

■ ARTHROPLASTY

Oxford hip and knee scores deteriorate in patients awaiting lower limb arthroplasty during the COVID-19 pandemic and predict a health state 'worse than death'



**J. O. Clark,
N. Razii,
S. W. J. Lee,
S. J. Grant,
M. J. Davison,
O. Bailey**

From NHS Lanarkshire
University Hospitals,
Glasgow, UK

Aims

The COVID-19 pandemic has caused unprecedented disruption to elective orthopaedic services. The primary objective of this study was to examine changes in functional scores in patients awaiting total hip arthroplasty (THA), total knee arthroplasty (TKA), and unicompartmental knee arthroplasty (UKA). Secondary objectives were to investigate differences between these groups and identify those in a health state 'worse than death' (WTD).

Methods

In this prospective cohort study, preoperative Oxford hip and knee scores (OHS/OKS) were recorded for patients added to a waiting list for THA, TKA, or UKA, during the initial eight months of the COVID-19 pandemic, and repeated at 14 months into the pandemic (mean interval nine months (SD 2.84)). EuroQoL five-dimension five-level health questionnaire (EQ-5D-5L) index scores were also calculated at this point in time, with a negative score representing a state WTD. OHS/OKS were analyzed over time and in relation to the EQ-5D-5L.

Results

A total of 174 patients (58 THA, 74 TKA, 42 UKA) were eligible, after 27 were excluded (one died, seven underwent surgery, 19 non-responders). The overall mean OHS/OKS deteriorated from 15.43 (SD 6.92), when patients were added to the waiting list, to 11.77 (SD 6.45) during the pandemic ($p < 0.001$). There were significantly worse EQ-5D-5L index scores in the THA group ($p = 0.005$), with 22 of these patients (38%) in a health state WTD, than either the TKA group (20 patients; 27% WTD), or the UKA group (nine patients; 21% WTD). A strong positive correlation between the EQ-5D-5L index score and OHS/OKS was observed ($r = 0.818$; $p < 0.001$). Receiver operating characteristic analysis revealed that an OHS/OKS lower than nine predicted a health state WTD (88% sensitivity and 73% specificity).

Conclusion

OHS/OKS deteriorated significantly among patients awaiting lower limb arthroplasty during the COVID-19 pandemic. Overall, 51 patients were in a health state WTD, representing 29% of our entire cohort, which is considerably worse than existing pre-pandemic data.

Cite this article: *Bone Jt Open* 2023;4-3:138–145.

Keywords: Arthroplasty, Waiting list, Elective surgery, Oxford hip score, Oxford knee score, Quality of life, Worse than death, COVID-19

Correspondence should be sent to
Jack O Clark; email:
jack.clark@nhs.scot

doi: 10.1302/2633-1462.43.BJO-
2022-0136.R1

Bone Jt Open 2023;4-3:138–145.

Introduction

Within a few weeks of the COVID-19 pandemic, many orthopaedic departments across the UK saw the immediate cessation of elective activity as part of a strategy to maximize bed capacity for patients with

SARS-CoV-2 infection, and reduce the risk of transmission among the wider population. Total knee arthroplasty (TKA) and total hip arthroplasty (THA) case volumes fell by 61% and 54% respectively, when compared to median case quantities pre-pandemic.¹

Table I. Combined results and comparison between total hip arthroplasty, total knee arthroplasty, and unicompartmental knee arthroplasty groups.

Variable	All patients	THA	TKA	UKA	p-value
Total, n	174	58	74	42	
Sex, M:F	90:84	30:28	39:35	21:21	
Mean age, years (SD; range)	68 (9.28; 38 to 87)	69 (9.07; 40 to 86)	69 (9.96; 38 to 87)	64 (7.06; 47 to 79)	0.005*
Mean initial OHS/OKS (SD)	15.43 (6.92)	13.04 (6.13)	16.54 (5.45)	18.00 (10.91)	0.044*
Mean repeat OHS/OKS during pandemic (SD)	11.77 (6.45)	9.75 (4.55)	12.66 (5.95)	14.09 (10.37)	0.007*
Mean change in OHS/OKS (SD)	3.66 (5.29)	3.29 (4.70)	3.89 (5.58)	3.91 (6.17)	0.895*
Mean index EQ-5D-5L during pandemic (SD)	0.185 (0.276)	0.088 (0.243)	0.231 (0.278)	0.236 (0.287)	0.005*
Health state WTD during pandemic, n (%)	51 (29)	22 (38)	20 (27)	9 (21)	0.172†
Mean EQ-VAS during pandemic (SD)	49.54 (26.28)	43.67 (27.88)	53.93 (24.97)	50 (25.27)	0.871*

*Analysis of variance.

†Chi-squared test.

EQ-5D-5L, EuroQol five-dimension five-level health questionnaire; EQ-VAS, EuroQol visual analogue scale; OHS, Oxford hip score; OKS, Oxford knee score; SD, standard deviation; THA, total hip arthroplasty; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty; WTD, worse than death.

Table II. Correlation between Oxford hip and knee scores and EuroQol five-dimension five-level health questionnaire index scores during the COVID-19 pandemic.

Variable	Mean OHS/OKS	Mean EQ-5D-5L	Correlation coefficient	Coefficient of determination	p-value
All patients	11.77 (6.45)	0.185 (0.276)	0.818	0.669	< 0.001
THA	9.75 (4.55)	0.088 (0.243)	0.763	0.583	< 0.001
TKA	12.66 (5.95)	0.231 (0.278)	0.826	0.682	< 0.001
UKA	14.09 (10.37)	0.236 (0.287)	0.826	0.682	< 0.001

EQ-5D-5L, EuroQol five-dimension five-level health questionnaire; OHS, Oxford hip score; OKS, Oxford knee score; THA, total hip arthroplasty; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty.

Table III. Receiver operating characteristic curve analysis for the diagnostic ability of Oxford hip and knee scores to predict a health state ‘worse than death’ during the COVID-19 pandemic.

Variable	AUC	OHS/OKS threshold for a health state WTD	Sensitivity (%)	Specificity (%)	Youden index
All patients	0.904	8	88	73	0.609
THA	0.931	8	80	82	0.618
TKA	0.905	9	79	75	0.538
UKA	0.855	9	88	89	0.767

AUC, area under the curve; OHS, Oxford hip Score; OKS, Oxford knee score; THA, total hip arthroplasty; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty; WTD, worse than death.

This has not only resulted in increasingly unmanageable waiting lists for elective joint arthroplasty within the NHS, but has also led to a significant decline in quality of life for those already awaiting surgery.² Pre-pandemic data indicated that 12% of patients waiting for a TKA and 19% of patients waiting for a THA were in a health state labelled ‘worse than death’ (WTD), when assessed using the EuroQol five-dimension health questionnaire (EQ-5D).³

THA, TKA, and unicompartmental knee arthroplasty (UKA) have an established record as successful, cost-effective interventions in improving performance and quality of life in degenerative joint disease. However, an ageing population, rising obesity prevalence, and the pandemic have greatly contributed to increased demand.⁴ Excessive waiting list times have been shown to contribute to deterioration in both physical and mental health, alongside an increasing reliance on multimodal analgesics and the burden of their side-effects.^{2,3,5,6}

The primary aim of this study was to examine changes in joint-specific patient-reported outcome measures (PROMs) of patients awaiting THA, TKA, and UKA during the COVID-19 pandemic. Secondary aims were to determine the proportion of these patients in a state WTD during the pandemic, and investigate any correlation with PROMs. This research is intended to supplement contemporary evidence on the need for arthroplasty provision at a time of immense pressure on elective services.

Methods

In this prospective cohort study, preoperative Oxford hip scores (OHS)^{7,8} and Oxford knee scores (OKS)^{7,9} were routinely recorded for patients in NHS Lanarkshire who were placed on the waiting list for primary lower limb arthroplasty (THA, TKA, or UKA), under the care of three high-volume arthroplasty surgeons (SJC, MJD, OB). Patients were eligible if they had been added to

the waiting list within eight months following the World Health Organization declaration of COVID-19 as a global pandemic (11 March to 11 November 2020).¹⁰ In practice, the majority of our cohort joined the waiting list after June 2020, when lockdown restrictions (which had been introduced on 23 March 2020) were gradually eased for Scotland, as many outpatient clinics had been cancelled and surgical staff redeployed during the first wave of the pandemic.

At 14 months into the pandemic, in May 2021, all eligible patients were invited to complete an EQ-5D-5L questionnaire by post, with a repeat OHS/OKS (mean interval nine months (standard deviation (SD) 2.84)), depending on their listed procedure. Patients who had died during the study period, declined to participate, or already underwent surgery, were excluded from the study. These data, as well as baseline characteristics, were obtained through electronic patient records.

The OHS and OKS are validated, joint-specific questionnaires consisting of 12 parts, which use a Likert scale with values between 0 and 4, in order to quantify the level of joint-specific function and degree of disability based on activity over the previous four weeks.⁷⁻⁹ For both questionnaires, a score is generated between 0 and 48, with higher scores representing better function.

The EQ-5D-5L assessment is a tool for assessing health status and quality of life, and has been validated for use in musculoskeletal pathology.^{11,12} It measures five levels of function (no problem, slight problems, moderate problems, severe problems, or unable/extreme problems) in each of five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). The tool also records a visual analogue scale (EQ-VAS) between 0 and 100 as a measure of subjective general health. This study was registered with the EuroQol Research Foundation.

Responses from the EQ-5D-5L are coded as single digit numbers expressing the severity level selected in each dimension. The EQ-5D-5L summary index is derived by applying a formula that attaches value to each of the levels in each dimension, which has been obtained from a standardized valuation exercise, in which a representative sample of the general population in each country is asked to place a value on EQ-5D health states. EQ-5D-5L index scores were calculated for each completed questionnaire and a negative score is considered to represent a health state 'worse than death'.¹³

Statistical analysis. Data were analyzed using statistical software (GraphPad Prism v. 9.0.0; USA). A paired *t*-test was used to assess changes in Oxford scores over time, while a one-way analysis of variance (ANOVA) with post hoc Tukey test was used to examine differences in baseline characteristics and functional scores between the THA, TKA, and UKA groups. The chi-squared test was

used to compare the proportions of patients in a health state WTD between the three groups.

Linear regression analyses were performed to compare EQ-5D-5L index scores, Oxford scores, and EQ-VAS scores, and the Pearson correlation coefficient (*r*) was calculated between these variables. The coefficient of determination (*r*²) was also calculated to measure goodness of fit between the OHS/OKS and the EQ-5D-5L.

Receiver operating characteristic (ROC) curve analysis was undertaken and the area under curve (AUC) was used to determine the diagnostic ability of the OHS/OKS to predict a health state WTD. The AUC ranges from 0.5 (random assignment) to 1.0 (perfect accuracy), with AUC values above 0.8 considered excellent. Sensitivity and specificity were calculated, and the Youden index was used to evaluate threshold values in the OHS/OKS for a health state WTD. For statistical tests, a *p*-value < 0.05 was considered significant.

Results

There were 201 patients initially eligible for the study. Subsequently, 27 patients were excluded; seven underwent arthroplasty surgery as planned, one died preoperatively, and there were 19 non-responders. In total, 174 patients (58 THA, 74 TKA, 42 UKA) with a mean age of 68 years (SD 9.28) were analyzed (Table I). While baseline demographics between the three groups were similar, we observed a lower mean age of participants in the UKA group, in comparison to the THA (*p* = 0.010, ANOVA) and TKA (*p* = 0.005, ANOVA) groups.

There was a statistically significant decline observed in the overall mean OHS/OKS, from 15.43 (SD 6.92) at the initial time of placement on a waiting list, to 11.77 (SD 6.45) at 14 months into the COVID-19 pandemic (*p* < 0.001, paired *t*-test). This change was especially marked in the THA and TKA groups. The initial mean OHS was 13.04 (SD 6.13), and subsequently 9.75 (SD 4.55), in patients awaiting THA (*p* = 0.001, paired *t*-test). The initial mean OKS was 16.54 (SD 5.45), and subsequently 12.66 (SD 5.95), in patients awaiting TKA (*p* < 0.001, paired *t*-test). The mean OKS for the smaller UKA group deteriorated from 18.00 (SD 10.91) to 14.09 (SD 10.37), but this did not reach statistical significance (*p* = 0.062, paired *t*-test).

There was a statistically significant difference in the mean OHS/OKS between the three groups (*p* = 0.044, ANOVA) at the initial time of placement on a waiting list, although post hoc Tukey analysis indicated that the scores for each group (THA, TKA, and UKA) were not significantly different when compared as pairs with each other. There was also a statistically significant difference in the mean OHS/OKS score between the three groups (*p* = 0.007, ANOVA) at 14 months into the COVID-19 pandemic, but this time, post hoc Tukey analysis demonstrated significantly worse scores in the THA group, compared with the TKA group (*p* = 0.020, ANOVA) and UKA group (*p* =

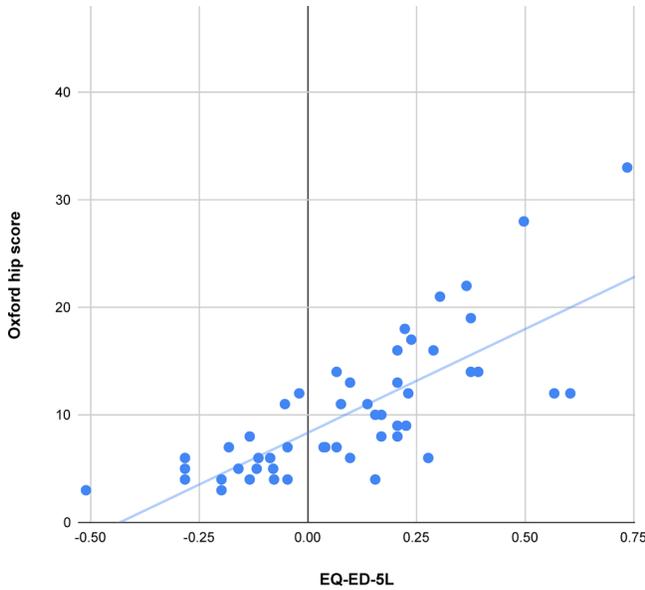


Fig. 1

Linear regression analysis for patients awaiting total hip arthroplasty, comparing Oxford hip scores with EuroQol five-dimension five-level health questionnaire (EQ-5D-5L) index scores.

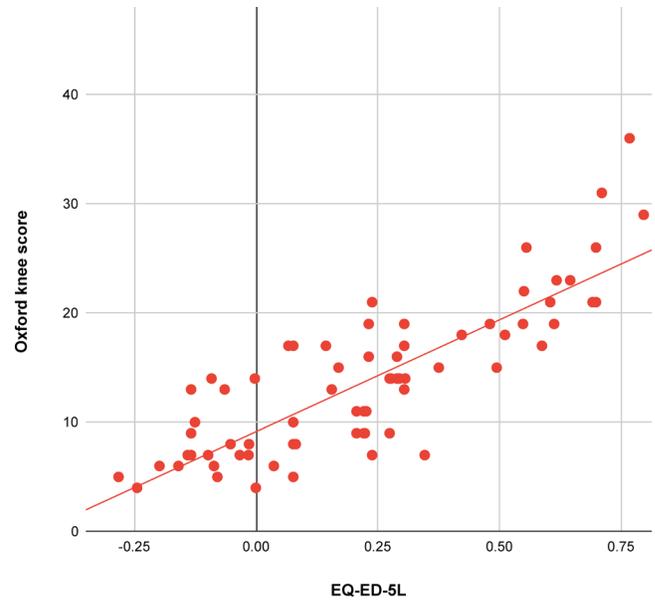


Fig. 2

Linear regression analysis for patients awaiting total knee arthroplasty, comparing Oxford knee scores with EuroQol five-dimension five-level health questionnaire (EQ-5D-5L) index scores.

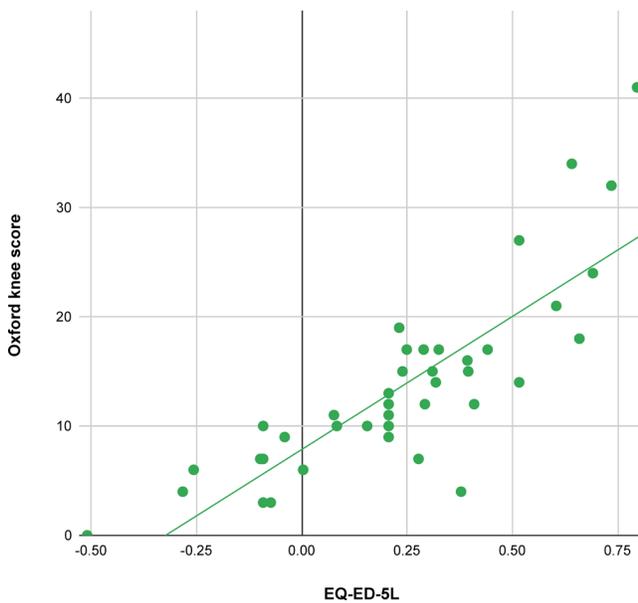


Fig. 3

Linear regression analysis for patients awaiting unicompartmental knee arthroplasty, comparing Oxford knee scores with EuroQol five-dimension five-level health questionnaire (EQ-5D-5L) index scores.

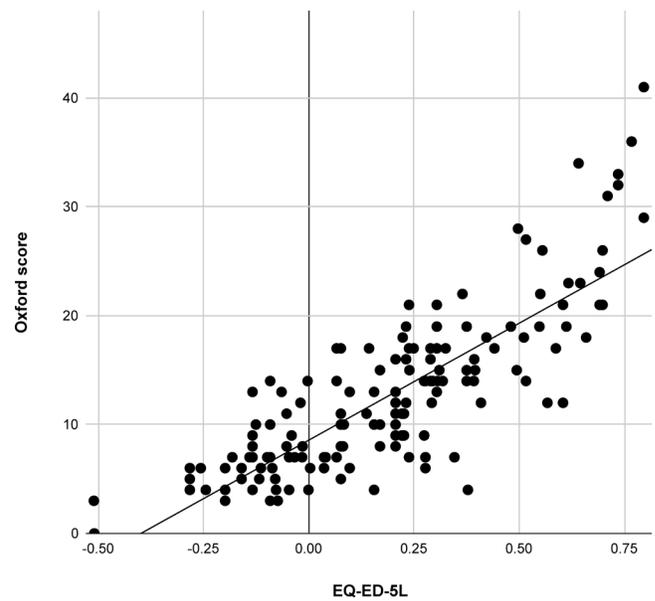


Fig. 4

Combined linear regression analysis for the entire cohort, comparing Oxford hip and knee scores with EuroQol five-dimension five-level health questionnaire (EQ-5D-5L) index scores.

0.026, ANOVA) individually. However, the rate of decline in the OHS/OKS during the pandemic was found to be similar between the three groups ($p = 0.895$, ANOVA).

During the COVID-19 pandemic, 51 patients (29% of the entire cohort) had negative EQ-5D-5L index scores, representing a health state WTD. This comprised 22 patients in the THA group (38%), 20 patients in the TKA

group (27%), and nine patients in the UKA group (21%). The proportions of those WTD between these groups were not significantly different ($p = 0.172$, chi-squared test). However, there was a statistically significant difference in mean EQ-5D-5L index scores between the three groups ($p = 0.005$, ANOVA), with post hoc Tukey analysis demonstrating significantly worse scores in the THA

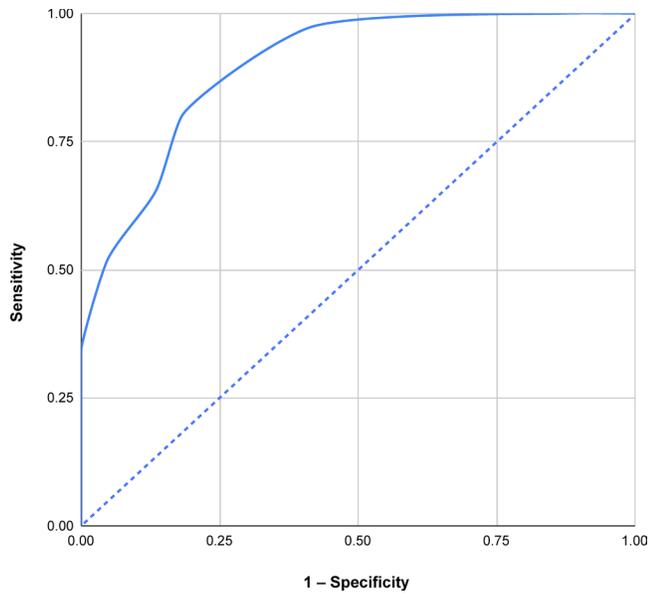


Fig. 5

Receiver operating characteristic curve for the Oxford hip score as a predictor of a health state 'worse than death' in patients awaiting total hip arthroplasty.

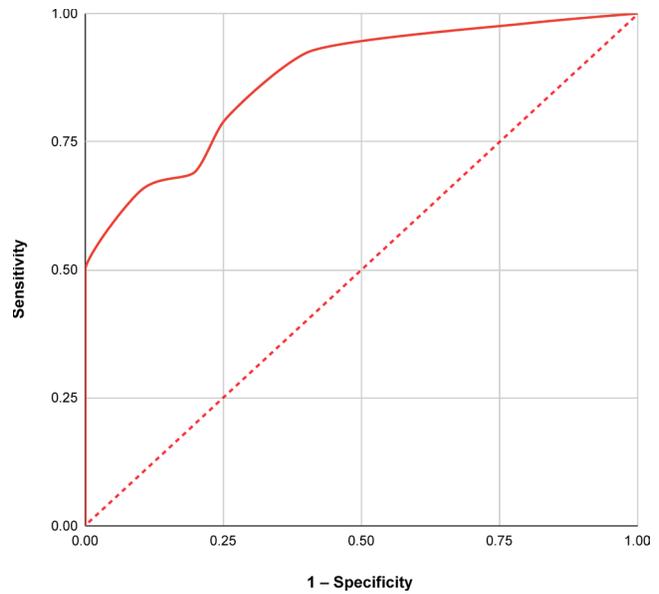


Fig. 6

Receiver operating characteristic curve for the Oxford knee score as a predictor of a health state 'worse than death' in patients awaiting total knee arthroplasty.

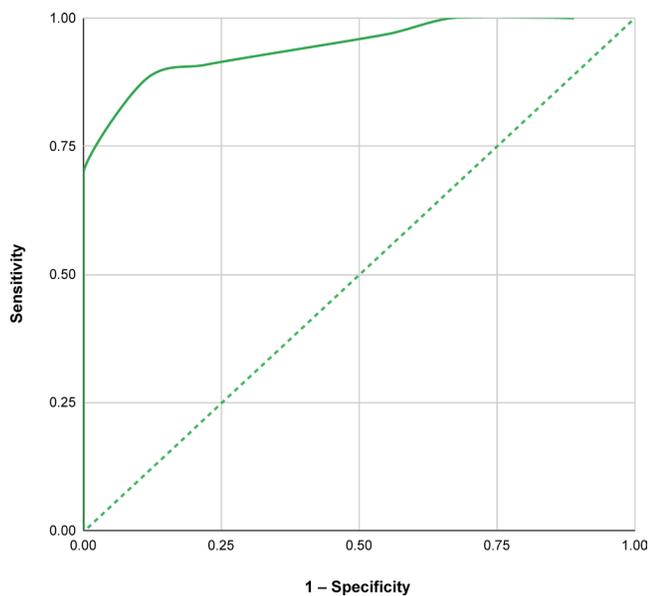


Fig. 7

Receiver operating characteristic curve for the Oxford knee score as a predictor of a health state 'worse than death' in patients awaiting unicompartmental knee arthroplasty.

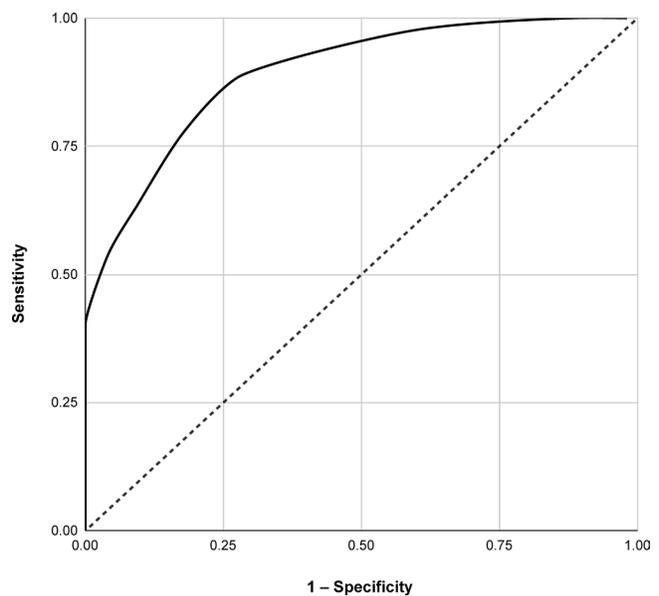


Fig. 8

Receiver operating characteristic curve for Oxford hip and knee scores as a predictor of a health state 'worse than death' across the entire cohort.

group, compared with the TKA group ($p = 0.016$, ANOVA) and UKA group ($p = 0.012$, ANOVA).

The overall mean EQ-VAS score was 49.54 (SD 26.28). The THA group reported a mean EQ-VAS score of 43.67 (SD 27.88), the TKA group reported a mean EQ-VAS score of 53.93 (SD 24.97), and the mean EQ-VAS score for the UKA group was 50 (SD 25.27). There were no statistically

significant differences in mean EQ-VAS scores between the three groups ($p = 0.871$, ANOVA). There was only a moderate positive correlation observed when comparing EQ-VAS scores with the OHS/OKS ($r = 0.466$; $p < 0.001$), and when comparing EQ-VAS scores with EQ-5D-5L index scores ($r = 0.490$; $p < 0.001$), across all patients.

Linear regression analysis (Table II) revealed a strong positive correlation between the EQ-5D-5L index score

and OHS/OKS for the THA group ($r = 0.763$; $p < 0.001$) (Figure 1), TKA group ($r = 0.826$; $p < 0.001$) (Figure 2), UKA group ($r = 0.826$; $p < 0.001$) (Figure 3), and the overall cohort ($r = 0.818$; $p < 0.001$) (Figure 4). In ROC analysis (Table III), the AUC was 0.931 for the THA group (Figure 5), 0.905 for the TKA group (Figure 6), and 0.855 for the UKA group (Figure 7). The AUC for the entire cohort was 0.904 (Figure 8), signifying that Oxford hip and knee scores demonstrate excellent discrimination for predicting a health state WTD. In patients awaiting THA, the threshold OHS was 8 for a health state WTD (80% sensitivity and 82% specificity). Meanwhile, the threshold OKS was 9 for a health state WTD in both TKA patients (79% sensitivity and 75% specificity) and UKA patients (88% sensitivity and 89% specificity). Across the entire cohort, an OHS/OKS less than 9 was indicative of a health state WTD, with 88% sensitivity and 73% specificity.

Discussion

In this study, OHS/OKS deteriorated significantly during the COVID-19 pandemic, and almost one-third of our patients awaiting lower limb arthroplasty surgery reported a health state WTD. Significantly worse EQ-5D-5L index scores and Oxford scores were seen in patients awaiting THA, in comparison with those awaiting TKA or UKA. These findings are consistent with a recent cohort study from Denmark, which demonstrated worse EQ-5D index scores in patients with hip osteoarthritis than knee osteoarthritis ($p < 0.001$), despite a similar duration of symptoms ($p = 0.867$).¹⁴ Likewise, cross-sectional studies of patients awaiting lower limb arthroplasty at various orthopaedic departments across the UK have revealed a similar trend, where individuals awaiting THA are significantly more likely to be in a health state WTD.^{2,15} It was also found that each additional six months of waiting for lower limb arthroplasty corresponds with a clinically significant deterioration in EQ-5D-3L score.

Pain and disability related to hip and knee osteoarthritis has been associated with a significant increase in both mortality and cardiovascular disease, independent of confounding factors.^{16,17} Meanwhile, arthroplasty significantly reduces the overall mortality rate in patients with end-stage knee osteoarthritis, up to 12 years post-operatively, when compared to the general population.¹⁸ However, poorer preoperative PROMs and negative EQ-5D scores significantly affect return to work following THA and TKA.¹⁹ This finding is even more consequential when taking into account the evidence, which has remained consistent before and during the COVID-19 era, that joint-specific functional scores and quality of life deteriorate when patients spend more than six months on the waiting list for surgery.^{15,20,21}

A study by Scott et al,³ undertaken prior to the pandemic, indicated that up to one-fifth of patients awaiting THA and TKA were already in a health state

WTD. Nationwide data have shown that the number of patients WTD has almost doubled with the cessation of elective activity during the peak of the pandemic.² An index score WTD does not imply that such a patient would rather be dead. In the standardized valuation exercise for the EQ-5D, a representative sample of the general population in each country is asked to place value scores, based on their beliefs of quality of life for each hypothetical health state. The value set, as used in this study, is specific to the UK and would change for respondents in other countries.

It should also be noted that our use of the EQ-5D-5L, which differs from contemporary studies that have used EQ-5D-3L scores,^{2,3,15,22} does have implications. The EQ-5D-5L descriptive set was developed to provide more precise measurements than the EQ-5D-3L at individual and group levels,²³ and comparative studies have suggested that it has stronger validity for patients awaiting THA and TKA.^{24,25} Importantly, there are far fewer WTD states in the five-level value set (5.1%) than the three-level equivalent (34.6%) for the UK.¹¹ All other countries have higher minimum values and fewer WTD health states than the UK, when using the EQ-5D-3L descriptive set.¹³ It is likely that a much larger proportion of our cohort would have been considered WTD, if we had used EQ-5D-3L scores.

The use of different EQ-5D systems may also explain the considerable difference in our threshold Oxford score (8), and that of a retrospective study of patients undergoing primary TKA prior to the pandemic (16),²² to predict a health state WTD. Nevertheless, the proportion of patients WTD in the present study was more than twice as high, despite using the EQ-5D-5L, and the mean OKS for our patients awaiting knee arthroplasty was significantly lower. The decline in PROMs highlights the increasing burden of degenerative joint disease, and it has already been shown that quality of life may be considerably improved by performing arthroplasty in these patients.³

The NHS faces ongoing effects of the pandemic, including staff shortages and lack of hospital beds, while attempting to restart and maintain elective operating.²⁶ These pressures compound the significant rise in demand for hip and knee arthroplasty, which had already been projected in the years prior to the pandemic.⁴ The National Institute for Health and Clinical Excellence uses quality-adjusted life years (QALYs) as the principal measure of health outcomes and makes recommendations about interventions on this basis.²⁷ Interventions costing less than £20,000 per QALY are considered to be cost-effective; THA, TKA, and UKA are therefore extremely cost-effective treatments, especially with higher case volumes. It has previously been assessed that the cost per QALY for THA is £1,372, the cost per QALY for TKA is £2,101, and the cost per QALY for UKA is less than TKA.^{28,29}

Theatre capacity has become a precious commodity during the COVID-19 pandemic, and among surgical specialties, orthopaedics has experienced the highest disruption rate of 82%.³⁰ In order to address increasing waiting lists, the Federation of Surgical Speciality Association recommended prioritization categories of all surgical subspecialties from Prioritization 1 (surgery to be performed within 24 hours of listing) to Prioritization 4 (surgery can be performed beyond three months without significant risk of harm) during the pandemic.³¹ This guide was devised early in the pandemic and not designed for long-term use. The results of this study show that patients listed in a single category (Prioritization 4) may have considerable variation in joint-specific function and quality of life (Figure 4). The British Orthopaedic Association and several specialist societies therefore published an alternative prioritization process based upon frequent timed review and recategorization of elective arthroplasty patients, as symptoms and quality of life dictate.³² Furthermore, it had already been demonstrated in the initial year of the pandemic that elective surgery could be safely restarted using dedicated pathways.^{33,34}

We recognize that this study has limitations. First, EQ-5D-5L index scores are not routinely obtained alongside the OHS/OKS when patients are added to the waiting list for lower limb arthroplasty within our health board, and these would have been interesting to observe over time. Second, there are other validated scoring systems available for assessing joint-specific function and overall quality of life, such as the American Knee Society Score and the 36-Item Short Form Survey,^{35,36} which were not measured. Third, although we recruited patients across two hospitals, there are likely to be variations in perceived quality of life and public health across the country. However, the purpose of this study was to analyze preoperative PROMs, and the association with a health state WTD, within a specified cohort of consecutive patients during the pandemic. Finally, it should be noted that other comorbidities might adversely influence EQ-5D-5L index scores, but as this study did not involve a control group without end-stage osteoarthritis, these were not examined.

In conclusion, this study reinforces the assertion that elective surgery does not mean expendable surgery,^{37,38} even while health boards across the country contend with unprecedented levels of demand. Although COVID-19 remains a significant public health concern, deferring arthroplasty procedures is not benign either, as joint-specific function and quality of life continues to decline among patients currently on the waiting list for these operations. Further health and socioeconomic analysis is required to assess the impact of resource reallocation and delays in elective surgery on the wider population.



Take home message

- Oxford hip and knee scores deteriorated significantly amongst patients awaiting elective lower limb arthroplasty during the COVID-19 pandemic.
- Oxford scores correlate strongly with the EuroQol five-dimension five-level (EQ-5D-5L) index score. Worse preoperative scores were observed in those awaiting hip arthroplasty, than knee arthroplasty.
- Almost a third of patients of our patients awaiting hip and knee arthroplasty are in a health state 'worse than death', which is considerably worse than pre-pandemic data. This proportion would have been even higher with EQ-5D-3L index scores.

Twitter

Follow NHS Lanarkshire @NHSLanarkshire

References

1. Yapp LZ, Clarke JV, Moran M, Simpson A, Scott CEH. National operating volume for primary hip and knee arthroplasty in the COVID-19 era: a study utilizing the Scottish arthroplasty project dataset. *Bone Jt Open*. 2021;2(3):203–210.
2. Clement ND, Scott CEH, Murray JRD, Howie CR, Deehan DJ, IMPACT-Restart Collaboration. The number of patients "worse than death" while waiting for a hip or knee arthroplasty has nearly doubled during the COVID-19 pandemic. *Bone Joint J*. 2021;103-B(4):672–680.
3. Scott CEH, MacDonald DJ, Howie CR. "Worse than death" and waiting for a joint arthroplasty. *Bone Joint J*. 2019;101-B(8):941–950.
4. Culliford D, Maskell J, Judge A, et al. Future projections of total hip and knee arthroplasty in the UK: results from the UK Clinical Practice Research Datalink. *Osteoarthritis Cartilage*. 2015;23(4):594–600.
5. Silverman SL, Schepman P, Rice JB, et al. Drug utilization, clinical and economic outcomes of patients with osteoarthritis of the hip and/or knee treated with long-term use of traditional NSAIDs, topical NSAIDs, and COX-2 inhibitors. *Curr Med Res Opin*. 2022;38(7):1153–1166.
6. Farrow L, Gardner WT, Tang CC, Low R, Forget P, Ashcroft GP. Impact of COVID-19 on opioid use in those awaiting hip and knee arthroplasty: a retrospective cohort study. *BMJ Qual Saf*. 2021;bmjqs-2021-013450.
7. Murray DW, Fitzpatrick R, Rogers K, et al. The use of the Oxford hip and knee scores. *J Bone Joint Surg Br*. 2007;89-B(8):1010–1014.
8. Dawson J, Fitzpatrick R, Carr A, Murray D. Questionnaire on the perceptions of patients about total hip replacement. *J Bone Joint Surg Br*. 1996;78-B(2):185–190.
9. Dawson J, Fitzpatrick R, Murray D, Carr A. Questionnaire on the perceptions of patients about total knee replacement. *J Bone Joint Surg Br*. 1998;80-B(1):63–69.
10. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed*. 2020;91(1):157–160.
11. Lloyd A. EQ-5D: Moving from three levels to five. *Value Health*. 2018;21(1):57–58.
12. Feng YS, Kohlmann T, Janssen MF, Buchholz I. Psychometric properties of the EQ-5D-5L: a systematic review of the literature. *Qual Life Res*. 2021;30(3):647–673.
13. Devlin NJ, Shah KK, Feng Y, Mulhern B, van Hout B. Valuing health-related quality of life: An EQ-5D-5L value set for England. *Health Econ*. 2018;27(1):7–22.
14. Roos EM, Grønne DT, Thorlund JB, Skou ST. Knee and hip osteoarthritis are more alike than different in baseline characteristics and outcomes: a longitudinal study of 32,599 patients participating in supervised education and exercise therapy. *Osteoarthritis Cartilage*. 2022;30(5):681–688.
15. Clement ND, Wickramasinghe NR, Bayram JM, et al. Significant deterioration in quality of life and increased frailty in patients waiting more than six months for total hip or knee arthroplasty: a cross-sectional multicentre study. *Bone Joint J*. 2022;104-B(11):1215–1224.
16. Hawker GA, Croxford R, Bierman AS, et al. All-cause mortality and serious cardiovascular events in people with hip and knee osteoarthritis: a population based cohort study. *PLoS One*. 2014;9(3):e91286.
17. Leyland KM, Gates LS, Sanchez-Santos MT, et al. Knee osteoarthritis and time-to all-cause mortality in six community-based cohorts: an international meta-analysis of individual participant-level data. *Aging Clin Exp Res*. 2021;33(3):529–545.
18. Choi HG, Kwon BC, Kim JI, Lee JK. Total knee arthroplasty reduces the risk of mortality in osteoarthritis patients up to 12 years: A Korean national cohort longitudinal follow-up study. *J Orthop Surg (Hong Kong)*. 2020;28(1):2309499020902589.
19. Al-Hourani K, MacDonald DJ, Turnbull GS, Breusch SJ, Scott CEH. Return to work following total knee and hip arthroplasty: the effect of patient intent and preoperative work status. *J Arthroplasty*. 2021;36(2):434–441.

20. **Ahmad I, Konduru S.** Change in functional status of patients whilst awaiting primary total knee arthroplasty. *Surgeon.* 2007;5(5):266–267.
21. **Ostendorf M, Buskens E, van Stel H, et al.** Waiting for total hip arthroplasty: avoidable loss in quality time and preventable deterioration. *J Arthroplasty.* 2004;19(3):302–309.
22. **Clement ND, Afzal I, Liu P, et al.** The Oxford Knee Score is a reliable predictor of patients in a health state worse than death and awaiting total knee arthroplasty. *Arthroplasty.* 2022;4(1):33.
23. **Greene ME, Rader KA, Garellick G, Malchau H, Freiberg AA, Rolfson O.** The EQ-5D-5L improves on the EQ-5D-3L for health-related quality-of-life assessment in patients undergoing total hip arthroplasty. *Clin Orthop Relat Res.* 2015;473(11):3383–3390.
24. **Conner-Spady BL, Marshall DA, Bohm E, et al.** Reliability and validity of the EQ-5D-5L compared to the EQ-5D-3L in patients with osteoarthritis referred for hip and knee replacement. *Qual Life Res.* 2015;24(7):1775–1784.
25. **Jin X, Al Sayah F, Ohinmaa A, Marshall DA, Smith C, Johnson JA.** The EQ-5D-5L is superior to the -3L version in measuring health-related quality of life in patients awaiting THA or TKA. *Clin Orthop Relat Res.* 2019;477(7):1632–1644.
26. **Madanipour S, Iranpour F, Goetz T, Khan S.** COVID-19: lessons learnt and priorities in trauma and orthopaedic surgery. *Ann R Coll Surg Engl.* 2021;103(6):390–394.
27. **Rawlins MD, Culyer AJ.** National Institute for Clinical Excellence and its value judgments. *BMJ.* 2004;329(7459):224–227.
28. **Jenkins PJ, Clement ND, Hamilton DF, Gaston P, Patton JT, Howie CR.** Predicting the cost-effectiveness of total hip and knee replacement: a health economic analysis. *Bone Joint J.* 2013;95-B(1):115–121.
29. **Beard DJ, Davies LJ, Cook JA, et al.** The clinical and cost-effectiveness of total versus partial knee replacement in patients with medial compartment osteoarthritis (TOPKAT): 5-year outcomes of a randomised controlled trial. *Lancet.* 2019;394(10200):746–756.
30. **COVIDSurg Collaborative.** Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. *Br J Surg.* 2020;107(11):1440–1449.
31. **No authors listed.** Clinical guide to surgical prioritisation during the coronavirus pandemic. Federation of Surgical Specialty Associations. 2020. https://fssa.org.uk/_userfiles/pages/files/covid19/prioritisation_master_240720.pdf (date last accessed 17 February 2023).
32. **Roy B.** Caring for patients awaiting orthopaedic surgery. British Orthopaedic Association. 2021. <https://www.boa.ac.uk/resources/caring-for-patients-awaiting-orthopaedic-surgery.html> (date last accessed 17 February 2023).
33. **Chang JS, Wignadasan W, Pradhan R, Kontoghiorghe C, Kayani B, Haddad FS.** Elective orthopaedic surgery with a designated COVID-19-free pathway results in low perioperative viral transmission rates. *Bone Jt Open.* 2020;1(9):562–567.
34. **Dixon J, Mirtorabi N, Cutteridge J, Karia M, Pollard T.** A safety evaluation of the resumption of elective orthopaedic services in higher risk patients during the COVID-19 pandemic. *Cureus.* 2022;14(2):e22339.
35. **Reddy KIA, Johnston LR, Wang W, Abboud RJ.** Does the Oxford Knee Score complement, concur, or contradict the American Knee Society Score? *J Arthroplasty.* 2011;26(5):714–720.
36. **Rowen D, Brazier J, Roberts J.** Mapping SF-36 onto the EQ-5D index: how reliable is the relationship? *Health Qual Life Outcomes.* 2009;7:27.
37. **Clement ND, Skinner JA, Haddad FS, Simpson A.** Prioritization versus rationing of healthcare - elective surgery is not optional surgery: how should priority be assessed to ensure equity? *Bone Joint Res.* 2022;11(5):301–303.
38. **Morris JA, Super J, Huntley D, Ashdown T, Harland W, Anakwe R.** Waiting lists for symptomatic joint arthritis are not benign: prioritizing patients for surgery in the setting of COVID-19. *Bone Jt Open.* 2020;1(8):508–511.

Author information:

- J. O. Clark, MBChB, BSc (MedSci), MRCS, Orthopaedic Clinical Fellow
- M. J. Davison, MBChB, BSc (MedSci), FRCS (Tr&Orth), Consultant Trauma and Orthopaedic Surgeon
- O. Bailey, MBChB, BSc (MedSci), MSc, FRCS (Tr&Orth), Consultant Trauma and Orthopaedic Surgeon
Department of Trauma and Orthopaedics, University Hospital Wishaw, Lanarkshire, UK.
- N. Razii, BSc (Hons), MB BCh, MRCS, Orthopaedic Specialist Registrar
- S. W. J. Lee, MBChB, FRCS (Tr&Orth), Orthopaedic Specialist Registrar
Department of Trauma and Orthopaedics, Queen Elizabeth University Hospital, Glasgow, UK.
- S. J. Grant, MBChB, FRCS (Tr&Orth), Consultant Trauma and Orthopaedic Surgeon,
Department of Trauma and Orthopaedics, University Hospital Hairmyres, Glasgow, UK.

Author contributions:

- J. O. Clark: Conceptualization, Methodology, Investigation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing.
- N. Razii: Conceptualization, Methodology, Supervision, Formal analysis, Visualization, Writing – original draft, Writing – review & editing.
- S. W. J. Lee: Methodology, Investigation, Formal analysis, Writing – review & editing.
- S. J. Grant: Conceptualization, Project administration, Resources, Supervision, Investigation, Writing – review & editing.
- M. J. Davison: Conceptualization, Project administration, Resources, Supervision, Investigation, Writing – review & editing.
- O. Bailey: Conceptualization, Methodology, Project administration, Resources, Supervision, Investigation, Writing – review & editing.
- J. O. Clark and N. Razii are joint first authors.

Funding statement:

- The authors received no financial or material support for the research, authorship, and/or publication of this article.

Acknowledgements:

- The authors would like to thank A. J. Duguid and G. McKean. We also gratefully acknowledge our colleagues at University Hospital Wishaw and University Hospital Hairmyres for contributing to the care of patients in this study.

Ethical review statement:

- This study did not require ethical approval as it was deemed a service evaluation by the institution's research and development department. Participants within this anonymized study cohort gave informed consent to participate, and participated voluntarily.

Open access funding

- Open access funding for this article was provided by the NHS Lanarkshire Orthopaedic Endowment Fund (HM091).

© 2023 Authors et al. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (CC BY-NC-ND 4.0) licence, which permits the copying and redistribution of the work only, and provided the original author and source are credited. See <https://creativecommons.org/licenses/by-nc-nd/4.0/>