

# Substantial Increase in the Incidence of Surgery for Osteoarthritis of the Base of the Thumb Between 1997 and 2019 in Finland

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**Abstract.** *Background/Aim: Osteoarthritis (OA) at the trapeziometacarpal joint (TMC) is common. However, no published data on the TMC-OA surgery incidence exist. The aim of this study was to evaluate the incidence and trends of TMC-OA surgical treatment. Patients and Methods: A nationwide hospital discharge register-based study was conducted among patients surgically treated for TMC-OA in Finland between 1997 and 2019. Results: A total of 8,728 surgeries were performed. The annual surgery incidence increased 10-fold from 1997 to 2019. The incidence was higher in women and increased the most in the age groups of 50-59 and 60-69 years. TMC resection arthroplasty with or without ligament reconstruction and/or tendon interposition accounted for 91% of all surgeries. Conclusion: The increase in the surgical procedure rates is substantial. It is not explained by advancements in surgical treatment or by the ageing population. The indications for surgery appear to have become broader.*

Osteoarthritis (OA) of the trapeziometacarpal joint (TMC) at the base of the thumb is one of the most common degenerative diseases. Female gender and heredity are known risk factors for hand OA (1). Moreover, the prevalence of TMC-OA increases with age (2-5). Up to 44% of Caucasian men and 57% of women >60 years of age have been reported to have signs of radiographic TMC-OA, whereas 3.7% of men and 9.3% of women suffered from symptomatic TMC-OA leading to pain, weakness, and disability (5).

If non-operative measures fail to treat pain adequately in patients with TMC-OA, operative intervention is considered

(6). Trapeziectomy, described by Gervis in 1949 (7), is still the gold-standard surgical procedure for TMC-OA. Several different modifications of this procedure have been described, which combine *e.g.*, ligament reconstruction, tendon interposition (LRTI), or both (8-10). Various interposition implants and total joint replacement designs have also been described (11). Arthrodesis is considered an option for patients with isolated TMC-OA (12).

While a major increase in hand-OA prevalence seems unlikely, a study by Wildin *et al.* showed that the number of patients seeing a surgeon for hand OA has almost tripled in 10 years from 13 to 34/100000 (13). In a Scandinavian study, more than 1 in 20 elderly women consulted a physician for TMC-OA (14). However, no national-level epidemiological studies on surgical treatment of TMC-OA have been previously reported. Thus, the purpose of this study was to investigate the incidence and trends of surgical treatment of TMC-OA in Finland between 1997 and 2019.

## Patients and Methods

The Finnish National Hospital Discharge Register (FNHDR) is a statutory nationwide registry for all public and private hospitals. The database contains comprehensive information on patient characteristics, diagnoses, and surgical procedures performed in Finland. FNHDR data have been previously used in multiple epidemiologic studies (15, 16).

In this study, we analyzed FNHDR data of all surgical procedures on adults (>18 years) for TMC-OA performed between 1 January 1997 to 31 December 2019. We investigated the number of surgical TMC-OA procedures using the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) and the Finnish version of the Nordic Medico-Statistical Committee (NOMESCO) classifications of Surgical Procedures (NCSP). We included patients with ICD-10 diagnosis codes M15.0, M15.4, M15.8, M15.9, M18, M18.0, M18.1, M18.2, M18.3, M18.4, M18.5, M18.9, M19, M19.0, M19.1, M19.2, M19.8, and M19.9 as well as with NOMESCO procedure codes NDG60 (TMC arthroplasty), NDG70 (TMC arthrodesis), NDB58 (TMC joint replacement), and NDK00 (carpal bone incision or excision). Commonly, both complete or partial trapeziectomy with or without LRTI are performed under the code NDG60, but NDK00 may also

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be used for complete or partial trapeziectomy. Likewise, both interpositional and total joint replacement are performed under the code NDB58. Whereas NDG60, NDG70, and NDB58 are TMC joint-specific, NDK00 was only included when the corresponding diagnosis code was M18-M18.5, indicating TMC-OA.

The FNHDR data do not include information on the operated side or on the occurrence of revision procedures. Therefore, we only included the first procedure (primary procedure) of each patient in the final analysis of surgery incidence. The incidence of multiple procedures on the same patient are reported separately, indicating either operation of the contralateral hand or a revision of the hand primarily operated on.

To calculate the yearly incidence of each TMC-OA procedure in the population, we extracted annual data of the Finnish population, including the population distribution in 10-year age cohorts obtained from the public authority database Statistics Finland. Since the incidence of TMC-OA procedures was based on the actual surgery rates in the entire Finnish adult population, confidence intervals were not calculated. A statistical software program was used for analyzing entered data (IBM SPSS Statistics for Windows, Version 27.0. IBM Corp., Armonk, NY, USA).

Access to data was granted after Findata (data permit authority, operating at the National Institute for Health and Welfare) approved the study design. The data that support the findings of this study are available from Findata but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Findata.

Ethical review and approval were waived for this study, due to the fact that it was a register-based analysis of blinded data. In such case, neither informed consent nor ethical approval are required according to Finnish legislation (medical research act 488/1999, amendments 295/2004, 794/2010).

## Results

A total of 8,728 surgeries for TMC-OA were performed in Finland between 1997-2019, of which 7,256 (83%) were primary procedures and included in further surgery incidence analysis. The total number of NDK00 procedures was 561, with 134 (24%) cases linked to an M18-M18.5 diagnosis and thus included in the analysis. A total of 1,324 patients had two surgeries (83% females), 130 patients (95% females) three, and 18 patients (78% females) had four surgeries, which was the maximum number of procedures performed on a single patient.

The number of all primary TMC-OA procedures increased 12-fold from 52 procedures in 1997 to 606 in 2019. The population of Finland was 5.16 million with an adult population of 3.99 million in 1997 and 5.53 million with an adult population of 4.48 million in 2019. In relation to the adult population size, the incidence of TMC-OA surgery increased 10-fold from 1.3/100,000 in 1997 to 13.5/100,000 in 2019. TMC arthroplasty (NDG60) was the most common surgical procedure, with a total of 6,095 procedures. This accounted for 84% of all primary procedures during the whole study period, with an increase in yearly surgery incidence from 49 to 469

procedures in 1997 and 2019, respectively. Moreover, 489 (6.7%) carpal bone excisions (NDK00) were performed for TMC-OA, increasing the total amount of TMC resection arthroplasties with or without LRTI (NDG60+NDK00) to 91% during the study period. TMC arthrodeses (NDG70) and TMC joint replacements (NDB58) accounted for 541 (7.5%) and 131 (1.8%) of the cases (Figure 1).

The incidence of surgical treatment was higher among female patients; 5,789 (80%) primary procedures were performed on women and 1,467 (20%) on men. Out of the total number of primary procedures on female patients, 4,985 (86%) were TMC arthroplasties (NDG60) and 320 (5.5%) carpal bone excisions (NDK00), totaling the amount of TMC resection arthroplasties with or without LRTI (NDG60+NDK00) to 92%. A total of 367 (6.3%) TMC arthrodeses and 117 (2.0%) TMC joint replacements were performed on female patients. Among male patients, TMC resection arthroplasties with or without LRTI (NDG60+NDK00) accumulated to 1,279 (87%) procedures with 1,110 (76%) TMC arthroplasties (NDG60) and 169 (12%) carpal bone excisions (NDK00). TMC arthrodeses and TMC joint replacements comprised 174 (12%) and 14 (1.0%) operations, respectively (Table I).

The mean age of surgically treated TMC-OA patients was 58.9 years (8.4 SD, range=20-96 years) in women and 58.8 years (9.2 SD, range=20-89 years) in men. The most common age for surgical treatment among female patients in relation to the corresponding age group population was 50-59 years, with 6.1 procedures/100,000 in 1997 and 59.2/100,000 in 2019 (Figure 2). Among male patients in 1997, TMC-OA procedures were most commonly performed on those 70-79 years, with an incidence of 2.3/100,000. In 2019, the age groups 50-59 and 60-69 showed equal-scale incidences of 12.7/100,000 and 14.4/100,000 (Figure 3).

## Discussion

The nationwide population-based incidence of surgical treatment for TMC-OA in Finland increased 10-fold between 1997 and 2019. The increase in surgically treated TMC-OA was greatest in the age groups 50-59 and 60-69 years, *i.e.*, among the working-age and early retirement-age population. The increase was significantly smaller among people <50 years of age, most likely owing to the lower incidence of TMC-OA in this age group. Elderly people generally have lower physical demands than their younger counterparts, which could explain the lower surgery rates in the 70-79 and >80 years age cohorts.

Consistent with the higher prevalence of TMC-OA in females, the incidence of primary TMC-OA surgery in this study was higher among women than men (3, 17). TMC resection arthroplasties with or without LRTI (NDG60+NDK00) accounted for most procedures, whereas

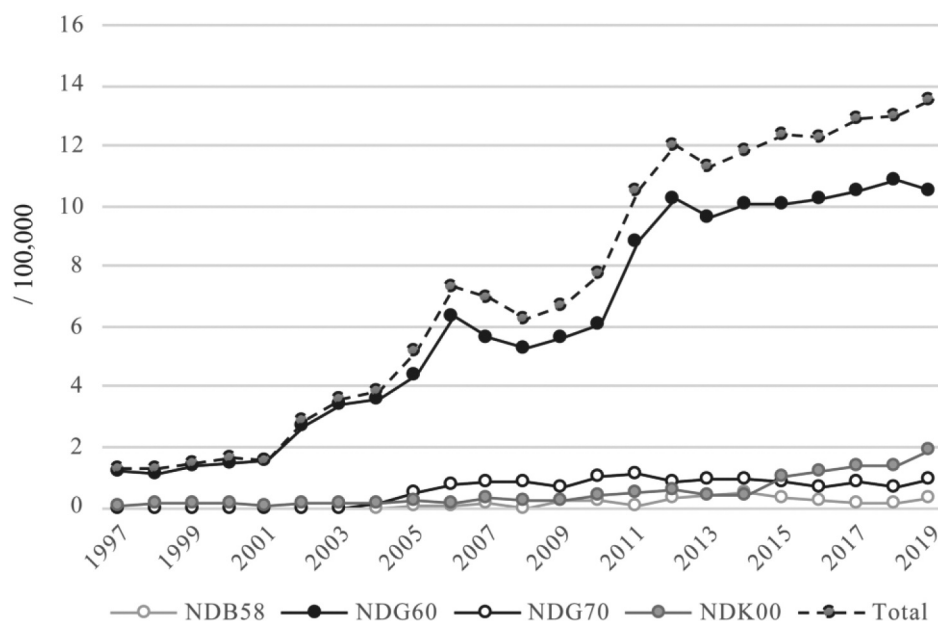


Figure 1. The yearly incidence of primary surgical trapeziometacarpal (TMC) osteoarthritis procedures in relation to the Finnish adult population per 100000 persons. NDB58: TMC joint replacement; NDG60: TMC arthroplasty; NDG70: TMC arthrodesis; and NDK00: carpal bone incision or excision. Only the first procedure for TMC-OA of each patient is included as primary surgical treatment.

the incidences of joint replacements and arthrodeses were relatively low, likely because these procedures do not address OA present at the scapho-trapezio-trapezoid (STT) joint, which becomes evident with disease progression. Moreover, higher risk for adverse events in TMC joint replacement and arthrodesis (11, 12) might explain the lower rates for these procedures. Noticeably, arthrodeses accounted for 12% of all surgeries performed on males, in contrast to 6.3% of all surgeries performed on females.

Only one previous study has investigated the incidence of TMC-OA surgical procedures. A Norwegian registry study from 1994 to 2011 covered 515 primary thumb TMC joint implant arthroplasties in 432 patients. Out of the 479 implant procedures included in the analysis, 371 (76%) were due to OA. During the study period, the overall annual incidence of thumb TMC joint implant arthroplasties did not change. The number of joint implant arthroplasties performed for inflammatory arthritis decreased, whereas operations for OA increased (18). Our study yielded similar results with respect to an increase in TMC joint replacements, although their yearly number in Finland still remains small.

Similar to many other countries, there is an ongoing demographic ageing phenomenon in the Finnish population. In 1997, 48% of the Finnish population was  $\geq 40$  years, whereas in 2019 the proportion had increased to 54%. The large post-World War II baby-boom generation, which in Finland is generally considered to be people born between 1945-1949, is now in its 70s. With population ageing and

Table I. Number of all primary surgical procedures for trapeziometacarpal (TMC) osteoarthritis in Finland between 1997 and 2019 stratified by procedure type and sex.

Procedure type	Total	Females	Males
All primary procedures	7,256	5,789 (80%)	1,467
TMC arthroplasty (NDG60)	6,095	4,985 (82%)	1,110
TMC arthrodesis (NDG70)	541	367 (68%)	174
Carpal bone incision or excision (NDK00)	489	320 (65%)	169
TMC joint replacement (NDB58)	131	117 (89%)	14

since the prevalence of degenerative conditions, including TMC-OA, increases with age, it could be anticipated that the incidence of surgical interventions for degenerative conditions should increase accordingly. However, based on our results, the rising incidence of TMC-OA surgery is not explained by the ageing population, given the increase in surgery incidence across all age groups, even when adjusted to corresponding age group population data.

No advances in surgical techniques have been developed for TMC-OA that could explain the increase in surgery incidence during the study period. In contrast, in recent years there has been a shift back towards simple trapeziectomy along with accumulating evidence of its non-inferiority compared to trapeziectomy combined with LRTI procedures (19, 20) and the higher failure rates of implant procedures

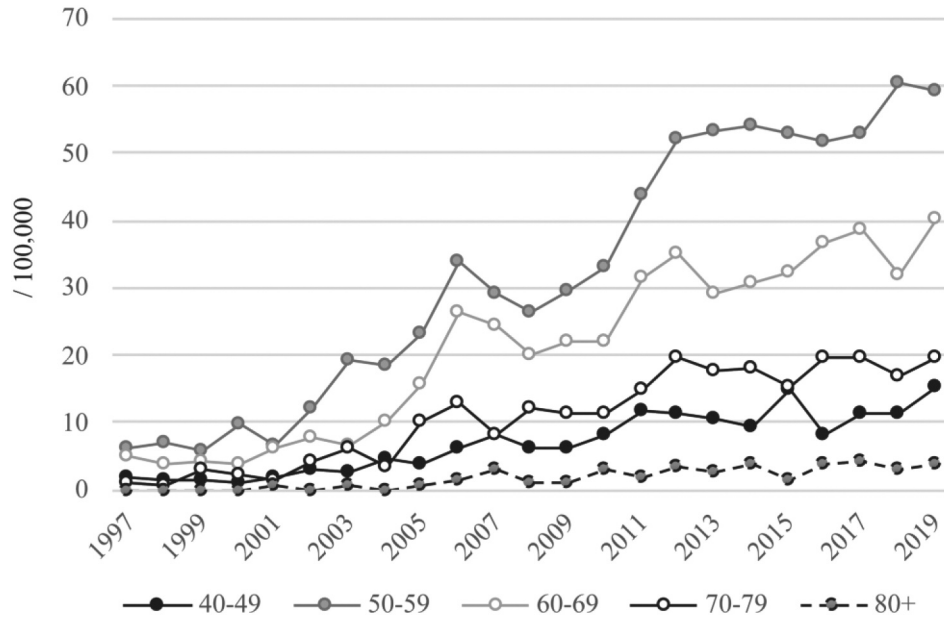


Figure 2. The yearly incidence of primary surgical trapeziometacarpal osteoarthritis (TMC-OA) treatment in females. The incidence is reported in 10-year age cohorts per 100,000 persons in the corresponding age group population. Only the first procedure for TMC-OA of each patient is included as primary surgical treatment.

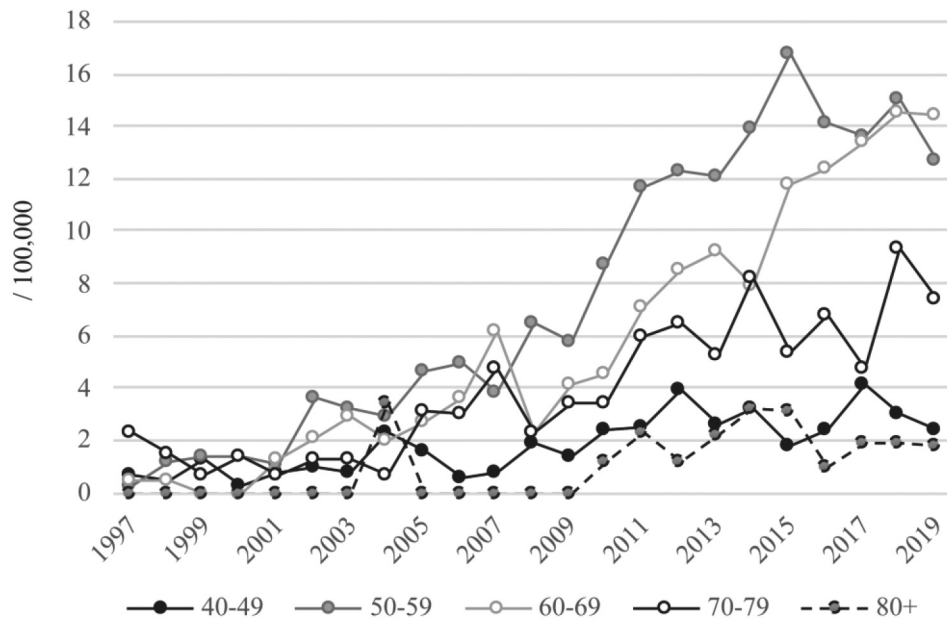


Figure 3. The yearly incidence of primary surgical trapeziometacarpal osteoarthritis (TMC-OA) treatment in males. The incidence is reported in 10-year age cohorts per 100,000 persons in the corresponding age group population. Only the first procedure for TMC-OA of each patient is included as primary surgical treatment.

(11). This is also consistent with our findings of persistently low rates of joint replacement in Finland. Regardless of the absence of recent advancements in surgical techniques, the results of TMC resection arthroplasties with or without LRTI

are known to be good in terms of pain management and patient satisfaction based on observational studies (21, 22), which could be the underlying reason for the rising popularity of TMC surgical procedures.



The natural progression of TMC-OA symptoms is still poorly known and the impact of physical, functional, and psychological factors on clinical manifestations of TMC-OA remain unidentified. Moreover, long-term outcomes after non-operative treatment of painful TMC-OA have not been reported (23). Low quality studies suggest that hand exercise may have a mild positive effect on hand pain, function and finger joint stiffness in the short term (23), however, an occupational therapy regimen has not been shown to significantly delay or reduce the rate of surgery (24). As a growing number of patients, even with few or mild symptoms, are seeking expert opinion on TMC-OA treatment (13, 14, 25), high-quality research is warranted to aid decision making between non-operative and operative treatment in order to avoid surgical over-treatment.

The increasing incidence of TMC-OA surgery is consistent with previous Scandinavian studies for other degenerative conditions. For example, lumbar decompressions and spine fusions increased by 155% in Finland between 1997 and 2018 (26). Another Finnish study reported that the incidence of hip arthroplasty for primary OA in patients 30-59 years increased 6-fold between 1980 and 2007 (27). Moreover, the incidence of knee arthroplasty increased 2.1-fold in Finland between 2000 and 2012, 6.0-fold in Denmark, 3.9-fold in Norway, and 2.3-fold in Sweden between 1997 and 2012 (28).

The strength of our study is the high-quality nationwide nature of the data. The FNHDR is mandatory for all Finnish public and private hospitals. The representativeness of the register has shown to be excellent for the last two decades. Recent studies on peritrochanteric fractures and cruciate ligament injuries reported a FNHDR coverage of 92-98% and accuracy of 88-89% in procedural coding (15, 16).

There are some limitations to the FNHDR data. First, there is a possibility of missing defectively coded diagnoses/procedures (*e.g.*, NDK00 procedures for TMC-OA combined with M19.X diagnoses). Second, because both simple trapeziectomy and trapeziectomy with LRTI are performed under the same procedural codes (NDG60 and NDK00), it is impossible to report the current trend between these two most common procedures. Likewise, it is impossible to separate interpositional and total joint replacement (NDB58). Third, the side of the operation or possible reoperations on the same extremity are not distinctly recorded in the database. Therefore, we excluded all but the first procedure of each patient in the incidence analysis. Due to this limitation, some revision procedures with the primary operation performed before 1997 might be included in the incidence analysis. However, we expect this number to be minimal due to the low operation rates during the early years of this study and the low revision rate for TMC resection arthroplasties with or without LRTI (4.6%) reported in our previous study (29). Likewise, we may assume that most of the 1,176 second operations to be bilaterally operated

patients rather than revisions. Only 148 patients were operated three or more times for TMC-OA in this study. Another limitation of our study is the lack of data concerning possible changes in the prevalence of TMC-OA in Finland during the study period. The prevalence of hip and knee OA has remained unchanged in Finland over the last decades (30) and we consider the probability of major changes in TMC-OA prevalence to be low.

Considering the drastic rise in the incidence of surgery for TMC-OA in Finland, cautious assumptions may be made of either surgical undertreatment in the early years of the study, overtreatment in the later years, or both. As the rising surgery incidence observed in this study is not explained by changing population demographics, TMC-OA prevalence, or advances in surgical techniques, the indications for surgery of TMC-OA appear to have become broader.

### Conflicts of Interest

The Authors declare that they have no competing interests in relation to this study.

### Authors' Contributions

S.A. conceived the study. All authors contributed to designing the study. S.A. and E.W. acquired the data. S.A. and M.M. performed the data analysis and M.M. drafted the manuscript. All Authors contributed to refinement and approved the final manuscript.

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