

# Trends and Variation in Knee Osteotomy Surgical Volumes in England: analysis of hospital episode statistics data over twenty-five years

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## INTRODUCTION:

Knee osteotomy (KO) is performed with the goal of altering the weight-bearing biomechanics of the knee to improve joint pain, function, or stability. Indications include the offloading of partial thickness osteoarthritis, where joint replacement is associated with poor outcomes, or to protect other joint preserving procedures such as complex cartilage and meniscal surgery. For full-thickness arthritis, especially in young and active patients, it may offer the best chance for these patients to return to a higher level of activity and significantly delay the need for a subsequent arthroplasty. The purpose of this study was to investigate trends and geographic variation in the rates of high tibial osteotomy and distal femoral osteotomy in England.

## METHODS:

All hospital episodes for patients undergoing KO between 1 January 2002 and 31 December 2022 were extracted by procedure code from the national hospital episode statistics (HES). Age and sex standardised rates of surgery were calculated using Office for National Statistics (ONS) population data as the denominator and analysed over time both nationally and regionally by NHS Integrated Care Board (ICB). Exclusion included unspecified osteotomy type, rotational osteotomy, the use of external fixators, missing demographic information, simultaneous bilateral procedures or any previous osteotomy to the same knee.

## RESULTS:

### Knee Osteotomy

Between 2002 and 2022 a total of 26,971 knee osteotomies were performed (14,452 male, 10,352 female). Nationally the age-sex standardised rate of osteotomies increased 3.3 fold from 1.4/100k (95% CI 1.3 – 1.5) (n=719) in 2002 to 5/100k (n=2766) at their peak in 2019 (95% CI 4.8 – 5.2). Nationally the rate fell by almost half to 2.6/100,000 in 2020 (95% CI 2.5 - 2.8, n=1457), and showed a slow recovery post pandemic to a rate of 4/100k (95%CI 3.8 - 4.1) in 2022 (n=2229). In 2022, rates were higher in men (4.4 per 100k, (95% CI 4.2 - 4.6 per 100k) than in women (3.6 per 100k (95% CI 3.4 - 3.8 per 100k). The highest rate was seen in the 40-59 age group (5.4 per 100k, (95% CI 5 - 5.8 per 100k). The rate of double osteotomies (concurrent DFO & HTO) also increased over the study period, from 0.1/100k (95% CI 0 – 0.1/100k) in 2005, to a peak of 0.5/100k in 2019 (95% CI 0.4 – 0.6/100k).

### High Tibial Osteotomy

Nationally the age-sex standardised rate of high tibial osteotomies increased 3.55 fold from 0.9/100k (95% CI 0.8 – 1.0) in 2002 to 3.2/100k at their peak in 2019 (95% CI 3.1 – 3.4). Nationally the rate of HTO fell by over a third to 1.8/100k in 2020 (95% CI 1.7 - 1.9), and showed a slow recovery post pandemic to a rate of 2.6/100k (95%CI 2.5 - 2.8) in 2022, representing a 2.88 fold increase from the 2002 rate (figure 1C). HTO rates were higher in men than women across all years, with the rate in men in 2022 (3/100k, (95% CI 2.8 – 3.2/100k) 1.3 fold higher than the rate in women (2.3/100k (95% CI 2.1 – 2.5/100k). The highest rates were seen in the 40-59 age group, with a rate of 3.9/100k (95% CI 3.6 – 4.2/100k) seen in this group in 2022.

### Distal Femoral Osteotomy

Nationally the age-sex standardised rate of high tibial osteotomies increased 3.33 fold from 0.3/100k (95% CI 0.2 – 0.3) in 2002 to 1/100k at their peak in 2019 (95% CI 0.9 – 1.1). Nationally the rate of DFO fell by half to 0.5/100k in 2020 (95% CI 0.4 – 0.6), and showed a slow recovery post pandemic to a rate of 0.7/100k (95%CI 0.7 - 0.8) in 2022, representing a 2.33 fold increase from the 2002 rate.

DFO rates were similar in men and women across all years, with the rate in men in 2022 0.7/100k (95% CI 0.6 – 0.8/100k), and the rate in women also 0.7/100k (95% CI 0.6 – 0.8/100k). The highest rates were seen in the 0-19 age group, with a rate of 1.1/100k in 2022 (95% CI 0.9 – 1.3/100k). High rates were also seen in 20-39 age group (0.8/100k (95% CI 0.7 – 1.0/100k) and 40-59 age group (0.8/100k (95% CI 0.6 – 0.9/100k) in 2022.

### Regional Variation

Regional variation was observed in the number of osteotomies performed. In 2022 the highest regional rate of osteotomy was 9.1/100k (95% CI 7.2 to 11/100k). This represents a rate which is 2.33 fold higher rate than the national ICB average rate/100k in 2022. The lowest rate observed in was 1.4 knee osteotomies/100k (95% CI 0.7 – 2.1/100k) in 2022. In 2022 the national average rate was 3.9/100k, and two ICBs performed more than twice the national average rate.

### Concurrent ligamentous surgery

Simultaneous ACL reconstruction and knee osteotomy incidence increased over the duration of the study. In 2002, concurrent ACL/knee osteotomy surgery was only coded in 5 of the 42 NHS regions, with none of the others showing any measurable activity. The highest having a rate of 0.2 procedures per 100k (95% CI 0.1 – 0.7/100k). The rates increased slowly, with a national rate of 0.1/100k seen in 2005 for the first time (95% CI 0 – 0.1/100k), which increased to 0.4/100k in 2022 (95% CI 0.3 – 0.5/100k). In 2022 the highest volume NHS region did 1.4 (95% CI 0.7 – 2.1/100k) procedures per 100k , three times the national rate and 7 fold higher than the leading region 20 years prior. No concurrent meniscal procedures were coded in 2002, with the 2022 data showing only 13/42 NHS regions performing concurrent meniscal surgery, the highest rate of which was 0.2/100k procedures (95% CI 0 – 0.5.100k).

**Individual consultant volume**

The average number of osteotomies performed among all surgeons who performed at least one in 2022, was 4.38. The 20 highest volume surgeons all performed four times the national average, (>18 procedures each) in 2022.

**DISCUSSION AND CONCLUSION:**

Rates of osteotomy surgery increased over the twenty-year period, but a high degree of regional variation was detected. These findings suggest a need for the development of standardised treatment guidance and a review of service provision to ensure patients have access to the procedure when indicated.

