Summary

Title of thesis proposal:
Return to work outcomes after total hip or total knee arthroplasty.

Summary of thesis proposal
Background: Osteoarthritis (OA) is one of the most common reasons for joint disorders worldwide, affecting about one in eight adults. The hip and knee are among the most affected joints. In end-stage OA, total hip or knee arthroplasty (THA/TKA) is considered the most (cost)effective treatment to relieve pain and improve physical function. The number of patients aged <65 years undergoing THA or TKA has increased substantial over the past decades (between 2010 and 2019 THA increased from 11,110 to 15,500; TKA from 9,619 to 12,628), which makes return to work a salient clinical and societal outcome. As the number of studies on return to work (RTW) is limited, the follow-up time in existing studies is short (<1-year post-surgery) and the predictors for RTW are limited to personal factors, firm conclusions regarding RTW outcomes after THA and TKA and its related predictors cannot be drawn.

Aim: The overall aim of this thesis is to optimize employment outcomes for this growing group of patients by expanding our knowledge on the role of work-related and system-related factors on RTW and by studying long-term employment outcomes among working-age THA and TKA patients

Method: The project consists of six studies. Longitudinal data of the "Work participation In Patients with Osteoarthritis" (WIPO) cohort (n= 246, 2-year follow-up period) and of the "Longitudinal Leiden Orthopedics Outcomes of Osteo-arthritis" (LOAS) cohort (n= 1350 employed patients between 2012-2018) will be used for conducting 5 studies. Moreover, a scoping review study will be performed to study the influence of health system-related factors on RTW policy and practices after THA/TKA. The Dutch system will be compared with the German and Danish.

This thesis will contribute to healthy aging and (work)participation of aging osteoarthritis patients which is currently a societal challenge.

Thesis proposal

Background of the thesis
Osteoarthritis (OA) is one of the most common reasons for joint disorders, affecting about one in eight adults(1,2). OA is a substantial source of disability with significant social costs due to surgical and medical interventions(2). The hip and knee are among the most affected joints(1). In end-stage OA, total hip or knee arthroplasty (THA/TKA) is considered the most (cost)effective treatment(1,2). In the Netherlands the demand is predicted to increase to 51,000 (+150%) for THA and 57,000 (+300%) for TKA by 2030(3). Individuals of working age in particular represent an increasing proportion of those receiving THA/TKA(2). These rising numbers are the result of an ageing population, the obesity epidemic, a more physically active population with more sports-related injuries and a higher retirement age(2,3). Furthermore, orthopedic surgeons are able to perform surgery on younger patients due to longer survivorships of prostheses(2,3);

Due to the increased number of working patients receiving THA/TKA, the ability to participate in work after surgery is becoming increasingly important(2). Work is known to be a key aspect of participation and a major determinant of health and well-being, i.e. it helps us build confidence and self-esteem, and rewards us financially(4). Optimizing employment outcomes for this group of patients therefore has health, social and economic benefits for both patients and society.

Research on predictors for RTW among THA/TKA patients has mainly focused on personal factors and found that sociodemographic characteristics (higher age, female, low educational level) and limited joint function are associated with delayed RTW(5). Adverse physical and psychosocial

working conditions are associated with premature exit from the labor force(2). In various other populations previous research showed that high perceived work-attitude, high level of self-efficacy and high perceived social support is associated with earlier RTW(6). Moreover, patients' expectations of medical care and their fulfilment are linked to their assessments of outcome and satisfaction(7). However, research on patient's expectations and their fulfilment in the context of RTW is scarce. Research into the role of work-related factors is also limited and mainly focusing on the impact of physical work-related factors such as kneeling and sitting which were associated with delayed RTW (2,5). There is insufficient knowledge about the association of psychosocial working conditions (e.g. work pace, role clarity, job satisfaction) with RTW. In addition, more research is needed to explore whether specific lower-educated occupational groups (e.g. elementary occupations) are at higher risk for delayed RTW compared to higher-educated groups (e.g. managers, professionals).

At outcome level, work participation involves two important outcomes: first patients need to *return to work*, thereafter they need to *remain in long-term paid employment*. Previous studies mainly examined first time of RTW after THA/TKA and found that the majority of patients RTW within six months postoperatively(2), yet the absolute number not returning is still substantial. Despite good results after THA/TKA, 28-54% of patients (age ≤65) still experience functional problems at work(2). Eventually this may increase the risk of premature exit from paid employment. Taking into account the increasing retirement age world-wide, uncertainties about long-term employment among THA/TKA patients still exist, as most studies don't look beyond the first time of RTW or only have a follow-up of 1-2 years.

Differences in RTW outcomes may also exist between countries. This could be due to cross-country differences in RTW policy and practices resulting from a different health- and social security system(8). A recent study revealed that German patients RTW 2.3 weeks earlier than Dutch patients(9). Another study reported that absenteeism in US employees was remarkably lower in comparison to employees in Europe(2). Both studies concluded that probably cross-country differences in organization of the health- and social security system may affect differences in RTW outcome across countries among THA/TKA patients. Comparitive studies can be useful to explore which aspects of the health- and social security system related to RTW policy and practices can explain cross-country differences in RTW outcome.

Overall aim of the thesis
The overall aim of this thesis is to optimize work participation for the growing group of THA and TKA patients by expanding our knowledge on the associations between both work-related and system-related factors on RTW and by studying long-term employment outcomes among working-age THA and TKA patients.
The specific research aims are:
1. To study the effect of psychosocial work-related factors on RTW among working-age THA and TKA patients *(i.e. psychosocial working conditions, social support, patient expectations and their fulfilment).*
2. To examine long-term employment outcomes and associated factors among working-age THA and TKA patients *(i.e. sociodemographic characteristics, clinical characteristics and occupational group membership).*
3. To gain insight into cross-country similarities and differences of RTW policy and practices after THA or TKA and the potential impact on RTW outcome.

Methods
Within this thesis, among others, data of two longitudinal cohorts will be used; "Work participation In Patients with Osteoarthritis" (WIPO) and Longitudinal Leiden Orthopedics Outcomes of Osteo-Arthritis study (LOAS). We will refer back to the following overview in the studies.

WIPO-cohort: A prospective, multicenter, survey study was conducted among patients who underwent THA/TKA for primary OA. WIPO (Trial-ID NTR3497) is an initiative of the departments of Orthopedics and Health Sciences, Community and Occupational Medicine of University Medical Center Groningen (UMCG). This project has been approved by the Medical Ethical Board of UMCG

(METc 2012.153). Patients were recruited between March 2012 and July 2014 at the departments of Orthopedics of four Dutch hospitals in the northern region of the Netherlands. Data was gathered preoperatively and 6 weeks, 3, 6 ,12 and 24 months post-operative(appendix A). In total 246 patients were included. All patients were preoperatively employed and aged between 18 and 63 years.

LOAS-cohort: An ongoing, multi-center, longitudinal prospective study that includes patients undergoing THA/TKA. It is an initiative of the department of Orthopedics of Leiden University Medical Center (LUMC). Ethical approval was obtained by the Medical Ethics Committee at LUMC (P12.047). LOAS (Trial-ID NTR3348) started in June 2012, with follow-up waves at 3, 6, 12 and 24 months and thereafter every two years and inclusion is still ongoing(appendix A). Between 2012 and 2018 in total 1350 of the included patients were employed.

Study 1 and 2 have been completed and submitted.

Study 1: Psychosocial work factors are important in the return-to-work process after total knee and hip arthroplasty
Objective: To determine which work-related factors were associated with time-to-RTW after THA/TKA.
Methods: Data of the WIPO-cohort was used. Data on the following preoperative work-related factors was used: work characteristics, physical working conditions, psychosocial working conditions and work adjustments. Covariates included age, gender, education, home situation, BMI and comorbidity. Time-to-RTW was defined as days from surgery until RTW.
Statistics: Descriptive statistics were used for demographic characteristics and questionnaire scores. Multivariate regression analyses were conducted for THA and TKA patients separately.
Implication: Results underscored the importance of psychosocial work factors in RTW after THA/TKA.

Study 2: Work-related social support affects return-to-work after total hip and knee arthroplasty
Objective: To investigate the association between perceived work-related social support and RTW status 6 months postoperatively in a sample of THA/TKA patients.
Methods: Data of the WIPO-cohort was used. Data on the following sources of social support was used: home, work, and healthcare professionals. RTW was defined as participants fully returning to work 6 months postoperatively. Covariates included sex, age, education, type of surgery and number of comorbidities.
Statistics: Descriptive statistics were used for demographic characteristics and questionnaire scores. Multivariate logistic regression analyses were conducted.
Implication: Results underscored the important role of perceived social support from the workplace in the RTW process.

Study 3: Exploring differences in long-term employment trajectories following total hip and total knee replacement: a 4-year follow-up study
In collaboration with LUMC
Background: For working-age THA/TKA patients not only RTW after surgery is important, but also remaining in paid employment.
Objective: To examine long-term employment outcomes up to 4 years after THA/TKA by identifying RTW trajectories. Furthermore, we will explore whether differences exist in sociodemographic- and clinical characteristics between these trajectories.
Methods: Data of the LOAS-cohort will be used. Employment status and number of working hours were measured. Sociodemographic characteristics include: sex, age, BMI, home situation, comorbidities and ASA-classification. Clinical characteristics were collected with the Hip/Knee disability Osteoarthritis Outcome Score (HOOS/KOOS) questionnaires.
Statistical analysis: Descriptive statistics will be used for demographic characteristics and questionnaire scores. RTW trajectories consist of a sequence of RTW. Each trajectory starts with a

surgery and will be characterized by a sequence of RTW states. RTW states will be calculated based on employment status and working hours and can consist of full-time, part-time or no RTW. Secondly, linear mixed model analysis will be used to analyze the potential effect of covariates, i.e. sociodemographic- and clinical characteristics, on the different trajectories.

Study 4: Patient expectations and their fulfilment towards paid employment in the context of return-to-work after total hip and total knee arthroplasty.
In collaboration with LUMC
Background: Patient expectations and their fulfillment might be an indicator for successful RTW outcomes after THA/TKA, but research on this topic is scarce. Furthermore, it is unknown if patient characteristics, clinical characteristics or work characteristics (e.g. physically demanding work) are related to expectations regarding RTW after surgery.
Objective: To investigate which sociodemographic-, clinical- and work characteristics are associated with preoperative expectations towards paid employment. Secondly, to examine the association between preoperative expectation and fulfilment of patient expectations towards paid employment and actual RTW.
Methods: Data of the LOAS-cohort will be used. RTW will be defined per timestamp (6- and 12-months post-surgery). RTW will be assumed whenever a patient partially or fully RTW. Preoperatively patient expectations were assessed with the Hospital for Special Surgery (HSS) hip/knee replacement expectations survey. This is a 19-item self-administered survey, measuring expectations in domains of pain, function, activities, and psychological wellbeing. We will focus on the 'What are your expectations towards paid employment after surgery' item. Standardized answer options are given (5-Likert boxes). At 6- and 12-months follow-up, fulfilment of paid employment expectations will be calculated by subtracting preoperative from postoperative HSS scores (score$\leq$ 1:unfulfilled; score 0:fulfilled, score$\geq$1:exceeded). Preoperative data include sociodemographic characteristics (age, gender, educational level, wage earner, marital status), clinical characteristics (BMI, comorbidity, ASA), self-reported disability (HOOS/KOOS) and work characteristics (tasks; physical/mental/combination).
Statistical analysis: Multivariate logistic regression analyses will be conducted to analyze sociodemographic, clinical and work characteristics and expectations. Secondly, Linear Mixed Model (LMM) analysis will be conducted to analyze preoperative expectations and RTW at 6 and 12 months, adjusted for confounders. Thereafter LMM analysis will be conducted for fulfilment of expectations and RTW at 6 and 12 months, including confounders and an interaction term between preoperative expectations and fulfillment.

Study 5: Differences in return-to-work outcomes between occupational groups following total hip or knee replacement
In collaboration with LUMC
Background: Jobs with mainly physical tasks may impede RTW(10), however the validity of studies done so far on this topic is low. More insight is needed on differences in RTW and long-term employment outcomes between occupational groups.
Objective: To examine the association between occupational groups and RTW. Secondly, to examine the association between occupational groups and long-term employment.
Methods: Data of the LOAS-cohort will be used. At baseline patients were asked about their occupation and the main tasks related to their occupation. Each occupation will be classified according to the International Standard Classification of Occupations (ISCO-08), a main international classification tool for organizing jobs, which takes level of education and type of work into account. The classification will be conducted by Statistics Netherlands (CBS) and will result into nine major occupational-type groups. Next, we will redefine these nine ISCO-08 occupation groups into four groups, taking into account both educational level and heaviness of the occupation: 1. high skilled white-collar (managers, professionals, technicians and associate professionals), 2. low skilled white-collar (clerical support workers, service and sales workers), 3. high skilled blue-collar (skilled agricultural, forestry and fishery workers, craft and related trades workers,) and 4. low skilled blue collar (plant/machine operators and assemblers and elementary occupations). RTW will be assumed whenever a patient partially or fully RTW within the first year after surgery. Long-term employment

will be defined as a worker returning to regular full-time work for a minimum of 2 consecutive follow-up moments after surgery within the 4-year follow-up. Covariates included will be sex, age, BMI, education, home situation, comorbidities and ASA classification.

Statistical analysis: Descriptive statistics will be used for demographic characteristics. Multivariate logistic regression analyses will be conducted, adjusted for confounders, to analyze the association between the four ISCO-08 occupational groups and both RTW outcomes. Odds ratios will be calculated, including 95% confidence intervals.

Study 6: A cross-country comparison of return-to-work policy and practices after THA or TKA between the Netherlands, Denmark and Germany.
In collaboration with University of Oldenburg/Pius Hospital Oldenburg (Germany) and Odense University Hospital (Denmark).

Background: The growing group of working-age patients receiving THAs/TKAs results in an increasing social and economic burden, not only in the Netherlands but within Europe and worldwide. Organization of the health- and social security system can be of influence on outcome and consequently on RTW after THA/TKA.

Objective: To gain insight into RTW policy and practices. Secondly, to explore barriers and facilitators of the three different European healthcare- and social security systems with regard to RTW policy and practices.

Methods: A comparative study will be conducted. A scoping review will be used to compare the Dutch system with the German and Danish. To gain insight into the different systems three actions are planned. First, the national systems will be described by using, among others, the OECD Health System Characteristics online database. In addition, an overview will be given of the existence and content of national guidelines and recommendations of RTW policy and practices issued by different professional organizations involved in the care of THA/TKA patients (e.g. orthopedic surgeons, physiotherapists and occupational physicians). Finally, structured interviews will be executed (by T. Kamp) with a sample of health care professionals in the three countries. By means of these interviews insight will be obtained on how these professionals organize care within the context of the different systems and national recommendations and their perceived barriers and facilitators. All interviews will be audiotaped. Data collection will be completed when the interviews don't reveal new ideas or insights (data saturation). METc approval is not needed.

Healthcare professionals will be recruited from our own network, with the help of NOV, from the network of PIUS Hospital Oldenburg and from the network of Odense University Hospital.

Data analysis: Data of the interviews will be categorized with the Nvivo program and subsequently described. The interviews will be transcribed verbatim by two researchers (T. Kamp and an experienced qualitative researcher) based on the audiotapes. A summary of all interviews per country will be send to the participants to check. Data will be coded using thematic content analysis. The two researchers will code the interviews independently by means of open coding leading to a coding tree. To interpret the data, themes will be summarized per main category.

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