working populations suggest that it is key for workers to have a certain level of influence over their RTW to accomplish an early and sustainable RTW (13). Blue-collar workers might therefore be limited in the extent to which they can adjust their work according to their needs, which could obstruct their RTW process (14).

In line with previous studies, we found that the majority of working-age patients RTW 6-12 months postoperatively (15,16). Having returned to work does not inevitably mean that these patients have fulfilled their preoperative expectations towards paid employment. Our results showed that working-age patients planning to undergo a THA or TKA have high preoperative expectations regarding paid employment (**Chapter 7**). However, only approximately three out of four patients had fulfilled expectations 6 months postoperatively. Fulfilment of preoperative expectations has been reported as an important determinant of treatment satisfaction (17,18). Managing patient expectations has been mentioned as a conceivably effective strategy to address realistic expectations of outcome (19). In this context, orthopaedic surgeons and occupational physicians need to be aware of potential differences between individual patients' expectations and of the benefit that patients prone to unfulfilled expectations might gain from adequate preoperative expectation-management education (20–23).

Methodological considerations

This section discusses methodological considerations concerning the study samples and the quality of the obtained data.

Study populations

For this thesis we used data of two longitudinal cohort studies: "Work participation In Patients with Osteoarthritis" (WIPO; **Chapters 4 and 5**) and "Longitudinal Leiden Orthopaedics Outcomes of Osteo-Arthritis study" (LOAS; **Chapters 6 and 7**). WIPO patients were included from four hospitals in the northern part of the Netherlands. Patients included in the LOAS cohort were derived from eight hospitals in the western part of the Netherlands. Representativeness based on disease severity and patient complexity was pursued in both cohorts, as at least one general hospital, one large teaching hospital and one tertiary hospital were included. In both cohorts the retention rates during follow-up were relatively high (>77% responded at the 12-month follow-up).

We are aware that the study population in **Chapter 2** only consisted of a limited group of healthcare professionals (n=3 orthopaedic surgeons and n=3 occupational physicians), so no definitive conclusions can be drawn from the results. Still, some starting points were obtained for additional research that is desirable and needed.

In **Chapter 3**, the web-based survey used to gain insight into RTW practices and perceptions of orthopaedic surgeons was distributed to potential participants in several ways. Orthopaedic surgeons were approached via the electronic newsletter and social media of their country's respective orthopaedic association. In addition, to create a snowball sampling method, personal contacts of the research group

and respondents were asked to distribute the survey to colleagues. This snowball sampling method might have led to compromised representativeness.

Bias, measurement errors and confounding

Problems with cohort studies may arise from bias and confounding. Data in both cohorts was susceptible to information bias, as patients had to recall their date of RTW and self-reported data over a certain time period was used. The presence of measurement errors in self-reported data is a well-known phenomenon. Not all chapters in this thesis have been affected by confounding, but for example in **Chapter 6** confounding could have been an issue, as for instance socio-economic status has been linked to both occupational class and RTW (24–26). Confounding could have also occurred in **Chapters 4 and 5**, although we did adjust for main confounders such as gender, comorbidity and age.

Job type was assessed in WIPO (**Chapters 4 and 5**) and LOAS (**Chapter 6**) by asking participants if they performed a mainly mentally or mainly physically demanding job, or a combination of both mental and physical demands. A limitation of the aforementioned classification is that it does not distinguish between different levels of occupations based on educational level, as well as types of occupations (e.g. unskilled workers, operators, transporters, salespersons, managers) (27). To further refine this classification, we used the International Standard Classification of Occupations (ISCO-08) for **Chapter 6**, which enabled to create and study four occupational classes (27). Categorising occupations into different occupational classes (high/low skilled, blue/white collar) may help gain better insight into occupational factors.

Stakeholders

This thesis explored the perspectives of several key stakeholders (i.e. healthcare professionals and patients), which enabled us to shed light on the research questions from several angles to create a more complete overview compared to solely focussing on one perspective. We included the perspectives of orthopaedic surgeons (**Chapters 2 and 3**), occupational physicians (**Chapter 2**), and patients (**Chapters 4-7**). Although we have taken a first step in exploring the perspectives of these key stakeholders, we did not include all stakeholders. For example, the perspective of insurers might be valuable since they have to determine whether and how interventions to support RTW of THA and TKA patients should be reimbursed.

Implications for clinical practice and policy and recommendations for research

Research in this thesis adds unique and important insights into working-age patients undergoing THA or TKA. Based on the findings, several suggestions for clinical practices and policies plus recommendations for research can be made, which will be presented in the following section.

Implications for healthcare professionals

An important goal of healthcare is to enable optimal participation in society, including work (28). THA and TKA are considered to be among the most effective and successful medical procedures that can lead to an improved quality of life (29,30). The rapidly growing group of working-age THA and TKA patients warrants the raw need to also focus on RTW as treatment outcome. Elective surgical procedures appear to be a perfect, timely opportunity for healthcare professionals to create a RTW strategy. Hence, orthopaedic care may have the potential to support work participation of the growing working-age patient group (31). However, currently work-related matters may not be adequately addressed in care for this patient group (3,32). It is therefore important to focus more on the work-related challenges THA and TKA patients may experience in orthopedic care. Orthopedic surgeons and other associated healthcare professionals (e.g., physician assistants, nurses, physiotherapists) may play an important role in timely preparation of these patients for possible interference of the surgery with work and in signalling other potential concerns related to work participation (33,34). They could also refer patients planning to undergo a THA or TKA to appropriate work-oriented support outside the hospital. However, current guidance and support in terms of RTW for THA and TKA patients is suboptimal, and to date work-oriented care in hospitals is lacking (35–37). More structural contact and cooperation between orthopaedic professionals and occupational healthcare organisations may help optimise counselling throughout the RTW process of THA and TKA patients; this could support patients with their work-related concerns by complementing each other's expertise (3), and ultimately improve rehabilitation and RTW of THA and TKA patients (38). Special attention should be paid to blue-collar workers by addressing the expected longer time to RTW in order to arrive at realistic expectations of workers about the sick leave duration and the RTW process. Development and implementation of work-oriented clinical care showed to be successful for patients with renal disease in University Medical Center Groningen (UMCG) (39), and could be a promising next step to improve guidance and support in terms of RTW for THA and TKA patients.

Implications for employers

In the Netherlands, employers have a key role in facilitating the RTW process of THA and TKA patients, as they are responsible for guiding and facilitating the RTW of patients on sick leave (40). Strong evidence indicates that perceived social support from work is an important determinant in the RTW process among a variety of working populations, while a lack of support from the employer hampers the RTW process (41). Employers could play a considerable role in initiating effective support strategies, such as accommodations, in agreement with the occupational physician (41–43). Work accommodations showed to decrease time to RTW and improve functioning at work (44–46). Therefore, employers should be aware of the possible important role of the work environment in the RTW process of workers after THA or TKA. This may be particularly important for low-skilled blue-collar workers, as it may be difficult to implement work adaptations (47). Employers could focus on giving voice to those workers and empowering them to obtain control over their RTW (13). To strengthen their supportive role towards THA and TKA patients, employers could aim to optimise their leadership and communication during the RTW process (48) and/or the organisational culture to facilitate employees' needs (e.g. increase job control and recognition) (49,50).

Implications for policymakers and professional associations

The findings of this thesis suggest that it is necessary to provide more knowledge about and expertise with work/RTW after THA or TKA to healthcare professionals that provide care to this patient group. This is in line with findings of the Dutch Orthopaedic Association (NOV), since the topic was considered as an evidence uncertainty in the 2019-2022 research agenda. We therefore advise professional associations in the Netherlands (NOV, Dutch Association of Occupational Medicine (NVAB), Royal Dutch Society for Physical Therapy (KNGF)) to stress among all stakeholders that this topic needs attention. To align the information provided by the different stakeholders and create a well-connected care chain, we recommend that a vision on work-oriented care of this patient group be developed. One way to achieve this would be by addressing the topic in multidisciplinary guidelines and education for healthcare providers, in which interprofessional collaboration is specifically addressed and preferably facilitated.

Recommendations for future research

This thesis focussed on RTW outcomes after THA or TKA. However, we did not consider the time period after RTW. Also, other studies mainly examined first time of RTW with a maximum follow-up of 1-2 years. Hence uncertainties exist about sustainable RTW and recurrence of work absences after first time of RTW.

Future studies should include longer (>2 years) follow-up periods to investigate and ensure sustainable RTW. THA and TKA patients should preferably be followed until their retirement, to explore their needs to remain in paid employment from surgery to retirement. Special attention should be paid to blue-collar workers, as it is known that they are at risk for premature exit from the labour market (51).

Since returning to work does not necessarily imply a restored work functioning, research should likewise focus on work functioning and fulfilment of patient expectations. The concept of work functioning was established for assessing the performance of tasks after a worker returned to work, and reflects the interaction between health and work (52,53). Good work functioning occurs when workers experience no difficulties meeting all their work demands (52,53). Insight into work functioning and its associated factors is important to promote sustainable RTW. Investigating how THA or TKA patients function at work after RTW is important for all stakeholders (e.g. orthopaedic surgeons, occupational physicians, employers, physiotherapist, patients). With regard to expectations and fulfilment of expectations, future studies should focus on the underlying reasons that could explain why some patients have fulfilled expectations towards paid employment and others do not. Investigating the link between work functioning and fulfilled expectations could also help understand work participation after THA or TKA. With this knowledge, patients in need of additional guidance and support after returning to work can be identified and receive adequate guidance and support.

Multiple stakeholders play a role in the RTW process: healthcare providers, employers, workers, insurers, and policymakers (54). This important role spans multiple systems – health, work and social (55). However, those stakeholders may have different interests depending on their organisational goals. For example, occupational physicians fulfil the task of gatekeeper in the Dutch social security system resulting in (some) orthopaedic surgeons not considering RTW guidance as a part of their main tasks (**Chapter 3**). Investigating these multisystem interactions and how these ideally can be used in a RTW intervention strategy should be addressed in future studies. Previous studies among other populations (i.e. workers with musculoskeletal or pain-related conditions, cardiovascular diseases, mental disorders) indicated that these multidisciplinary interventions have the potential to reduce work disability duration and associated costs (42,56–58). This thesis indicates that such a RTW intervention strategy should address THA and TKA patients separately.

Conclusion

This thesis adds an overview of evidence about the role of system-related and work-related factors on time to RTW after THA or TKA, and fulfilment of patient expectations towards paid employment. An important finding is that there seems to be limited attention to RTW in orthopaedic departments, there appears to be limited cooperation between healthcare professionals, guidelines are scarce and, when available, contain limited information. Furthermore, it was found that not only physical but also psychosocial working conditions may be important for the duration until RTW, i.e. in particular low-skilled blue-collar workers needed a longer time to RTW. Moreover, possibilities for personal job development, more work recognition, high quality of supervisor leadership, and social support facilitated RTW. We also found that six months after surgery only three out of four patients had fulfilled expectations. Some factors influencing fulfilment may be modifiable (i.e. work tasks, difficulties at work due to hip or knee complaints) and could be targeted by the occupational physician or the employer. Based on these findings it is recommended that a vision on work-oriented care of this patient group be developed, for example by addressing the topic in multidisciplinary guidelines. Identifying and implementing a cost-effective multidisciplinary RTW intervention strategy to facilitate sustainable RTW is the challenge for future research. The importance of this is underlined by the increasing numbers of THAs and TKAs among working-age patients for whom participating in work is of critical importance, and the rising retirement age.

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Appendices

A

Summary

With a rising rate anticipated to be the fastest among all chronic disorders in the Netherlands, osteoarthritis (OA) is expected to become the most prevalent chronic disorder in the country by 2040. For end-stage hip or knee OA, total hip or knee arthroplasty (THA/TKA) is considered the most cost-effective treatment to reduce pain and improve function. Demand for arthroplasties is increasing, and individuals of working-age in particular represent a growing proportion of those undergoing a THA or TKA. The ongoing increase of working-age patients induces a shift in rehabilitation and recovery demands. For this expanding patient group, return to work (RTW) and the ability to participate in work after surgery is becoming an increasingly important treatment goal. Up to now, most studies among THA or TKA patients focused on personal factors associated with RTW. System-related factors and work-related factors affecting RTW after THA or TKA have only been investigated in a limited number of studies. Furhtermore, to gain better understanding of a successful RTW process it is also important to look beyond RTW and focus on fulfilment of expectations towards paid employment.

For that, the overall aim of this thesis is to expand our knowledge on the role of system-related factors and work-related factors on RTW, and to identify factors associated with fulfilment of patient expectations towards paid employment for the growing group of working-age THA and TKA patients.

The specific research aims were:

1. To gain insight into national and international RTW policies and practices used and conducted by healthcare professionals treating working-age THA and TKA patients; (Chapters 2 and 3)
2. To study the association between work-related factors and RTW/time to RTW among working-age THA and TKA patients; (Chapters 4, 5 and 6)
3. To identify factors associated with fulfilment of patient expectations towards paid employment among working-age THA and TKA patients. (Chapter 7)

Chapter 2 describes a semi-structured expert meeting with three orthopaedic surgeons and three occupational physicians in the Netherlands to discuss their barriers in guiding the RTW process of working-age THA and TKA patients. The findings revealed that both orthopaedic surgeons and occupational physicians experience the following barriers: inadequate expectation management; a mismatch between the patients' occupation and the physical limitations remaining after THA or TKA; consulting an occupational physician only in a later phase; and differences in vision between physician and patient regarding the possibilities

in functioning. Based on the findings the orthopaedic surgeons and occupational physicians concluded that in order to optimise the RTW process several changes are needed: more intensive and structural contact between both healthcare professionals, preoperative contact between patient and occupational physician, advice from the orthopaedic surgeon regarding RTW, and adequate expectation management.

Chapter 3 presents an exploratory study that provides an overview of current RTW policies and practices in three European countries with their own specific healthcare and social security systems: Denmark, Germany and the Netherlands. The study consisted of three aspects (1) description of the organisation of the healthcare systems and social security systems based on desk research; (2) identification of national RTW guidelines through expert consultations; and (3) gaining insight into RTW practices and perceptions of orthopaedic surgeons, including barriers and facilitators they experience by conducting a web-based survey. The results illustrated that healthcare and social security systems differed on several aspects (i.e., fast-track vs longer post-operative stay; coverage of rehabilitation costs; length of income replacement by the employer). National guidelines were only available in Germany (THA and TKA) and the Netherlands (TKA), and contained limited RTW information. Overall, orthopaedic surgeons reported in the survey needing more knowledge and better collaboration with other healthcare practitioners in order to adequately support RTW after THA or TKA.

Chapter 4 describes a prospective multicentre survey study examining the associations between work-related factors and time to RTW within 12 months of THA or TKA. Work-related factors from four domains were included: workplace characteristics (e.g. working hours, type of contract, job tasks, job type), physical working conditions (e.g. standing, walking, sitting), psychosocial working conditions (e.g. work pace, role clarity, job satisfaction) and work adjustments (e.g. lighter duties, shorter hours, different workstation). We found that besides type of job tasks (mainly physical and a combination of physical and mental tasks), the key factors were psychosocial working conditions for both patient groups. Although some differences in factors were found between THA and TKA patients, our findings suggest overall that possibilities for personal job development, more work recognition and high quality of supervisor leadership are important factors towards RTW after arthroplasty. In addition, our findings showed that THA and TKA patients who perform mainly physical tasks and a combination of physical and mental tasks have a longer time to RTW compared to those in jobs with mental tasks.

Chapter 5 investigates the influence of preoperative and postoperative perceived social support on RTW status 6 months after THA or TKA in a prospective multicentre cohort study. Perceived social support from three sources was included: from home (friends, family), from work (co-workers, supervisors) and from healthcare (occupational physician, general practitioner, other caregivers). Preoperatively, patients perceiving social support from the occupational physician were more likely to RTW within 6 months of surgery compared to patients who perceived no support. Postoperatively, patients perceiving social support from the occupational physician or from their supervisor were more likely to RTW compared to patients who perceived no support. Social support from home was not associated with RTW.

Chapter 6 investigated the distribution of occupational class and the association between occupational class and time to RTW after THA or TKA. Data from a prospective multicentre cohort study were used. Occupational class was categorized according to the International Standard Classification of Occupations 2008 (ISCO-08) to create four groups: 1. high-skilled white-collar workers (managers, professionals, technicians, associate professionals), 2. low-skilled white-collar workers (clerical support, service and sales), 3. high-skilled blue-collar workers (skilled agricultural, forestry and fishery, craft and related trades), and 4. low-skilled blue-collar workers (plant and machine operators, assemblers, elementary occupations). Six months after THA, RTW rates were 78% of low-skilled blue-collar workers compared to 83-86% within other occupational classes, increasing after 12 months to 87-90% in all occupational classes. Six months after TKA, RTW rates were 58% of low-skilled and 64% of high-skilled blue-collar workers compared to 80-89% of white-collar workers. After 12 months, 79% of low-skilled blue-collar workers returned to work compared to 87-92% within other occupational classes. Additionally, it was found that high-skilled white-collar workers (THA and TKA) and low-skilled white-collar workers (TKA) have a higher hazard to RTW within 6 months postoperatively compared to low-skilled blue-collar workers.

Chapter 7 describes a study examining factors related to fulfilment of patient expectations towards paid employment at both 6 and 12 months postoperatively. Data from a prospective multicentre cohort study were used. Factors included were sociodemographic, health-related and work-related. Expectations were collected with the paid employment item of the Hospital-for-Special-Surgery Expectations Surveys at three waves (preoperatively and at 6 and 12 months postoperatively). Preoperatively, the majority of the patients had high expectations as they expected back-to-normal paid employment. Six months postoperatively, three out of four patients had fulfilled expectations, slightly increasing 12 months postoperatively

to approximately 80%. Preoperative factors associated with fulfilment were older age, mental work tasks (compared to physical work tasks), and less sick leave due to knee complaints (only at 6 months postoperatively). Postoperative factors associated with fulfilment were better physical functioning, and having no difficulties at work related to the hip or knee (only at 6 months postoperatively).

Finally, **Chapter 8** summarises and reflects on the main findings, followed by methodological matters that should be considered when interpreting these findings, and provides implications for clinical practice and policy plus recommendations for research. Overall, the findings of this thesis provide an overview of evidence about the role of system-related factors and work-related factors in RTW, and fulfilment of patient expectations towards paid employment. The findings of this thesis may contribute to improve care aimed at supporting workers in their RTW after THA or TKA. An important finding is that opportunities seem to exist to optimise the attention that is currently paid to work, there appears to be limited cooperation between healthcare professionals and guidelines are scarce – and, if available, contain limited information. Furthermore, we found that not only physical but also psychosocial working conditions and expectations may be important for RTW and should be considered by both clinicians and researchers. The insights of this thesis may offer important implications for clinical practice and policy. We recommend that a vision on work-oriented care of this patient group be developed. One way to achieve this, would be by addressing the topic in multidisciplinary guidelines and education for healthcare providers, in which interprofessional collaboration is specifically addressed and preferably facilitated. The challenge for future research is to identify and implement a cost-effective multidisciplinary RTW intervention strategy to facilitate sustainable RTW with a patient-tailored approach and create a well-connected care chain.

Samenvatting

In Nederland is artrose de snelst stijgende chronische aandoening. Derhalve zal artrose naar verwachting in 2040 de meest voorkomende chronische aandoening in Nederland zijn. In het eindstadium van heup- of knie-artrose wordt een totale heup- of knieprothese (THP/TKP) beschouwd als de meest kosteneffectieve behandeling om pijn te verminderen en functie te verbeteren. De vraag naar prothesen neemt toe en met name werkenden vormen een steeds groter deel van degenen die een THP of TKP krijgen. Deze toename van werkenden leidt tot een verschuiving in de eisen die aan revalidatie- en herstel gesteld worden. Werkhervatting en de mogelijkheid om deel te blijven nemen aan het arbeidsproces na een operatie is een steeds belangrijker behandeldoel geworden. Tot op heden hebben de meeste studies bij mensen met een THP/TKP zich gericht op persoonlijke factoren die samenhangen met werkhervatting. Systeem-gerelateerde factoren en werk-gerelateerde factoren die werkhervatting na het krijgen van een THP/TKP beïnvloeden zijn slechts door een beperkt aantal studies onderzocht. Daarnaast is het ook belangrijk om verder te kijken dan naar werkhervatting alleen en ook te focussen op verwachtingen ten aanzien van werk.

Doel van dit proefschrift is het vergroten van onze kennis over de rol van systeem- en werk gerelateerde factoren op werkhervatting en het identificeren van factoren die samenhangen met het uitkomen van verwachtingen over werk voor de groeiende groep werkenden met een THP/TKP.

De specifieke onderzoeksdoelen waren:
1. Inzicht krijgen in (inter)nationaal beleid en de dagelijkse praktijk van zorgprofessionals die werkenden met een THP/TKP behandelen en begeleiden in het werkhervattingsproces; (Hoofdstuk 2 en 3)
2. Het bestuderen van het verband tussen werk gerelateerde factoren en (tijd tot) werkhervatting bij werkenden met een THP/TKP; (Hoofdstuk 4, 5 en 6)
3. Factoren identificeren die samenhangen met verwachtingen over werk bij werkenden met een THP/TKP. (Hoofdstuk 7)

Hoofdstuk 2 beschrijft een semigestructureerde expertmeeting met drie Nederlandse orthopedisch chirurgen en drie Nederlandse bedrijfsartsen. Doel van dit onderzoek was inzicht krijgen in de ervaren barrières tijdens de begeleiding van het werkhervattingsproces van werkenden met een THP/TKP. Uit de resultaten bleek dat orthopedisch chirurgen en bedrijfsartsen de volgende barrières ervaren: inadequaat verwachtingsmanagement; een mismatch tussen het beroep van de werkende en de fysieke beperkingen die overblijven na het plaatsen van een THP/

TKP; het pas in een (te) late fase raadplegen van een bedrijfsarts; en verschillen in visie tussen arts en patiënt ten aanzien van de mogelijkheden in functioneren. Op basis van hun ervaringen adviseerden de zorgprofessionals dat verschillende veranderingen nodig zijn om het werkhervattingsproces te verbeteren, namelijk: intensiever en structureel contact tussen beide zorgprofessionals, preoperatief contact tussen patiënt en bedrijfsarts, advies van de orthopedisch chirurg met betrekking tot werkhervatting en adequaat verwachtingsmanagement.

Hoofdstuk 3 betreft een onderzoek met als doel om een overzicht te krijgen van het huidige beleid en de dagelijkse praktijk in het kader van werkhervatting van werkenden met een THP/TKP in drie Europese landen: Denemarken, Duitsland en Nederland. De studie bestond uit drie aspecten (1) beschrijving van de organisatie van de gezondheidszorgsystemen en socialezekerheidsstelsels op basis van (grijze) literatuur; (2) identificatie van nationale werkhervattingsrichtlijnen met behulp van input van experts; en (3) inzicht krijgen in werkhervattingspraktijken en opvattingen van orthopedische chirurgen, inclusief belemmerende en bevorderende factoren die ze ervaren met behulp van een online enquête. De resultaten lieten zien dat de gezondheidszorgsystemen en socialezekerheidsstelsels van de drie landen op verschillende vlakken van elkaar verschillen (bijv. fast track vs. langer postoperatief verblijf; dekking van revalidatiekosten; duur van de inkomenscompensatie door de werkgever). Nationale richtlijnen waren alleen beschikbaar in Duitsland (THP en TKP) en Nederland (TKP) en bevatten beperkte informatie over werkhervatting. Over het algemeen gaven orthopedisch chirurgen in de enquête aan meer kennis en (betere) samenwerking met andere zorgverleners nodig te hebben om werkhervatting van mensen met een THP/TKP adequaat te kunnen ondersteunen.

Hoofdstuk 4 beschrijft een longitudinale multicenter cohortstudie die de samenhang onderzocht tussen werk-gerelateerde factoren en de tijd tot werkhervatting binnen 12 maanden na het krijgen van een THP/TKP. Hiervoor werd data gebruikt van het 'Work In Patients with Osteoarthritis' (WIPO) cohort. Werk-gerelateerde factoren uit vier domeinen werden onderzocht, namelijk: werkkenmerken (bijv. werktijden, type contract, type taken, type werk), fysieke werkomstandigheden (bijv. staan, lopen, zitten), psychosociale werkomstandigheden (bijv. werktempo, rolduidelijkheid, werktevredenheid) en werkaanpassingen (bijv. lichtere taken, kortere werktijden, andere werkplek). We vonden voor beide patiëntgroepen dat naast het type taken (voornamelijk fysieke taken en een combinatie van fysieke en mentale taken), de psychosociale werkomstandigheden de belangrijkste factoren waren. Hoewel er enkele verschillen in factoren werden gevonden tussen werkenden met een THP en TKP, bleek dat mogelijkheden voor persoonlijke ontwikkeling in het werk, meer

erkenning voor het werk en goed leiderschap van de leidinggevende belangrijke factoren zijn voor werkhervatting na het krijgen van een THP/TKP. Bovendien lieten onze bevindingen zien dat werkenden met een THP/TKP die voornamelijk fysieke taken en een combinatie van fysieke en mentale taken uitvoeren een langere tijd tot werkhervatting hebben in vergelijking met degenen in banen met voornamelijk mentale taken.

In **hoofdstuk 5** werd het verband tussen preoperatieve en postoperatieve ervaren sociale steun op terugkeer naar werk 6 maanden na het krijgen van een THP/TKP onderzocht in een multicenter cohortstudie met behulp van data van het WIPO-cohort. Onderscheid werkt gemaakt naar ervaren sociale steun van thuis (vrienden, familie), op het werk (collega's, leidinggevenden) en vanuit de zorg (bedrijfsarts, huisarts, andere zorgverleners). Preoperatief hadden werkenden die sociale steun van de bedrijfsarts ondervonden een grotere kans op werkhervatting binnen 6 maanden na de operatie in vergelijking met werkenden die geen steun van de bedrijfsarts ondervonden. Postoperatief hadden werkenden die sociale steun ondervonden van de bedrijfsarts of van hun leidinggevende een grotere kans op werkhervatting dan werkenden die geen steun ondervonden. Sociale steun van thuis was niet geassocieerd met werkhervatting.

In **hoofdstuk 6** werd de verdeling van beroepsklasse en de associatie tussen beroepsklasse en tijd tot werkhervatting na het krijgen van een THP/TKP onderzocht. Data van het longitudinale multicenter cohort 'Longitudinal Orthopaedics Outcomes of Osteo-arthritis study' (LOAS) werd gebruikt. Beroepen werden preoperatief uitgevraagd en ingedeeld volgens de International Standard Classification of Occupations 2008 (ISCO-08) om vier beroepsklassen te creëren: 1. Hooggeschoold kantoorwerk (managers, professionals, technici etc.), 2. Laaggeschoold kantoorwerk (administratief ondersteunend personeel, service- en verkoopmedewerkers etc.), 3. hooggeschoold fysiek werk (geschoolde landbouw-, bosbouw- en visserijmedewerkers, ambachtslieden etc.), en 4. Laaggeschoold fysiek werk (fabrieks- en machinebedieners, assemblage medewerkers, elementaire beroepen etc.). Zes maanden na het krijgen van een THP was 78% van de werkenden met laaggeschoold kantoorwerk teruggekeerd naar werk (83-86% in de andere beroepsklassen), na 12 maanden steeg dit tot 87-90% in alle beroepsklassen. Zes maanden na het krijgen van een TKP was 58% van de werkenden met laaggeschoold fysiek werk en 64% met hooggeschoold fysiek werk teruggekeerd naar het werk, vergeleken met 80-89% van de werkenden met kantoorwerk. Twaalf maanden na het krijgen van een TKP keerde 79% van de werkenden met laaggeschoold fysiek werk weer terug naar het werk (87-92% in de andere beroepsklassen). Daarnaast hadden werkenden met hooggeschoold kantoorwerk (THP en TKP) en laaggeschoold kantoorwerk (TKP) een grotere kans

om het werk te hervatten binnen 6 maanden na de operatie in vergelijking met werkenden met laaggeschoold fysiek werk.

Hoofdstuk 7 beschrijft een onderzoek waarin de samenhang tussen sociodemografische-, gezondheids- en werk gerelateerde factoren en het uitkomen van verwachtingen van patiënten over werk werd onderzocht, zowel op 6 als 12 maanden postoperatief. Hiervoor werd eveneens data van de LOAS gebruikt. De onderzochte factoren waren leeftijd, geslacht, (sociodemografische factoren); comorbiditeit, preoperatieve HOOS-PS/KOOS-PS, postoperatieve HOOS-PS/KOOS-PS scores (gezondheid gerelateerde factoren); werktaken, preoperatief ziekteverzuim, postoperatieve moeilijkheden op het werk door heup- of knieklachten (werk gerelateerde factoren). Verwachtingen over werk werden gemeten met het item "Wat zijn uw verwachtingen ten aanzien van werk na de operatie?" van de Hospital-for-Special-Surgery Expectations vragenlijst op drie momenten (preoperatief, 6 en 12 maanden postoperatief). Preoperatief had de meerderheid van de werkenden hoge verwachtingen ("terug naar normaal"). Zes maanden na de operatie waren de verwachtingen in 75% van de werkenden (3 van de 4) vervuld. Dit percentage nam op 12 maanden postoperatief licht toe tot ongeveer 80%. Preoperatieve factoren die samenhingen met het uitkomen van verwachtingen waren oudere leeftijd, mentale werktaken (in vergelijking met fysieke werktaken), en minder ziekteverzuim vanwege knieklachten (alleen 6 maanden na TKP). Postoperatieve factoren die samenhingen met het uitkomen van verwachtingen waren beter fysiek functioneren en geen problemen hebben op het werk gerelateerd aan de heup of knie (alleen bij 6 maanden postoperatief).

Tot slot geeft **hoofdstuk 8** een samenvatting van en reflectie op de belangrijkste bevindingen, gevolgd door een reflectie op methodologische aspecten en implicaties voor de praktijk, beleid en vervolgonderzoek. Uit dit proefschrift blijkt dat er mogelijkheden zijn om de aandacht die momenteel aan werk wordt besteed in de praktijk te verbeteren, dat er beperkte samenwerking lijkt te zijn tussen zorgprofessionals en dat richtlijnen met betrekking tot terugkeer naar werk schaars zijn en, indien beschikbaar, beperkte informatie bevatten. Verder vonden we dat niet alleen fysieke, maar ook psychosociale werkomstandigheden en verwachtingen belangrijk kunnen zijn in het kader van terugkeer naar werk. De inzichten van dit proefschrift kunnen belangrijke implicaties hebben voor de klinische praktijk en beleid en zouden kunnen bijdragen aan het verbeteren van zorg gericht op het ondersteunen van werkenden met een THP/TKP in hun terugkeer naar werk. We adviseren dat er arbeidsgerichte zorg voor deze patiëntengroep wordt ontwikkeld door de relevante beroepsverenigingen in Nederland. Een manier om dit te bereiken is door het onderwerp te integreren in multidisciplinaire richtlijnen en tijdens onderwijs voor zorgverleners, waarin

(interprofessionele) samenwerking specifiek aan de orde komt en bij voorkeur wordt gefaciliteerd. Toekomstig onderzoek dient zich te richten op het ontwikkelen en evalueren van arbeidsgerichte interventiestrategieën om werkhervatting van mensen met een THP/TKP te faciliteren. Hierbij is een multidisciplinaire aanpak van belang om een goed aaneensluitende zorgketen te creëren.

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Nunc est bibendum

About the author

Tamara Kamp was born on July 24th, 1995 in Blaricum, the Netherlands. After she finished her high school at Gemeentelijk Gymnasium Hilversum, she started studying Pharmacy at the University of Groningen in 2013. Fortunately, in 2014 she was accepted to Medical school at the University of Groningen. During her bachelor she did a JSM pilot project at the department of Paediatrics, division of Paediatric Critical Care Medicine, which sparked her interest in research. During the first year of her master she became involved in research at the departments of Orthopaedics and Health Sciences (division Community and Occupational medicine) of the University Medical Center Groningen (UMCG). Finally, this led to a MD/PhD grant in 2021 supervised by prof. dr. S. Brouwer, dr. M. Stevens, and dr. M.G.J. Gademan, which resulted in this thesis.

Tamara combined her research with clinical rotations at Martini Hospital and Ziekenhuis Groep Twente (Almelo/Hengelo). In 2021 she received her medical degree. Additionally, she also completed a master in Business Administration Health in 2021 at the University of Groningen. During her studies and PhD she was active in various extracurricular activities, such as boards, committees and as rower and coach of the Groningse Studenten Roeivereniging Aegir. She committed herself, among others, to the foundation “Arts en Organisatie”. This organization encourages medical professionals to ‘think along’ at a policy level through a wide range of activities, aiming to contribute to a better healthcare in the future. To represent PhD candidates and the broader academic community in Groningen, she was a member of the GSMS PhD Council. Simultaneously with finishing her PhD she also finished her first full distance triathlon.

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