

# Factors affecting return to work after surgical treatment of trapeziometacarpal joint osteoarthritis

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## Abstract

This study aimed to identify factors contributing to the timing of return to work after surgical treatment of trapeziometacarpal joint osteoarthritis and to calculate the costs of lost productivity. We included 627 patients with paid employment who underwent trapeziectomy and ligament reconstruction with tendon interposition. Time to return to work was measured through filling online questionnaires and analysed using survival analysis at 6 weeks and 3, 6 and 12 months after the surgery. Patients also filled in the Michigan Hand Outcomes Questionnaire. Costs of lost productivity were calculated using the human capital method. After 1 year, 78% of the patients returned to work. The median time to return to work was 12 weeks. Factors that significantly affected the time to return to work were occupational intensity (light, moderate or heavy physical labour), whether the dominant hand was treated and the Michigan Hand Outcomes Questionnaire work score and hand function score of the unoperated side at baseline. The costs of lost productivity were estimated at €11,000 on the patient level, resulting in €16.8 million on the Dutch population level per year.

**Level of evidence:** II

## Keywords

Thumb base osteoarthritis, healthcare costs, surgical treatment, return to work

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## Introduction

Osteoarthritis (OA) has a big impact on patients' ability to work and thus on costs of lost productivity. Little is known about the factors associated with the time to return to work after surgical treatment of trapeziometacarpal joint OA. Wolf et al. (2018) reported that there were no effects of prior sick leave, sex or age and concluded that 'further evaluation of factors contributing to lengthy work absences is needed'. In patients with carpal tunnel syndrome, Peters et al. (2016) found an effect of several physical and psychosocial factors and functional limitations at work before surgery on delayed return to work.

Time to return to work translates directly into costs of lost productivity, but there is little insight into the costs beyond the expenses of the surgery itself. Marks et al. (2015) studied the economic aspects of surgical

treatment and steroid injection in patients with trapeziometacarpal joint OA and estimated the healthcare and lost productivity costs due to sick leave in the first

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year to be €5770 for surgical treatment and €5548 for a steroid injection. Marks et al. (2015), however, note that the indirect costs must be carefully extrapolated since monetary values are strongly dependent on the income, contractual weekly working hours and ratio of the employed to non-working patients in the study population.

This study aims primarily to identify factors contributing to the time to return to work after surgical treatment of trapeziometacarpal joint OA and secondly to calculate the costs of lost productivity due to sickness absence.

## Methods

Consecutive patients who had a trapeziectomy at the Xpert Clinic in the Netherlands, a specialized centre for treatment of hand and wrist problems with 18 different locations, between 2011 and 2018 were included in this study. The 18 hand surgeons had experience levels two (2), three (5), four (4) and five (7) (Tang and Giddins, 2016). Depending on the surgeon's preference, a ligament reconstruction with tendon interposition was carried out according to Weilby (1988) or Burton and Pellegrini (1986).

Other inclusion criteria were that the patient had paid employment, provided information about return to work at least once, and had given written informed consent. Patients followed a standard postoperative regimen consisting of a cast for up to 10 days and followed by a removable splint for up to 6 weeks. Patients had two sessions of hand therapy and were advised to follow an extensive programme of hand exercises. A detailed description of the splinting and therapy protocol has been reported earlier (Tsehaie et al., 2019). The study was approved by the local institutional review board.

### *Baseline demographics of the patients*

The diagnosis of trapeziometacarpal joint OA was made by a certified hand surgeon based on clinical examination, such as a positive grind test. In most patients, a radiograph was taken and the trapeziometacarpal and scaphotrapeziotrapezoidal joints were assessed. Additionally, surgeons inspected both joints during the procedure. We only included patients who underwent trapeziectomy and ligament reconstruction with tendon interposition without additional procedures. Baseline characteristics of all patients, including age, sex, occupational intensity, duration of complaints and hand dominance, were collected. Three levels of occupational intensity were defined: light physical work (e.g. an office job),

medium physical work (e.g. working in a shop) and heavy physical work (e.g. working at a construction site). This was documented by a hand therapist during the first consultation following diagnosis.

### *Data collection*

Patients were asked to complete an online questionnaire on return to work at 6 weeks and 3, 6 and 12 months after the surgery. The maximal length of the data collection was 12 months after surgery. The questionnaire consisted of five questions: (1) whether the patient was able to work and, if not, whether this was due to the hand disorder, (2) for how many hours a week the patient used to work, (3) how many hours a week the patient was currently working, (4) whether the patient was performing the original work or had adjusted work, (5) how many weeks after the treatment the patient returned to performing the original work (if applicable). The patients were also asked to fill in the Dutch translation of the Michigan Hand Outcomes Questionnaire (MHQ) (Chung et al., 1998; Huijsmans et al., 2001). Study data were collected and managed using a secure web-based application for the distribution of questionnaires and forms during medical research and quality registrations.

Return to work was defined as the first time a patient reported to have returned to performing the original work for a minimum of 50% of the original hours a week as stated in the patient's contract. We chose 50% return to work as our primary outcome since Dutch labour laws require patients to perform less than 50% of their original work in order to receive any form of compensation. If the patients are working more than 50% of their original work, but perform adjusted work activities, they are legally still on sick leave in the Netherlands. The time to return to work was defined as the time in weeks between surgery and the return to work.

### *Costs of lost productivity*

The costs of lost productivity can be defined as costs associated with production loss and replacement costs due to illness, disability and death of productive persons, both paid and unpaid (Brouwer et al., 1997). These are the costs for the employer related to less employee productivity due to health problems. In this analysis, productivity loss is limited to sickness absence and does not include lower productivity due to functional limitations while at work. We used the human capital method to calculate the costs of lost productivity: any hour that the patient does not work is considered as an hour of lost productivity.

The human capital method multiplies the total of working hours lost due to health problems and rehabilitation treatment (like hand therapy) with the average costs of lost productivity per hour. The total working hours lost due to health problems and treatment were calculated by multiplying the median time to return to work by the patient population's average working hours per week. The average costs of lost productivity per hour were calculated as a weighted value of the mean income per hour for women (€32) and men (€38) in the Netherlands in 2012 (CBS, 2018; Hakkaart-van Roijen, 2015; Statline, 2019), resulting in €33.26 per hour for our patients. As a formula: total costs of lost productivity per patient = median time to return to work (weeks) × average working hours per week × €33.26.

To estimate the costs of lost productivity for patients with specific characteristics, cumulated costs for subgroups compared with the costs of the entire cohort were calculated. Median survival was estimated using Kaplan–Meier curves. Continuous variables were split at the mean to create categories for the Kaplan–Meier curves.

To calculate the annual costs of lost productivity for the Dutch population, we estimated the number of patients that are surgically treated for trapeziometacarpal joint OA every year. According to open data of the Dutch healthcare authority, over the past 5 years, approximately 1500 patients were surgically treated annually (Zorgautoriteit, 2019). We then calculated the annual costs of lost productivity for the Dutch population by multiplying by the individual costs. As a formula: total annual costs of lost productivity on population level = 1500 × total costs of lost productivity per patient.

### Statistical analysis

Univariate survival was estimated with the Kaplan–Meier method and the survival curves were plotted. Multivariate survival analysis was performed using a Cox proportional hazard model. The dependent variable was time to return to work. As independent variables, we included age, sex, duration of complaints, dominant side, occupational intensity and whether surgery was performed as part of a second opinion. We also included MHQ scores for the operated and unoperated side in the Cox model to control for symptoms on the unoperated side. The major advantage of this model is that patients who reached retirement or did not complete any additional questionnaires were censored, thus dealing with loss to follow-up and minimizing bias. For all tests, we considered a *p*-value smaller than 0.05 as statistically significant.

## Results

We included 627 patients. Patient characteristics are shown in Table 1.

### Return to work

In the first year after surgery, 78% of the patients returned to work. The median time (Q1, Q3) to return to work (RTW) was 12 weeks (6, 29) and the survival analysis curve for return to work is shown in Figure 1. The curve shows that few additional patients went back to work beyond about 20 weeks.

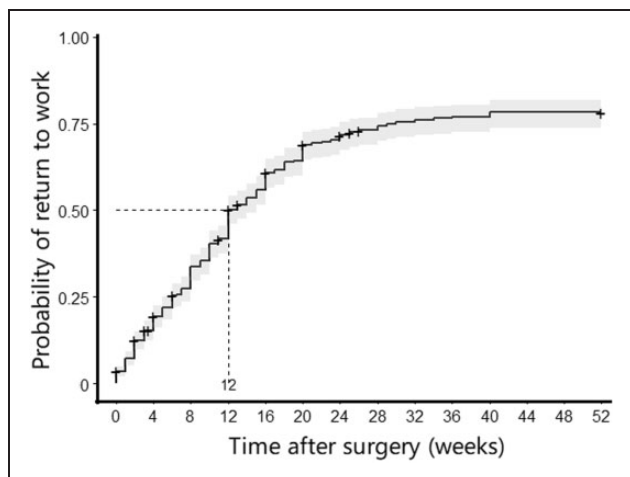
The overall return to work was 87% for light, 76% for medium and 70% for heavy physical labour. Figure 2 shows the Kaplan–Meier curves by occupational intensity. Overall return to work was the same in men and women. Twenty-five per cent of the patients performing light physical work returned to work within the first 3 weeks, compared with 7% and 5% for medium and heavy physical work.

When corrected for other patient characteristics, the occupational intensity of the patient's work remained associated with return to work (online Table S1). Compared with light physical labour,

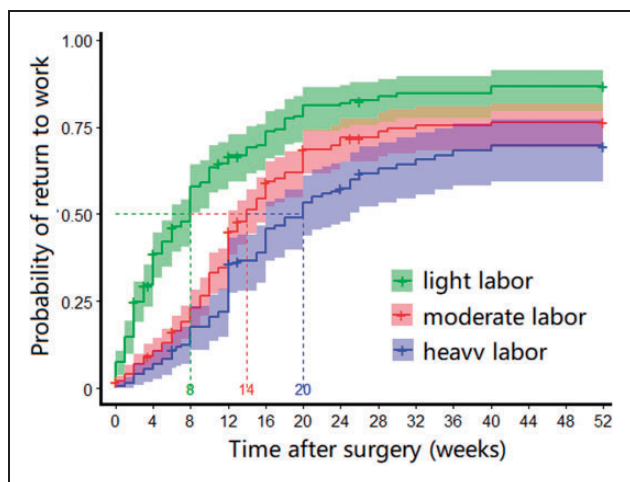
**Table 1.** Baseline characteristics and hand function scores of the study population (627 patients).

Characteristic	Value
Age, mean (SD)	55 (6) years
Female patients, <i>n</i> (%)	493 (79)
Weekly hours work, mean (SD)	28 (11)
Occupation-physical labour, <i>n</i> (%)	
Light, medium, heavy	217 (35), 264 (42), 146 (23)
Dominant side, <i>n</i> (%)	
Right, left, bimanual	530 (85), 69 (10), 28 (5)
Duration of complaints, median (IQR)	24 (36) months
MHQ, median (IQR)	
Pain, work	35 (15), 50 (40)
Operated side	
General hand function	50 (15)
ADL, aesthetics, satisfaction	45 (35), 81 (38), 29 (25)
Unoperated side	
General hand function	70 (15)
ADL, aesthetics, satisfaction	90 (25), 94 (25), 75 (50)

SD: standard deviation; IQR: interquartile range; MHQ: Michigan Hand Outcome Questionnaire (range 0–100); ADL: activities of daily life.



**Figure 1.** Kaplan–Meier plot of the overall return to work after surgery for trapeziometacarpal joint OA with a 95% confidence interval.



**Figure 2.** Kaplan–Meier plot of the return to work after surgery for trapeziometacarpal joint OA, stratified by different occupational intensities with corresponding 95% confidence intervals.

patients with medium physical labour had a hazard ratio (HR) of 0.54 [95% CI[0.42–0.69],  $P < 0.001$ ], and patients with heavy physical labour had an HR of 0.50 [95% CI[0.37–0.67],  $P < 0.001$ ]. This means that the return to work within the first year after surgery is 46% lower when performing medium physical labour and 50% lower when performing heavy physical labour compared with light physical labour. In addition, patients with a lower score on the MHQ work and the MHQ hand function of the unoperated sides had a longer period off work. Specifically, an increase of one point on the MHQ work and MHQ hand function of the unoperated side was associated with an HR of 1.02 [95% CI[1.02–1.03],  $P = 0.001$ ] and an HR of 1.01

[95%CI [1.00–1.02],  $P = 0.034$ ], respectively (online Table S1). Patients whose dominant hand was treated also had a delayed return to work with an HR of 0.745 [95% CI[0.60–0.93],  $P = 0.008$ ].

### Costs of lost productivity

On a patient level, the total costs of lost productivity per patient in the first year after surgery were €11,175 (25%–75%; €5588–€27,007). The median costs of lost productivity increased from €7450 in the light occupational intensity group to €18,626 in the heavy occupational intensity group (Online Table S2). The costs of lost productivity were €2794 higher in patients who were treated on their dominant side compared with the non-dominant hand.

On a population level, the annual loss of productivity costs on the population level was €16.8 million. Since the costs of lost productivity are directly dependent on the median time to return to work, 50% of the total costs of lost productivity occurred in the first 12 weeks after surgery.

### Discussion

In our patients, in the first year after trapeziectomy and ligament reconstruction with tendon interposition for trapeziometacarpal joint OA, 78% of the patients returned to work and 50% of the patients returned to work within 12 weeks. Factors associated with return to work were physical workload, dominance of the treated hand, and the MHQ work and hand function scores of the unoperated side at baseline.

Our results show a quicker return to work than previous studies after surgery for trapeziometacarpal joint OA. Wolf et al. (2018) found a median time to return to work of 18 weeks (124 days) for women and 20 weeks (138 days) for men, and Marks et al. (2015) reported an average of 10 weeks of fulltime sick leave. These differences in time to return to work may be explained by different definitions of return to work, since there is a lack of consistency and comprehensiveness of return to work (Wasiak et al., 2007). In addition to these methodological differences, differences in surgical procedures, post-operative treatment and rehabilitation may explain these different results. Tsehaie et al. (2019) found that plaster immobilization for 3 to 5 days after trapeziometacarpal joint OA surgery may lead to quicker recovery.

Other studies have noted several identical factors associated with return to work. Neutel et al. (2018) reported the type of work as an important predictor for return to work in patients with a traumatic wrist injury. However, they also found that being a woman

increased the time off work, which we were not able to corroborate in our patient population. Opsteegh et al. (2009) reported baseline pain to be a determinant of return to work in patients with hand disorders and hand injuries. Our findings do not support this result, but show that work impairments before surgery are more important than pain.

We found higher costs and economic burden than Marks et al. (2015) after trapeziectomy with ligament reconstruction and tendon interposition (LRTI) or arthrodesis for trapeziometacarpal joint OA. The mean age of their population (64 years) was 9 years older than ours (55 years). The difference in costs between both studies could be explained by lower productivity costs per hour, as Marks used values ranging between €16 and €24, whereas the weighted average in our study was €33. This difference partly stems from the fact that we used the total cost for the employer rather than the income of individuals. Also, our study was performed in patients who had paid employment before surgery, whereas 63% of their population was unemployed. Other studies report that roughly 50% of patients were unemployed before surgery (Marks et al., 2015).

The indirect costs of trapeziometacarpal joint OA are high compared with the indirect costs of other types of surgery. For example, the cost of lost productivity of hernia surgery (Gillion et al., 2016), €5376 are almost two times lower than our reported costs. This difference is most likely because hand function is crucial for performing nearly all jobs.

We were not able to make subgroups for different surgical procedures as the database does not provide reliable information on which ligament reconstruction tendon interposition was used. Also, we did not have any information on the recommended sick leave from the surgeon and on additional hand pathology, such as scapholunate dissociations, which may have influenced the results. Furthermore, we estimated the time to return to work with subjective questionnaires. Databases with information from public services could have provided a clearer picture, but we did not have access to them. Time to return to work in days or hours instead of weeks would make the economic evaluation more precise. Moreover, we did not have any information on whether patients returned to work quickly and then stopped due to complaints. The estimated costs in this study may be an absolute underestimation of the actual economic burden because we only included not attending work and did not take into account diminished functioning while attending work.

The factors that influence the return to work in the present study only partially explain the variance in return to work. Neutel et al. (2018) reported that

for wrist injuries, having complications and blaming someone else for the injury also were predictors for a delayed return to work. Opsteegh et al. (2009) reported accident location, job autonomy and symptoms of post-traumatic stress disorders to be determinants of return to work in patients with hand disorders and hand injuries. Work-related factors, such as working relationships, accommodations, and practical and physical limitations, are known to influence return to work outcomes in patients with musculoskeletal conditions (Young and Choi, 2016). In other illnesses, psychosocial factors are also associated with return to work (Cougot et al., 2015; Peters et al., 2016), for example, in patients with chronic back pain, more anxiety and depression were associated with later return to work. Psychosocial interventions might reduce the indirect costs of surgery for trapeziometacarpal joint OA due to a longer time to return to work. The influence of prior sick leave before the treatment should be investigated, as studies in lower back pain, musculoskeletal illnesses and respiratory diseases (Alexopoulos and Burdorf, 2001; Brendbekken et al., 2018; Burdorf et al., 1998) found that sick leave pattern before the current episode was associated with longer sick leave during follow-up. Determining the optimal timing for treatment might reduce the length of sick leave after surgery.

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