Worse than death and waiting for a hip or knee arthroplasty during the COVID-19 pandemic: a UK nationwide survey

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Abstract

Aim

To assess the quality of life of patients on the waiting list for a total hip (THA) or knee arthroplasty (KA). Secondary aims were to assess whether length of time on the waiting list influenced quality of life and rate of deferral of surgery.

Methods

During the study period (August & September 2020) 843 patients (THA n=394, KA n=449) from ten centres in the UK reported their EuroQol five dimensional (EQ-5D) scores and completed a COVID-19 questionnaire (2020 group). Patient demographics, procedure and date when listed were recorded. Patients scoring less than zero for their EQ-5D score were defined to be in a state "worse than death" (WTD). Data from a retrospective cohort (2014 to 2017) were used as the control group.

Results

The 2020 group had a worse EQ-5D score compared to the control group for both THA (mean difference 0.119, p<0.001) and KA (mean difference 0.074, p<0.001). Over a third (35%, n=138/394) of patients waiting for a THA and a quarter (22.3%, n=100/349) for KA were in a health state WTD, which was significantly increased compared to the control group (odds ratio 2.30 and 2.08, respectively, p<0.001). Over 80% of the 2020 group felt that their quality of life had deteriorated while waiting. Each additional month spent on the waiting list was independently associated (beta -0.013, p=0.0040) with a decrease in quality of life (EQ-5D score). There were 117 (13.9%) patients that wished to defer their surgery and the main reason for this was health concerns for themselves and or their family (99.1%).

Conclusion

One third of patients waiting for THA and a quarter waiting for a KA were in a state WTD, which was double that observed prior to the pandemic. Increasing length of time on the waiting list was associated with decreasing quality of life.

Level of evidence: Prospective study, Level 2

Keywords: COVID-19, total joint arthroplasty, quality of life, worse than death, waiting list.

Take home messages

- One third of patients waiting for THA and a quarter waiting for a KA were in a state worse than death

- Every increasing 6-month period a patient waited for surgery was associated with a clinically significant deterioration in quality of their life

Introduction

The COVID-19 pandemic has had a significant impact on elective arthroplasty services in the UK, with the cessation of non-urgent cases in mid to late March 2020(1–3). When the incidence of new COVID-19 cases decreases across the UK the recommencement of planned orthopaedic elective services will need to be prioritised alongside other cancer and surgical services as resources may not be available for a full return to normal practice. When normal capacity is resumed there will be increased numbers of patients waiting much longer for hip and knee arthroplasty. There may also be some patients on the waiting list that may prefer to defer surgery due to the mortality risk associated with COVID-19 in the postoperative period, despite this being relatively low even at the hight of first pandemic (4)

Scott et al(5) have previously shown the quality of life of patients waiting for hip and knee arthroplasty to be "worse than death" (WTD) for 19% and 12% of patients requiring hip and knee arthroplasty respectively. However, in their study patients were prioritised according to their symptoms and surgery for those with the worst quality of life was expedited. During the COVID-19 pandemic and cessation of elective services prioritising those with the worst quality of life has not been possible. Recommencement of services may prioritise patients who are low surgical risk, which may further delay surgery in those with worst quality of life due to their associated comorbidity (1). Currently there are no available data in relation to the quality of life of patients currently on NHS waiting lists for primary hip and knee replacement. It is unknown whether patients would want to undergo surgery due to the associated risk of COVID-19.(4)

The primary aim of this study was to assess the quality of life of patients currently on the waiting lists for a hip or knee arthroplasty. The secondary aims were to assess: whether length of time on the waiting list influenced quality of life, their opinions and options for future surgery, if patients wanted to proceed with surgery or delay in view of the risks associated with COVID-19, the reason(s) for delaying surgery should this be their decision, and whether these metrics differed between patients listed for hip or knee arthroplasty.

Patients and Methods

A multicentre cross-sectional study was conducted across ten orthopaedic departments in the UK on patients on the NHS waiting lists for either a total hip (THA) or knee arthroplasty (total-TKA or partial-PKA) during the months of August and September 2020. This survey was registered and approved at each of the participating sites as an audit project or a quality improvement project.

Patients meeting the inclusion and exclusion criteria were randomly selected from waiting lists at the ten study centres. When the survey was commenced, six centres were participating with the aim to obtain data on 100 patients (50 THA and 50 KA) to meet the power calculation (detailed below). However, four additional centres requested to participate during the study period and therefore 843 patients were included across ten sites. Patient demographics (age and sex), proposed procedure (THA or TKA or PKA), and date when listed were recorded. Patients were contacted by telephone and asked to complete an interviewer administrated verbal EuroQoL (EQ) questionnaire (6) and in addition were asked questions relating to their quality of life, opinions about undergoing surgery in view of the COVID-19 pandemic and whether they want to defer their surgery and the reasons for this. The study protocol, hard copy patient questionnaire (should the researcher require this while undertaking the telephone interview) and the data collection tool were sent to each recruiting site prior to the commencement of the study (supplementary documents). The inclusion criteria were patients placed on the non-urgent elective orthopaedic waiting list for a primary total hip or partial/total knee arthroplasty prior to and including March 2020 who were able to complete a telephone interview. Patients listed for revision surgery or urgent arthroplasty were excluded.

The EuroQoL (EQ) general health questionnaire evaluates five domains (5D): mobility, self-care, usual activities, pain/discomfort and anxiety/depression.(6) The 3L version of the EQ-5D questionnaire was used, with responses to the five domains recorded at three levels of severity (no/slight problems; moderate/severe; or unable/extreme problems). Permission was obtained from the EuroQol Research Foundation (Marten

Meesweg 107, 3068 AV Rotterdam, Netherland) to use the United Kingdom interviewer administrated version of the EQ-5D-3L version. This index is on a scale of -0.594 to 1, where 1 represents perfect health and 0 represents death.(7) Negative values therefore represent a state perceived as WTD. Patients scoring less than zero for the EQ-5D score were defined to be in a state WTD.(5) The minimal clinically important difference (MCID) in the EQ-5D score was defined as 0.08, therefore a difference in the score of 0.08 or more was clinically important.(8) The EQ visual analogue scale (VAS) was also completed, again using the United Kingdom interviewer administrated version, that assesses how good or bad the patient's health is on that day and ranges from 100 (best health) to 0 (worst health).

Data from the previously published study by Scott et al (5) was used for the control groups and was thought to represent baseline data over a period (from 2014 to 2017) that was not affected by the COVID-19 pandemic. Sex, age, EQ-5D and EQ-VAS data were available for 2073 patients waiting for a THA and 2168 patients waiting for a TKA.

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software (IBM, Inc., Armonk, New York, United States) version 17. Parametric tests were used to assess continuous variables for significant differences between groups using an unpaired *t*-test (age, EQ-5D and EQ-VAS scores). Dichotomous variables were assessed using a Chi square test or Fisher's exact test (if less than five in one cell) for the between group comparisons (sex, joint, WTD). Multivariable linear analysis was used to assess the independent association of factors influencing the EQ-5D score after adjusting for confounding variables. A p-value of <0.05 was defined as statistically significant.

A power calculation was performed using the MCID of 0.08 points in the EQ-5D score (8), a standard deviation of 0.32 points (5) (effect size 0.25), an alpha of 0.025 (Bonferonni correction for multiple testing: total hip and knee arthroplasty groups), two tailed unpaired *t*-test and a power of 95% determined a minimum of 280 patients would be required in each of the groups (THA and knee arthroplasty) from 2020 to compare to the 2000 patients in the control groups (allocation ratio 1:6).

Results

During the study period 843 patients reported their EQ-5D and EQ-VAS scores and completed the COVID-19 questionnaire. There were 344 (40.8%) male and 499 (59.2%) female patients with a mean age of 69.1 (range 26 to 98) years old. There were 394 waiting for a THA and 449 waiting for a TKA (n=418) or a PKA (n=31), for analysis purposes TKA and PKA were grouped together as a knee arthroplasty (KA) group.

Primary aim: quality of life of patients currently on the waiting list

There were no significant differences in patient demographics between the 2020 group and the control group (Table I). The 2020 group had significantly worse EQ-5D and EQ-VAS scores compared to the control group, for both patients awaiting THA and KA (Table I and Figure 1). Over a third (35%, n=138/394) of patients waiting for a THA and a quarter (22.3%, n=100/349) of patients waiting for a KA were in a state WTD, which was twice that observed percentage in the control groups for both THA (p<0.001) and KA (p<0.001) (Table I). The worse health-related quality of life in the 2020 group relative to the control group is illustrated by a shift to the left in the density plots of the EQ-5D scores (Figures 2 & 3).

Secondary aim: the influence of length of waiting time on quality of life

Patients were listed for their THA or KA between January 2019 to March 2020. There was a significant correlation between date of listing for THA (r=0.12, p=0.015) or KA (r=0.10, p=0.043) and EQ-5D scores, with longer waiting time being associated with a worse EQ-5D score (Figure 3). Regression analysis demonstrated that for each additional month spent on the waiting list was associated with a significant decrease in the EQ-5D score (Table II), and for each additional 6-months on the waiting list patients may experience a clinically significant deterioration in their health-related quality of life ($^{\text{MCID in EQ-5D 0.08}}/_{\text{change per month 0.013}}$ = 6-months).

Secondary aim: patients' opinion and options for future surgery

In the 2020 group over 80% of patients (680/843) felt that their quality of life had deteriorated while waiting for their arthroplasty. This was significantly greater in those awaiting THA compared to those waiting for a KA (p<0.001) (Table III). The majority (85.4%, n=720/843) of patients were willing to undergo their surgery during the COVID-19 pandemic, with those

waiting for a THA being more likely to want to go forward with their surgery (Table III). Approximately half (52.3%) of the patients wished to have a face-to-face consultation should they go forward with surgery and more than two-thirds (67.6%) felt a discussion regarding the risks of surgery could be left until immediately before surgery (Table III). Approximately half of the patients were happy to have their surgery under a different surgeon (58.7%) or hospital (49.7%) provided waiting times were equal (Table III).

Secondary aim: proceed or delay surgery in view of the current risks of COVID-19

There were 117 (13.9%) patients who wished to defer surgery due to the risks associated with COVID-19 when assessed during August and September 2020. Patients waiting for a KA were more likely to want to defer their surgery relative to those waiting for a THA (odds ratio 1.61, 95% CI 1.08 to 2.41, p=0.020). Patients on the waiting list for THA who wanted to defer their surgery (n=43) had a clinically and statistically significantly greater (better) EQ-5D score but this was not observed in the group awaiting a KA (Table IV).

Secondary aim: the reason(s) for delaying surgery

The main reason declared by the 117 patients wishing to defer their surgery was health concerns for themselves and/or their family (Table V). Two thirds of patients felt that they had not had the opportunity to discuss their concerns with a health professional (Table V). The main reasons for deferral were worries or acquiring COVID-19 in hospital (78.6%) and the risk of dying should they become infected (69.2%) (Table V). Whereas, the 14-day pre-surgery isolation period (16.2%), concerns regarding the hospitals ability to care for them (27.4%), and limited visiting of family and friends while in hospital (20.5%) were not reasons to defer for most patients (Table V). There were no differences in the reasons for deferral of surgery between THA and KA (Table V).

Secondary aim: differences between patients waiting for hip and knee arthroplasty

Patients waiting for a THA had significantly worse EQ-5D and EQ-VAS scores compared to those waiting for a KA in the 2020 cohort (Table VI, Figure 1), and were more likely to be in a state WTD. When adjusting for confounding, patients waiting for a THA had a clinically and statistically significantly worse EQ-5D score (Table III).

Discussion

This study has shown that patients waiting for THA and KA during the COVID-19 pandemic had a significantly worse quality of life than expected relative to previous years. Over a third of patients waiting for a THA and a quarter of patients waiting for a KA were in a health state WTD, which was double that observed prior to the pandemic. There was a direct correlation between increasing length of time of the waiting list and a worsening quality of life: for each additional 6-months of waiting there was a clinically significant deterioration in health-related quality of life. This was supported subjectively by the patients with over 80% stating that their quality of life had deteriorated while waiting for their arthroplasty. The majority of patients were willing to undergo their surgery despite the risks associated with the COVID-19 pandemic, however half wished to have a face-to-face consultation should they go forward with surgery. Half were happy to have their arthroplasty under a different surgeon or hospital. A small proportion (13.9%) of patients wished to defer their surgery due to the risks associated with COVID-19. Those wishing to defer surgery had concerns for themselves and or their family and were more likely to be waiting for a KA.

This study has limitations. Comorbidities and joint specific patient reported outcome measures (PROMs) were not included. This was for ease of applying the questionnaire over the telephone. The relationship between comorbidities, joint specific PROMs and EQ-5D indices have been investigated and delineated previously in a large cohort (5). Resource allocation within a health care setting like the NHS is based on quality adjusted life years that are derived from a health utility scores such as the EQ-5D score, not on joint specific function. Therefore EQ-5D scores were collected in isolation. Patients were selected at random from the waiting lists to avoid selection bias but were not consecutive and non-responders may have influenced the interpretation of results. The multicentre nature of the study however enhances its generalisability and external validity. The comparative control cohort from 2014-2017 was from a single centre, including over four thousand arthroplasty patients and is therefore likely to be representative of patients awaiting hip and knee arthroplasty across the UK. However, those in the 2020 group were interviewed during a

global pandemic and whilst during August and September 2020 in the UK there were only limited social restrictions, this was a different landscape to that of the data collection in the 2014-17 cohort; without sampling people not on the waiting list, as a background for the influence of COVID-19 on the population EQ-5D score this is persists as a limitation.

The EQ-5D score has been proven to be a reliable and responsive measure of health related quality of life and is validated for use in a number of populations and conditions including degenerative joint disease (DJD) (9,10). A total of 243 health states (indices) are possible and differ by country according to population preferences. This UK based study uses the UK value set in which 84/243 (35%) of the possible health states are negative and can be defined as WTD (11). This WTD definition is researcher-generated and reflects the construction of the EQ-5D score (9). These negative or WTD states have been defined as such by 3395 individuals from the UK grading each state using the time trade-off method: the less time in the health state that could be endured, the lower the score (11). These negative WTD scores are therefore a hypothetical value judgement made by the UK general public based on their beliefs of health-related quality of life. The ability to score negative health states enables a broader description of severe disability and severely poor health, and lessens the floor effect of this score. The control cohort of patients used in the current study demonstrated that using this definition, in normal circumstances, one fifth of patients waiting for THA and 12% of patients awaiting TKA are in a health state WTD (5). Under normal circumstances, these patients who are the worst affected by DJD would be prioritized and thus tend to wait less time for their surgery (5). It has therefore not been previously possible to investigate the effect of delayed and prolonged waiting times on health related quality of life.

At the start of the COVID-19 pandemic all non-urgent operating within the NHS was suspended. Trauma and orthopaedics were reduced to just 3.3% of normal operating volumes in England – the lowest percentage of any surgical specialty (3). Since restarting after the first wave, rates of orthopaedic admissions for surgery peaked at 63% of normal in England (3) and in Scotland arthroplasty surgery was being performed at a rate of 40% of

normal (2). This reduction of 60% in operating capacity far exceeds the 14% of patients who would have potentially chosen to defer their surgery because of the pandemic. As the pandemic has continued, the number of patients who wish to defer surgery is reducing (4,12). This may reflect a reduction in the fear of COVID-19 as vaccines are developed, but similarly could reflect a deterioration in health-related quality of life altering the balance of perceived risk (4).

COVID-19 free pathways have enabled some elective orthopaedic operating during the pandemic and have been shown to be effective and safe in terms of both viral transmission and morbidity and mortality (12,13). Developing COVID-19 during the perioperative period is associated with excess mortality (14,15), however the postoperative mortality risk due to COVID-19 following hip and knee arthroplasty at the peak of the first wave of the pandemic has been estimated at 1/1000 (14). As a specialty, the current rate of surgery in orthopaedics is lower than in all other surgical specialties except oral surgery (16). In England the number of patients waiting for surgery is higher for orthopaedics than for any other surgical specialty (3). Using data from the Scottish Arthroplasty Project Yapp et al (2) have reported that had arthroplasty operating been restarted at a rate of 120% of pre-COVID activity in October it would take 24-27 months to clear the backlog. This is also supported by waiting list data from England that estimated with 30% increased activity it would take 20 months if there was no hidden burden of unreferred patients, and 48 months if there was a hidden burden, to return to pre-COVID-19 waiting list numbers.(1) However, it may not possible to work at 120% or 130% within the NHS for the foreseeable future. Presently additional capacity from the private sector may not be utilized due to pressures from their own waiting lists. Non-urgent elective operating has again been postponed due to the second wave of the pandemic and therefore this waiting backlog is increasing.

The current study has demonstrated not only that a third of THA patients and a quarter of KA patients are now living in a health state WTD, but also that longer time on the waiting list was associated with a significantly worse health related quality of life. As of December 2020 approximately 40,000 patients in England and Scotland have been waiting

over one year for orthopaedic surgery (3,17). Based on previous levels of arthroplasty, approximately one third of these patients are likely to be waiting for hip or knee arthroplasty (17). This translates to more than 13,000 patients waiting over one year after listing for hip or knee arthroplasty. While patients wait longer their pain is managed in primary care where medical practitioners may come under increasing pressure to prescribe opiate medication, against current recommendations for osteoarthritis management (18). The current study has found that clinically significant deteriorations exceeding the EQ-5D MCID occur with each additional 6 months wait for hip or knee arthroplasty. Similar to Morris et al (19) >80% of patients subjectively reported their health related quality of life had deteriorated whilst on the waiting list during the pandemic. EQ-5D scores in patients with DJD of the hip and knee are known to be independently associated with joint specific PROMs and thus pain and function from the involved joint (5). It has also previously been demonstrated that patients with worse preoperative EQ-5D scores ultimately achieve worse Oxford hip and knee scores and worse rates of patient satisfaction following hip and knee arthroplasty (5) and are less likely to return to work (20). Delaying these patients on indefinite waiting lists and deprioritizing the recommencement of "elective" orthopaedic operating is not benign: it will have real and lasting effects on these patients who will achieve poorer outcomes as a result.

Over a third of patients waiting for a THA and a quarter of patients waiting for knee arthroplasty were in a health state WTD, double that observed previously. Subjectively over 80% of patients reported a decline in their health-related quality of life whilst on the waiting list. Objectively health related quality of life scores correlated and declined significantly with time on the waiting list. In a societal context this is highly relevant, especially when considering the health service rationing and prioritization that will be required not only during the recommencement of routine operating but over the upcoming years as the NHS recovers from COVID-19. Every extra 6-month period a patient waited for surgery was associated with a clinically significant deterioration in quality of life. The percentage of patients on the waiting lists who are in a health state WTD will grow as the wait grows. This finding is not specific to

the pandemic and should be considered for all future arthroplasty waiting lists. Excessive waits are not benign and constitute a predictable and growing public health dilemma.

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Table I. Patient demographics, EQ-5D, EQ-VAS and worse than death status for total hip and knee arthroplasty according group.

Demographic	Descriptive	Group		Difference / Odds Ratio (95% CI)	p-value*
		Control	2020		
Total Hip Arthroplasty		(n=2073)	(n=394)		
Age (years: mean, SD)		67.4 (11.6)	68.0 (12.3)	Diff 0.7 (-0.6 to 1.9)	0.304**
Sex	Female	1253 (60.4)	240 (60.9)	Reference	0.861
(n, % of group)	Male	820 (39.6)	154 (39.1)	OR 0.98 (0.79 to 1.22)	
EQ-5D (mean, SD)		0.360 (0.325)	0.241 (0.351)	Diff 0.119 (0.083 to 0.154)	<0.001**
EQ-VAS (mean, SD)		67.4 (22.2)	54.0 (23.3)	Diff 13.3 (10.8 to 15.9)	<0.001**
Worse than Death	No	1682 (81.1)	256 (65.0)	Reference	
(n, % of group)	Yes	391 (18.9)	138 (35.0)	OR 2.30 (1.83 to 2.93)	<0.001
Knee Arthroplasty		(n=2168)	(n=449)		
Age (years: mean, SD)		69.4 (9.6)	70.0 (9.4)	Diff 0.7 (-0.3 to 1.7)	0.159**
Sex	Female	1243 (57.3)	259 (57.7)	Reference	0.891
(n, % of group)	Male	925 (42.7)	190 (42.3)	OR 0.99 (0.80 to 1.21)	
EQ-5D (mean, SD)		0.408 (0.311)	0.335 (0.327)	Diff 0.074 (0.042 to 0.105)	<0.001**
EQ-VAS (mean, SD)		69.8 (20.6)	58.3 (21.9)	Diff 11.4 (9.2 to 13.7)	<0.001**
Worse than Death	No	1906 (87.9)	349 (77.7)	Reference	
(n, % of group)	Yes	262 (12.1)	100 (22.3)	OR 2.08 (1.61 to 2.70)	<0.001

*chi-square test unless otherwise stated, **unpaired t-test

Table II. Linear regression analysis was used to identify whether age, sex, joint (THA or KA) and time spent on waiting list were independent association with change in the EQ-5D score.

Predictors in model		Beta (change in EQ-5D)	95% CI		p-value
			Lower	Upper	
Age	Per year	0.003	0.001	0.005	0.005
Sex	Female	Reference			
	Male	0.057	0.011	0.103	0.016
Joint	KA	Reference			
	THA	-0.082	-0.128	-0.037	<0.001
Time on waiting list	Per month	-0.0135	-0.004	-0.023	0.004

Table III. Responses to the questions asked to the 2020 cohort (n=843) regarding their effect of waiting for surgery and opinions about future surgery according to whether they were waiting for a total hip or total knee arthroplasty.

Question	Response	All (n, %)	THA (n, %)	KA (n, %)	Odds Ratio (95% CI)	p-value*
Do you feel that your quality of life has deteriorated while waiting for your surgery?	Yes	680 (80.7)	338 (85.8)	342 (76.2)	1.89 (1.32 to 2.70)	**<0.001**
	No	163 (19.3)	56 (14.2)	107 (23.8)	Reference	
Would you be willing to undergo your proposed surgery in view of the COVID-19 pandemic?	Yes	720 (85.4)	352 (89.3)	368 (82.0)	1.80 (1.20 to 2.69)	**0.004**
	No	121 (14.4)	42 (10.7)	79 (17.6)	Reference	
	Missing	2 (0.2)	0 (0)	2 (0.4)	-	
If you decide to go ahead with surgery, which sort of consultation would you prefer?	Face to Face	441 (52.3)	199 (50.5)	242 (53.9)	Reference	
	Telephone	350 (41.5)	172 (43.7)	178 (39.6)	0.91 (0.78 to 1.07)	0.259
	Video	43 (5.1)	21 (5.3)	22 (4.9)	0.87 (0.49 to 1.54)	0.639
	Missing	9 (1.1)	2 (0.5)	7 (1.6)	-	
Do you think a full discussion on risk could be left until immediately before surgery?	Yes	570 (67.6)	268 (68)	302 (67.3)	0.99 (0.74 to 1.33)	0.999
	No	263 (31.2)	124 (31.5)	139 (31.0)	Reference	
	Missing	10 (1.2)	2 (0.5)	8 (1.8)	-	
All waiting times being equal, would you be happy for a different surgeon to carry out your surgery?	Yes	495 (58.7)	241 (61.2)	254 (56.6)	1.18 (0.90 to 1.56)	0.238
	No	339 (40.2)	151 (38.3)	188 (41.9)	Reference	
	Missing	9 (1.1)	2 (0.5)	7 (1.6)	-	
All waiting times being equal, would you be happy to have your operation in a different hospital?	Yes	419 (49.7)	209 (53)	210 (46.8)	1.26 (0.96 to 1.66)	0.094
	No	415 (49.2)	183 (46.4)	232 (51.7)	Reference	
	Missing	9 (1.1)	2 (0.5)	7 (1.6)	-	

*chi-square test

Table IV. Patient demographics, EQ-5D, EQ-VAS, and worse than death status according to whether they were wanted to proceed or defer their total hip or knee arthroplasty.

Demographic	Descriptive	Group		Difference / Odds Ratio (95% CI)	p-value*
		Proceed	Defer		
Total Hip Arthroplasty		(n=351)	N=43)		
Age (years: mean, SD)		67.7 (12.4)	71.2 (10.6)	Diff 3.6 (-0.3 to 7.5)	0.072**
Sex	Female	217 (61.8)	23 (53.5)	Reference	
(n, % of group)	Male	134 (38.2)	20 (46.5)	OR 1.41 (0.75 to 2.66)	0.290
EQ-5D (mean, SD)		0.224 (0.345)	0.385 (0.362)	Diff 0.162 (0.051 to 0.272)	**0.004****
EQ-VAS (mean, SD)		53.0 (23.4)	62.4 (21.0)	Diff 9.4 (1.5 to 17.3)	**0.020****
Worse than Death	No	224 (63.8)	32 (74.4)	Reference	
(n, % of group)	Yes	127 (36.2)	11 (25.6)	OR 0.61 (0.30 to 1.24)	0.169
Knee Arthroplasty		(n=375)	(n=74)		
Age (years: mean, SD)		69.9 (9.1)	71.0 (10.4)	Diff 1.2 (-1.1 to 3.5)	0.318
Sex	Female	209 (55.7)	50 (67.6)	Reference	
(n, % of group)	Male	166 (44.3)	24 (32.4)	OR 0.60 (0.36 to 1.02)	0.060
EQ-5D (mean, SD)		0.328 (0.322)	0.370 (0.351)	Diff 0.042 (-0.040 to 0.123)	0.316**
EQ-VAS (mean, SD)		57.7 (22.1)	61.5 (20.9)	Diff 3.8 (-1.9 to 9.5)	0.193**
Worse than Death	No	292 (77.9)	57 (77.0)	Reference	
(n, % of group)	Yes	83 (22.1)	17 (23.0)	OR 1.05 (0.58 to 1.90)	0.874

*chi-square test unless otherwise stated, **unpaired t-test

Table V. Responses to the questions asked to the patients from the 2020 cohort that wished to defer their surgery (n=117) in relation to the reasons behind their decision.

Question	Response	All (n, %)	THA (n, %)	KA (n, %)	Odds Ratio (95% CI)	p-value*
Was this because of health concerns for?	Yourself	46 (39.3)	18 (41.9)	28 (37.8)	Reference	
	Family	12 (10.3)	3 (7.0)	9 (12.2)	0.52 (0.12 to 2.18)	0.506**
	Both	58 (49.6)	22 (51.2)	36 (48.6)	0.95 (0.43 to 2.11)	0.888
	Neither	1 (0.9)	0 (0)	1 (1.4)	N/A	0.999
Have you had the opportunity to discuss your concerns around surgery with a health profession?	Yes	39 (33.3)	13 (30.2)	26 (35.1)	Reference	
	No	78 (66.7)	30 (69.8)	48 (64.9)	1.25 (0.56 to 2.80)	0.290
Are you worried that having surgery in hospital will increase your chance of catching COVID-19?	Yes	92 (78.6)	35 (81.4)	57 (77)	Reference	
	No	25 (21.4)	8 (18.6)	17 (23)	0.77 (0.30 to 1.96)	0.578
Are you concerned that if you catch COVD-19 your chance of survival is less because of the proposed surgery?	Yes	81 (69.2)	33 (76.7)	48 (64.9)	Reference	
	No	36 (30.8)	10 (23.3)	26 (35.1)	0.56 (0.24 to 1.31)	0.180
Did you decline surgery because you were unable to self-isolate for 14 days?	Yes	19 (16.2)	8 (18.6)	11 (14.9)	Reference	
	No	98 (83.8)	35 (81.4)	63 (85.1)	0.76 (0.28 to 2.08)	0.597
Did you decline surgery because of concerns over the hospital's ability to care for you during your admission because of the COVID-19 pandemic?	Yes	32 (27.4)	12 (27.9)	20 (27)	Reference	
	No	85 (72.6)	31 (72.1)	54 (73)	0.96 (0.41 to 2.22)	0.920
Did you decline surgery because of the lack of visiting rights in hospital for your friends and family?	Yes	24 (20.5)	11 (25.6)	13 (17.6)	Reference	
	No	93 (79.5)	32 (74.4)	61 (82.4)	0.62 (0.25 to 1.54)	0.301

*chi-square test unless otherwise stated, **Fishers exact test

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Table VI. Patient demographics, EQ-5D, EQ-VAS, worse than death status and patient's choice to defer their surgery according to whether they were waiting for a total hip or knee arthroplasty.

| Demographic | Descriptive | Group | | Difference / Odds Ratio (95% CI) | p-value* |
		THA (n=394)	KA (n=449)		
Age (years: mean, SD)		68.0 (12.3)	70.0 (9.4)	Diff 2.0 (0.5 to 3.5)	0.008**
Sex	Female	240 (60.9)	259 (57.7)	Reference	0.341
(n, % of group)	Male	154 (39.1)	190 (42.3)	OR 0.88 (0.66 to 1.15)	
EQ-5D (mean, SD)		0.241 (0.351)	0.335 (0.327)	Diff 0.093 (0.048 to 0.139)	<0.001**
EQ-VAS (mean, SD)		54.0 (23.3)	58.3 (21.9)	Diff 4.2 (1.0 to 7.6)	0.010**
Worse than Death	No	256 (65.0)	349 (77.7)	Reference	
(n, % of group)	Yes	138 (35.0)	100 (22.3)	OR 1.88 (1.39 to 2.55)	<0.001

*chi-square test unless otherwise stated, **unpaired t-test

Figures
Figure 1. EQ-5D scores for the control (pre-COVID-19) and 2020 (COVID-19) groups for patients waiting for a total hip or knee arthroplasty.
Figure 2. Density plot for the distribution of EQ-5D scores for patients awaiting a knee arthroplasty before the pandemic and for the 2020 cohort.
Figure 3. Density plot for the distribution of EQ-5D scores for patients awaiting a knee arthroplasty before the pandemic and for the 2020 cohort.
Figure 4. Scatter plot and line of best fit for correlation between the time patients were listed for their total hip (grey) or knee (black) arthroplasty and mean EQ-5D score in August/September 2020.

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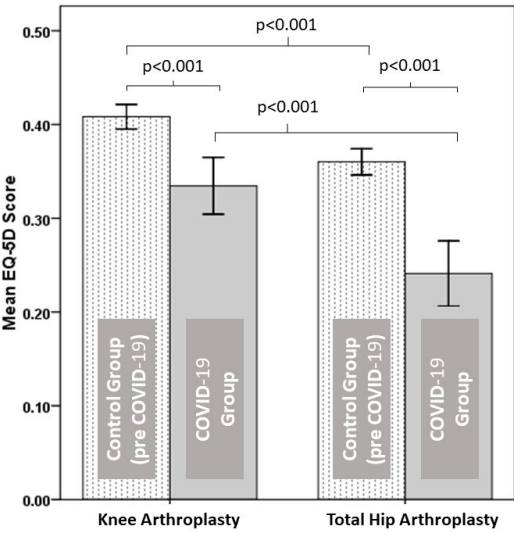21
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Figure 1. EQ-5D scores for the control (pre-COVID-19) and 2020 (COVID-19) groups for patients waiting for a total hip or knee arthroplasty.
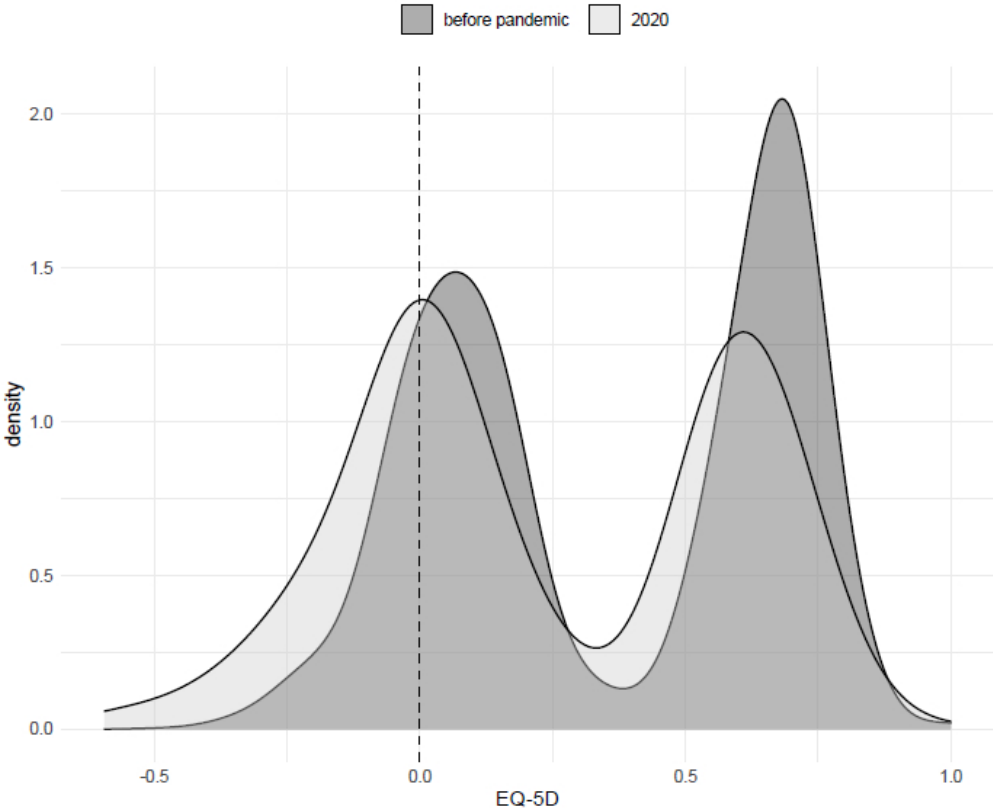
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Figure 2. Density plot for the distribution of EQ-5D scores for patients awaiting a knee arthroplasty before the pandemic and for the 2020 cohort.

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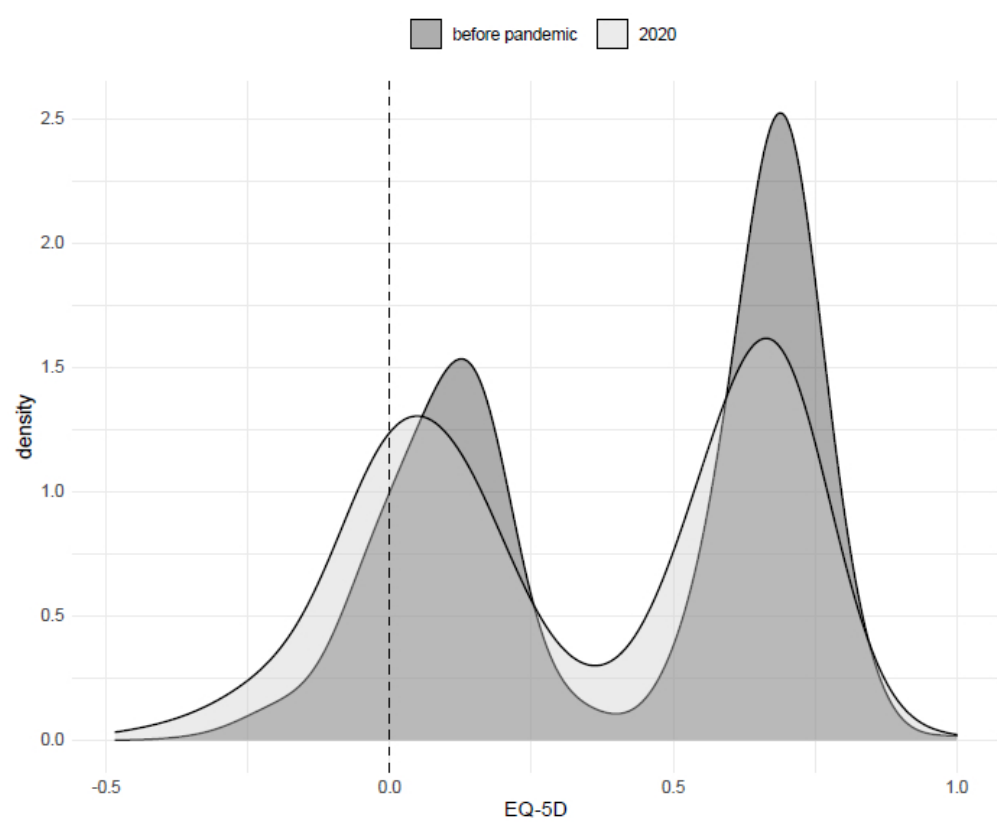

Figure 3. Density plot for the distribution of EQ-5D scores for patients awaiting a knee arthroplasty before the pandemic and for the 2020 cohort.

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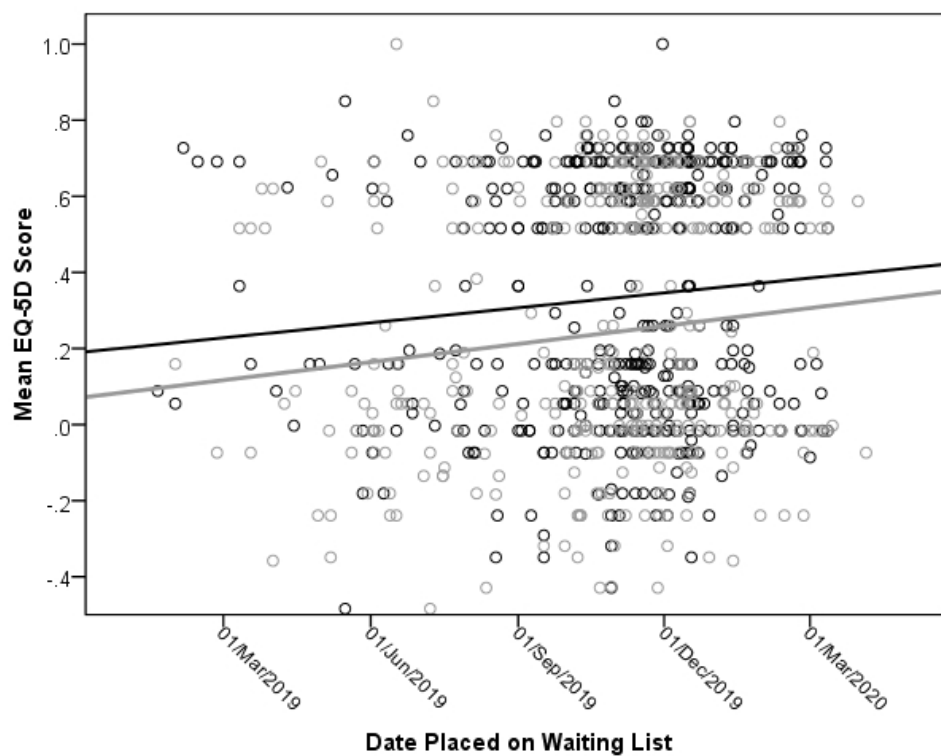51
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Figure 4. Scatter plot and line of best fit for correlation between the time patients were listed for their total hip (grey) or knee (black) arthroplasty and mean EQ-5D score in August/September 2020.