



## Original Research

# Equal waiting times for all? Empirical evidence for elective surgeries in the Austrian public healthcare system



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## ABSTRACT

**Objectives:** This study analyses waiting times for elective surgeries and potential determinants, including supplementary private health insurance, visits in the operating physician's private practice and informal payments for faster treatment.

**Study design:** Retrospective patient questionnaire survey.

**Methods:** The survey was conducted in eleven Austrian rehabilitation centres in 2019. Data was analysed based on bivariate tests ( $n = 400$ ) and a multivariate negative-binomial regression model ( $n = 310$ ) with institution- and patient-related characteristics as independent variables.

**Results:** Median waiting times were 8.9 weeks (IQR: 4.5–18.0) for hip replacement and 8.4 weeks (IQR: 5.0–20.0) for knee replacement surgery. 10.9% of the patients reported having received an offer to shorten their waiting time through a visit in the operating physician's private practice before the surgery or through an informal payment directly to the operating physician. Surgery in private for-profit hospitals, supplementary private health insurance and severe pain were associated with shorter waiting times.

**Conclusions:** While waiting times for elective surgeries in Austria are below international levels, shorter waits for patients with private health insurance and offers to reduce waiting times through informal payments point to equitable access concerns in a public healthcare system.

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## Introduction

Waiting times for elective surgeries (ES), i.e., non-emergency surgical procedures, have been a long-standing policy challenge in many OECD countries.<sup>1–4</sup> Thus, policy-makers have repeatedly introduced policy measures over the last two decades.<sup>5–7</sup> Waiting times can be reduced through supply-side policies (e.g., publicly funded, privately delivered services or streamlined pre-admission processes) or demand-side policies (e.g., prioritisation of patients).<sup>8–13</sup> However, despite previous political efforts, in 21 of 34 OECD countries waiting times for ES are a persistent issue.<sup>4</sup> In 2018, the median waiting time in OECD countries for a hip replacement was 16.1 weeks and for a knee replacement 27.0 weeks.<sup>4</sup>

Waiting times for ES also differ within healthcare systems depending on institution-related factors and patient-related factors. Empirical evidence has shown a relationship between waiting time and socioeconomic status: Patients with fewer economic resources and lower educational attainment experience longer waiting times.<sup>4,14–20</sup> Additionally, studies indicate that patients with statutory health insurance wait longer for hospital services than patients with (supplementary) private health insurance.<sup>21–25</sup> Such evidence stands in opposition to a core principle of equitable access, namely, to avoid inequality in access to health care based on socio-economic status.<sup>26</sup>

Another growing concern for achieving equitable access are informal payments from patients to healthcare providers for better or faster treatment or additional services.<sup>27,28</sup> This practice is traditionally common in Central and Eastern Europe<sup>29–33</sup> but is also becoming more widespread in Western Europe. A recent study<sup>33</sup> analysing Eurobarometer surveys on corruption found a prevalence of 3.8 percent for informal payments to healthcare providers in public healthcare facilities in the European Union (EU) in 2019,

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ranging from 0.0 percent in Sweden to 11.8 percent in Austria. The role of informal payments in the context of waiting times for ES, however, to the best of our knowledge, has not yet been investigated.

As Austria is leading in the EU with respect to the prevalence of informal payments in healthcare systems,<sup>33</sup> understanding to what extent such practices have an effect on waiting times for ES is vital. Within the solidarity-based Austrian healthcare system, legislation explicitly states that in publicly funded hospitals (public hospitals and private not-for-profit hospitals), medical treatment and care may only be based on medical criteria (cf. §16 Federal Hospital Act).<sup>34</sup> However, there are two features of the Austrian healthcare system that can facilitate informal skipping of waiting lists: Firstly, even in publicly funded hospitals, supplementary private health insurance offers supplementary services such as the option to choose the treating physician and special wards with better amenities, for which the treating physician and the hospital are compensated by the private health insurer. Due to the extra compensations, there is an incentive for physicians and hospitals to treat these patients preferentially. Indeed, case reports suggest that those with supplementary private health insurance have shorter waiting times for ES.<sup>35–37</sup> Secondly, physicians are allowed to have a private practice in addition to their employment in publicly funded hospitals. Anecdotal evidence suggests that waiting times can be reduced through visits in the operating physician's private practice prior to the ES – constituting a covert informal payment.<sup>35–37</sup> Additionally, waiting lists may be skipped through informal payments directly to the operating physician.<sup>35–37</sup>

Waiting times for ES have never been officially reported in Austria.<sup>2–4,38</sup> Accordingly, empirical evidence on waiting times in Austria and determining factors is lacking thus far. Therefore, the current study has two research aims. Firstly, to describe waiting times for two common ES (hip and knee replacement) in Austria, drawing on a patient questionnaire survey. Secondly, to investigate the relationship between institution- and patient-related factors and waiting times. A special focus is put on the role of supplementary private health insurance, visits in the operating physician's private practice prior to the ES and informal payments directly to the operating physician for shorter waiting times.

## Methods

### Data collection

The study population consists of patients who had undergone hip or knee replacement surgery in Austria. Study participants were recruited from Austrian rehabilitation centres where most patients are treated after undergoing such surgeries. All ten orthopaedic rehabilitation centres operated by the Pension Insurance Institution (*Pensionsversicherungsanstalt*, the largest public pension scheme), as well as seven general rehabilitation centres operated by other social insurance carriers or private entities, were contacted for study participation. Eleven rehabilitation centres in five federal states gave permission for surveying their rehabilitation patients. Data were collected between July and December 2019. Consenting patients received an anonymous questionnaire for self-completion, guided through written instructions as part of the questionnaire and oral instructions by trained research staff on site. The full questionnaire (in German) is included in [Additional file 1](#). Information was collected on the patient's self-reported waiting time, the type of surgery, institution-related factors and patient-related factors.

### Variables

Waiting time was defined in line with Siciliani et al.<sup>6</sup> as the time between the medical decision for surgery and the day of operation,

measured in weeks. Variables used for descriptive, bivariate and regression analyses were: Waiting time, type of surgery, hospital type, health insurance, offer visit operating physician's private practice to reduce waiting time, offer informal payment to reduce waiting time, any offer to reduce waiting time (summary variable), pain, physical limitations, both pain and physical limitations (summary variable), sex, age, labour force status, household income and education. [Table 1](#) provides information on definition and measurement of all variables.

### Sample

A total of 493 patients who had undergone either hip or knee replacement surgery participated in the study. Questionnaires with missing waiting time ( $n = 14$ ) were excluded as were such by patients with acute surgery ( $n = 3$ ). Patients who initiated rescheduling of the surgery themselves or whose surgery was rescheduled for patient health reasons were also excluded ( $n = 79$ ) as their waiting times do not reflect the waiting times scheduled by the hospital. A total of 400<sup>d</sup> questionnaires were used for descriptive and bivariate analyses. For regression analysis, only questionnaires with information on all individual covariates were used ( $n = 310$ ).

### Statistical analysis

Group differences in median waiting times were compared with bivariate analyses using non-parametric tests (Mann–Whitney-U test, MWU; Kruskal–Wallis test, KW; Spearman's correlation coefficient). Multivariate regression analysis was carried out with the waiting time in weeks as dependent variable and institution-related and patient-related characteristics as independent variables using a negative binomial model. In the regression, the summary variables for offers to reduce waiting time (binary indicator for any offer to reduce waiting time) and pain and physical limitations (binary indicator for severe/very severe pain and physical limitations) were used rather than the individual variables.

In all analyses, statistical significance refers to  $P < 0.05$ . Sensitivity analyses were conducted to check robustness ([Additional file 2](#)). Analyses were conducted with the statistical software R version 4.0.2.<sup>39</sup>

## Results

### Descriptive statistics

A descriptive overview of the study population is provided in [Table 2](#) ( $n = 400$ ). Roughly half (49.0%,  $n = 196$ ) of the study participants had undergone hip replacement and 51% ( $n = 204$ ) had undergone knee replacement surgery. In most cases, the surgery was either performed in a public hospital (67.0%,  $n = 266$ ) or a private not-for-profit hospital (27.5%,  $n = 109$ ) and in 5.5% ( $n = 22$ ) in a private for-profit hospital. Most study participants had statutory health insurance only (84.9%,  $n = 338$ ) and 15.1% ( $n = 60$ ) of the study participants had supplementary private health insurance. Some study participants stated that they had received an offer to shorten their waiting time through a visit in the operating physician's private practice (8.3%,  $n = 33$ ) or through an informal payment directly to the operating physician (5.1%,  $n = 20$ ). Overall, 10.9% ( $n = 43$ ) of the study participants reported having received at least one of these offers for faster treatment. Regarding pain and physical limitations at the time of medical decision for surgery,

<sup>d</sup> For 3 questionnaires, more than one of the exclusion criteria applied, hence the reduction from 493 to 400 observations rather than 397.

**Table 1**  
Variable description.

Variable	Variable type	Variable range	Measurement
Waiting time	Numeric	0+	Time between the medical decision for surgery and the day of operation, measured in weeks.
Type of surgery	Categorical	Hip replacement; Knee replacement	
Hospital type	Categorical	Public; Private not-for-profit; Private for-profit	Patients were asked to indicate the name of the hospital where the surgery was performed. From a registry of all hospitals in Austria, hospital type was matched via the hospital name.
Health insurance	Categorical	Statutory health insurance only; Supplementary private health insurance	Patients were asked to indicate whether or not they hold supplementary private health insurance in addition to the statutory health insurance.
Offer visit operating physician's private practice to reduce waiting time	Categorical	No; Yes	Patients were asked to indicate whether they had received an offer to reduce waiting time through a visit to the operating physician's private practice.
Offer informal payment to reduce waiting time	Categorical	No; Yes	Patients were asked to indicate whether they had received an offer to reduce waiting time through an informal payment directly to the operating physician.
Any offer to reduce waiting time (summary variable)	Categorical	No; Yes	A binary summary variable was generated indicating whether a patient had received an offer to reduce waiting time either through a visit to the operating physician's private practice or through an informal payment directly to the operating physician.
Pain	Categorical	No/mild/moderate; Severe/very severe	Degree of pain at time of medical decision for surgery. Pain was measured on a 5-point Likert scale (none, mild, moderate, severe, very severe). Pain was then recoded into a binary variable indicating either severe/very severe cases or none/mild/moderate cases.
Physical limitations	Categorical	No/mild/moderate; Severe/very severe	Degree of physical limitations at time of medical decision for surgery. Physical limitations were measured on a 5-point Likert scale (none, mild, moderate, severe, very severe). Physical limitations were then recoded into a binary variable indicating either severe/very severe cases or none/mild/moderate cases.
Both pain and physical limitations (summary variable)	Categorical	At least one no/mild/moderate; Both severe/very severe	A binary summary variable was generated indicating whether a patient had both severe/very severe pain and severe/very severe physical limitations.
Sex	Categorical	Male; Female	
Age	Categorical/Numeric	<50; 50–60; 60–70; 70–80; 80+	Patients were asked to indicate their year of birth. For descriptive purposes, age was then recoded into a categorical variable with five age groups. Age was used as a linear (mean-standardised) term in bivariate and regression analyses.
Labour force status	Categorical	Not in labour force; Employed/self-employed	Patients were asked to indicate whether they were employed, self-employed, unemployed, not working or retired. Labour force status was then recoded into a binary variable indicating whether a person was in the labour force.
Equalised household income in €	Categorical/Numeric	<800; 800–1200; 1200–1600; 1600–2000; 2000+	Patients were asked to indicate their household income category ranging from less than 1200€ to more than 4200€. Income was equalised by household size. For descriptive purposes, equalised household income was reported in five income groups. Equalised household income was used as a linear (mean-standardized) term in bivariate and regression analyses.
Education	Categorical	Primary; Secondary/tertiary	Patients were asked to indicate their highest educational attainment on a 7-point scale. Education was then recoded into a binary variable indicating either primary or secondary/tertiary education.

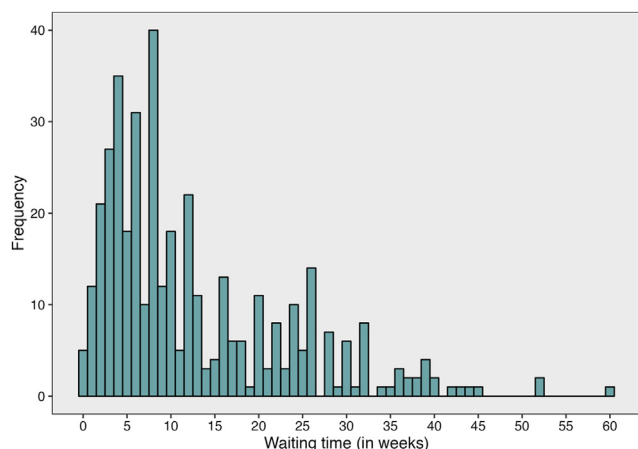
**Table 2**  
Descriptive statistics of study population, by type of surgery.

	Total	Hip replacement	Knee replacement
	N (%)	N (%)	N (%)
<b>Patients total</b>	400	196	204
<b>Hospital type</b>			
Public	266 (67.00%)	141 (72.31%)	125 (61.88%)
Private not-for-profit	109 (27.46%)	46 (23.59%)	63 (31.19%)
Private for-profit	22 (5.54%)	8 (4.10%)	14 (6.93%)
Missing	0.75%	0.51%	0.98%
<b>Health insurance</b>			
Statutory health insurance only	338 (84.92%)	167 (85.64%)	171 (84.24%)
Supplementary private health insurance	60 (15.08%)	28 (14.36%)	32 (15.76%)
Missing	0.50%	0.51%	0.49%
<b>Offer visit operating physician's private practice to reduce waiting time</b>			
No	365 (91.71%)	182 (93.81%)	183 (89.71%)
Yes	33 (8.29%)	12 (6.19%)	21 (10.29%)
Missing	0.50%	1.02%	0.00%
<b>Offer informal payments to reduce waiting time</b>			
No	375 (94.94%)	185 (96.35%)	190 (93.60%)
Yes	20 (5.06%)	7 (3.65%)	13 (6.40%)
Missing	1.25%	2.04%	0.49%
<b>Any offer to reduce waiting time</b>			
No offer	353 (89.14%)	175 (90.67%)	178 (87.68%)
At least one offer	43 (10.86%)	18 (9.33%)	25 (12.32%)
Missing	1.00%	1.53%	0.49%
<b>Pain</b>			
No/mild/moderate	84 (21.32%)	46 (23.96%)	38 (18.81%)
Severe/very severe	310 (78.68%)	146 (76.04%)	164 (81.19%)
Missing	1.50%	2.04%	0.98%
<b>Physical limitations</b>			
No/mild/moderate	165 (42.09%)	75 (39.06%)	90 (45.00%)
Severe/very severe	227 (57.91%)	117 (60.94%)	110 (55.00%)
Missing	2.00%	2.04%	1.96%
<b>Both pain and physical limitations</b>			
At least one no/mild/moderate	186 (47.09%)	88 (45.36%)	98 (48.76%)
Both severe/very severe	209 (52.91%)	106 (54.64%)	103 (51.24%)
Missing	1.25%	1.02%	1.47%
<b>Sex</b>			
Male	167 (42.17%)	79 (40.93%)	88 (43.35%)
Female	229 (57.83%)	114 (59.07%)	115 (56.65%)
Missing	1.00%	1.53%	0.49%
<b>Age</b>			
<50	17 (4.80%)	11 (6.29%)	6 (3.35%)
50–60	87 (24.58%)	51 (29.14%)	36 (20.11%)
60–70	103 (29.10%)	50 (28.57%)	53 (29.61%)
70–80	113 (31.92%)	47 (26.86%)	66 (36.87%)
80+	34 (9.60%)	16 (9.14%)	18 (10.06%)
Missing	11.50%	10.71%	12.25%
<b>Labour force status</b>			
Not in labour force	270 (72.19%)	123 (66.13%)	147 (78.19%)
Employed/self-employed	104 (27.81%)	63 (33.87%)	41 (21.81%)
Missing	6.50%	5.10%	7.84%
<b>Equalised household income</b>			
<800	66 (18.18%)	26 (14.86%)	40 (21.28%)
800–1200	112 (30.85%)	59 (33.71%)	53 (28.19%)
1200–1600	93 (25.62%)	42 (24.00%)	51 (27.13%)
1600–2000	26 (7.16%)	16 (9.14%)	10 (5.32%)
2000+	66 (18.18%)	32 (18.29%)	34 (18.09%)
Missing	9.25%	10.71%	7.84%
<b>Education</b>			
Primary	252 (64.95%)	118 (62.43%)	134 (67.34%)
Secondary/tertiary	136 (35.05%)	71 (37.57%)	65 (32.66%)
Missing	3.00%	3.57%	2.45%

severe/very severe pain (78.7%,  $n = 310$ ) and severe/very severe physical limitations (57.9%,  $n = 227$ ) were most common. Taken together, 52.9% ( $n = 209$ ) of study participants reported both severe/very severe pain and severe/very severe physical limitations. Regarding sociodemographic characteristics, 57.8% ( $n = 229$ ) of study participants were female, 61.0% ( $n = 216$ ) were aged between 60 and 80 years, 27.8% ( $n = 104$ ) were employed/self-employed, 49.0% ( $n = 178$ ) had an equalised household income below 1200€ and 35.1% ( $n = 136$ ) had at least secondary education.

### Univariate analysis

The distribution of waiting times is presented in Fig. 1. The median waiting time reported by patients was 8.7 weeks (IQR: 4.9–19.3). A small number of patients (1.3%,  $n = 5$ ) reported a waiting time of less than one week and in three cases waiting times of over one year were indicated. The distribution of waiting times was right-skewed with a substantial right tail. More specifically, over a quarter (26.8%,  $n = 107$ ) of



**Fig. 1.** Distribution of waiting times. Note:  $n = 399$ . One extreme outlier (waiting time = 104 weeks) was excluded in this figure for visualisation purposes. The bin-width is set to one, such that each bin represents the number of patients who indicated the respective waiting time in weeks. Bunching around multiples of four is visible in the figure, likely reflecting that patients often recall their waiting time in months and multiply to report in weeks in the questionnaire.

patients reported more than double the median waiting time (18 weeks or more).

#### Bivariate analyses

Waiting times in weeks by type of surgery are presented in Table 3. Median waiting times were 8.9 weeks (IQR: 4.5–18.0) for hip and 8.4 weeks (IQR: 5.0–20.0) for knee replacement surgery. The waiting times did not differ by surgery type ( $P = 0.737$ , MWU). Waiting times were found to differ by hospital type ( $P < 0.001$ , KW), with waiting times in private for-profit hospitals (median: 3.8, IQR: 2.6–7.3) being shorter than the waiting times in public hospitals (median: 8.7, IQR: 4.6–19.8) and private not-profit hospitals (median: 11.0, IQR: 6.0–21.7). Patients with supplementary private health insurance (median: 6.0, IQR: 3.0–10.6) experienced shorter waiting times ( $P < 0.001$ , MWU) than patients with statutory health insurance only (median: 9.5, IQR: 5.0–21.0). This held also when restricting the sample to patients in public or private not-for-profit hospitals only. Concerning the role of offers to reduce waiting time through a visit in the operating physician's private practice, no difference ( $P = 0.593$ , MWU) was found in the waiting time for patients who received such an offer (median: 8.0, IQR: 4.0–14.0) and patients who did not (median: 9.0, IQR: 5.0–20.0). Similarly, the difference in waiting time of patients who reported having been offered shorter waiting times through an informal payment directly to the operating physician (median: 8.5, IQR: 4.0–26.1) and patients who did not receive this offer (median: 8.7, IQR: 5.0–18.5) was not statistically significant ( $P = 0.913$ , MWU).

Patients who experienced severe/very severe pain at the time of medical decision-making for surgery (median: 8.0, IQR: 4.1–17.3) had a shorter waiting time ( $P = 0.015$ , MWU) than patients with up to moderate pain (median: 12.0 weeks, IQR: 6.0–22.0). Similarly, the waiting time of patients with severe or very severe physical limitations (median: 8.0, IQR: 4.0–16.0) was shorter ( $P = 0.007$ , MWU) than that of patients with up to moderate limitations (median: 10.0, IQR: 6.0–20.0). Waiting times did not differ by sex ( $P = 0.676$ , MWU), age ( $P = 0.796$ , Spearman), labour force status ( $P = 0.540$ , MWU), income ( $P = 0.907$ , Spearman) or education ( $P = 0.814$ , MWU).

#### Regression analysis

Regression results from a negative binomial model with waiting time in weeks as dependent variable and institution- and patient-related factors as independent variables are presented in Table 4. Having been operated in a private for-profit hospital was associated with a shorter waiting time for surgery ( $-0.722$ ; 95% CI:  $-1.209$ ,  $-0.236$ ). Having supplementary private health insurance was also associated with shorter waiting times ( $-0.497$ ; 95% CI:  $-0.794$ ,  $-0.200$ ), after controlling for hospital type. Importantly, this relationship held when restricting the sample to patients in public and private not-for-profit hospitals (see Additional file 2: Table A2), indicating that waiting times were shorter for those with supplementary private health insurance also within publicly funded hospitals. Having experienced severe/very severe pain and physical limitations at the time of decision-making for surgery was related to shorter waiting times ( $-0.245$ ; 95%-CI:  $-0.429$ ,  $-0.062$ ). The type of surgery, having received any offer to reduce the waiting time, sex, age, labour force status, income and education were not statistically significantly associated with the waiting time.

Confirming the findings from the bivariate analyses, the results are stable when controlling for multiple institution-related and patient-related characteristics. Additionally, the results are consistent across sensitivity analyses (Additional file 2: Tables A1–A5).

#### Discussion

This study is the first to describe waiting times for elective surgeries in Austria. Regarding our first research aim, we found that median waiting times were 8.9 weeks for hip and 8.4 weeks for knee replacement surgeries. These waiting times are considerably below the median waiting times in most OECD countries (16.1 weeks for hip and 27.0 weeks for knee replacement surgeries). Only Denmark and Italy have shorter waiting times.<sup>4</sup> While Austria has short median waiting times (around two months) for ES by international comparison, over a quarter of our sample reported waiting times of over four months.<sup>35–37</sup> Regarding our second research aim, we found that among institution-related factors, hospital type and health insurance matter for waiting times and among patient-related factors, pain and physical limitations at the time of decision-making matter for waiting time. Patients operated in private-for-profit hospitals had shorter waiting times than patients in public or private not-for-profit hospitals. This is, however, not problematic from an equity perspective, as in for-profit hospitals, the stay is only subsidised and not fully paid for by the statutory health insurance. Thus, these hospitals accommodate for the willingness-to-pay for shorter waiting times. At the same time, having a supplementary private health insurance compared to statutory health insurance only was associated with shorter waits within publicly funded hospitals, suggesting preferential treatment. Favouring patients with supplementary private health insurance is against the principle of equity in access to services for all patients and additionally against Austrian legislation. Healthcare policy needs to address this equity concern, for example by further mandating reporting of waiting times by health insurance status.

In our study, 8.3% of patients received an offer to reduce their wait through a visit in the operating physician's private practice prior to the ES. In the Austrian context, such an offer is equivalent to a covert informal payment. Offers to shorten the waiting times through informal payments directly to the operating physician were reported by 5.1% of patients. In total, 10.9% received at least one of these offers. These findings confirm previous studies stating that informal payments to shorten waiting times are common practice in Austria [33–35]. Median waiting times, however, did not

**Table 3**  
Median (mean) waiting times for elective surgery, by surgery type.

	Total		Hip replacement		Knee replacement	
	Median (mean)	IQR	Median (mean)	IQR	Median (mean)	IQR
<b>Patients total</b>	8.70 (12.98)	4.88–19.25	8.85 (12.69)	4.46–18.00	8.35 (13.26)	5.00–20.00
<b>Hospital type</b>						
Public	8.70 (12.76)	4.62–19.75	9.00 (12.31)	4.00–18.00	8.00 (13.27)	5.00–20.00
Private not-for-profit	11.00 (15.17)	6.00–21.74	9.00 (15.10)	6.00–21.94	12.00 (15.22)	6.00–20.87
Private for-profit	3.75 (4.84)	2.62–7.25	4.50 (5.81)	2.88–8.00	3.25 (4.29)	2.62–4.00
<b>Health insurance</b>						
Statutory health insurance only	9.50 (13.92)	5.00–21.00	9.00 (13.38)	4.42–20.00	10.00 (14.45)	6.00–21.87
Supplementary private health insurance	6.00 (7.91)	3.00–10.62	8.00 (8.91)	4.84–12.00	4.00 (7.03)	3.00–10.00
<b>Offer visit operating physician's private practice to reduce waiting time</b>						
No	9.00 (13.14)	5.00–20.00	8.35 (12.45)	4.35–17.85	9.00 (13.84)	5.00–20.50
Yes	8.00 (11.56)	4.00–14.00	14.00 (17.42)	8.00–24.00	7.00 (8.22)	4.00–12.00
<b>Offer informal payments to reduce waiting time</b>						
No	8.70 (12.99)	5.00–18.50	8.70 (12.43)	4.35–17.39	8.70 (13.53)	5.00–20.00
Yes	8.50 (14.13)	4.00–26.09	26.09 (23.73)	16.00–29.00	4.35 (8.96)	3.00–12.00
<b>Any offer to reduce waiting time</b>						
No offer	8.70 (12.98)	5.00–19.00	8.00 (12.03)	4.17–16.00	9.00 (13.91)	5.00–20.75
At least one offer	8.70 (13.48)	4.17–22.00	22.00 (20.39)	8.00–27.52	7.00 (8.51)	4.00–12.00
<b>Pain</b>						
No/mild/moderate	12.00 (14.60)	6.00–22.00	11.50 (13.74)	5.25–21.50	12.50 (15.63)	7.25–23.50
Severe/very severe	8.00 (12.55)	4.09–17.29	8.00 (12.33)	4.00–16.00	8.00 (12.75)	4.35–17.39
<b>Physical limitations</b>						
No/mild/moderate	10.00 (14.25)	6.00–20.00	9.00 (13.43)	6.00–17.70	11.00 (14.93)	6.00–23.75
Severe/very severe	8.00 (12.26)	4.00–16.00	8.00 (12.42)	4.00–18.00	8.00 (12.08)	4.00–13.04
<b>Both pain and physical limitations</b>						
At least one no/mild/moderate	10.50 (14.30)	6.00–21.94	10.25 (13.63)	6.00–20.00	11.00 (14.91)	6.00–23.75
Both severe/very severe	8.00 (11.88)	4.00–16.00	8.00 (11.96)	4.00–16.00	8.00 (11.80)	4.00–13.02
<b>Sex</b>						
Male	8.70 (12.87)	5.00–20.00	8.00 (12.73)	4.67–20.00	9.00 (12.99)	6.00–20.00
Female	8.00 (13.03)	4.00–18.00	9.00 (12.54)	4.62–16.00	8.00 (13.51)	4.00–19.00
<b>Age</b>						
<50	7.00 (13.77)	5.00–10.00	7.00 (14.82)	4.50–23.00	7.00 (11.86)	6.00–9.50
50–60	8.00 (12.73)	5.00–17.70	9.00 (12.12)	5.50–16.00	8.00 (13.60)	3.88–24.50
60–70	9.00 (13.62)	4.75–18.50	10.25 (13.05)	4.39–19.50	8.00 (14.16)	5.00–18.00
70–80	10.87 (13.59)	4.00–20.00	9.00 (13.11)	4.00–20.00	12.00 (13.94)	4.00–21.74
80+	8.50 (12.99)	4.00–20.00	5.50 (12.63)	3.00–22.83	11.00 (13.31)	6.50–20.00
<b>Labour force status</b>						
Not in labour force	9.00 (12.75)	4.00–20.00	8.70 (12.28)	4.00–20.00	10.00 (13.15)	4.67–20.00
Employed/self-employed	8.00 (14.26)	5.00–21.25	9.00 (13.51)	6.00–16.00	8.00 (15.39)	5.00–24.00
<b>Equalised household income</b>						
<800	8.35 (11.67)	4.00–16.00	8.35 (10.06)	4.00–12.00	8.35 (12.72)	4.75–18.48
800–1200	8.00 (13.20)	4.46–17.54	8.00 (12.42)	4.00–19.00	9.00 (14.07)	5.00–17.00
1200–1600	10.00 (14.02)	4.00–22.00	10.25 (13.19)	4.35–20.00	10.00 (14.70)	4.00–24.00
1600–2000	8.50 (12.85)	6.00–19.00	10.50 (12.94)	6.00–18.00	7.50 (12.71)	5.25–17.75
2000+	8.00 (12.52)	5.00–13.00	9.00 (14.36)	6.00–17.50	8.00 (10.79)	3.62–12.75
<b>Education</b>						
Primary	8.00 (13.59)	4.35–21.19	8.00 (12.68)	4.00–19.50	8.70 (14.38)	5.00–21.94
Secondary/tertiary	9.50 (12.25)	6.00–16.00	10.00 (12.95)	6.50–16.00	8.00 (11.49)	4.00–16.00

Abbreviations: IQR, Interquartile range.

**Table 4**  
Determinants of waiting times in public and private not-profit hospitals.

	Estimate	95% CI-Interval	P-value
<b>Surgery type:</b> knee replacement [vs. hip replacement]	0.057	–0.129 to 0.242	0.550
<b>Hospital type:</b> private not-for-profit [vs. public]	0.201	–0.006 to 0.409	0.057
<b>Hospital type:</b> private for-profit [vs. public]	–0.722	–1.209 to –0.236	0.004**
<b>Health insurance:</b> supplementary private [vs. statutory]	–0.497	–0.794 to –0.200	0.001***
<b>Any offer to reduce waiting time:</b> yes [vs. no]	0.016	–0.281 to 0.312	0.917
<b>Pain and physical limitations:</b> severe/very severe [vs. no/mild/moderate]	–0.245	–0.429 to –0.062	0.009**
<b>Sex:</b> female [vs. male]	0.010	–0.182 to 0.201	0.920
<b>Age</b>	0.093	–0.022 to 0.209	0.114
<b>Labour force status:</b> employed/self-employed [vs. not in labour force]	0.227	–0.021 to 0.476	0.073
<b>Equalised household income</b>	0.035	–0.066 to 0.136	0.497
<b>Education:</b> secondary/tertiary [vs. primary]	–0.067	–0.273 to 0.139	0.525
Constant	2.670	2.438 to 2.901	<0.001***

Abbreviations: CI, Confidence Interval.

Note: N = 310; \*\*\* <0.001, \*\* <0.01, \* <0.05.

differ whether such an offer was made or not, possibly because it was not always also taken up. Nevertheless, the current study shows that offers to shorten waiting times through informal payments are widespread in Austria. Although such practices are illegal and a violation of professional standards, effective enforcement seems to lag behind.<sup>33</sup> These insights stress the need for more political awareness to promote equality in access to healthcare services by reducing the spread of informal payments.

Regarding patient-related factors, reporting more severe pain and physical limitations at the time of medical decision-making for surgery was associated with shorter waiting times. This result indicates that patients are being prioritised according to the severity of the medical case, which is in line with international evidence e.g., from the UK.<sup>40,41</sup> Prioritising patients with more severe pain and limitations is particularly important from a patient health perspective to reduce negative health outcomes.<sup>12</sup> Looking beyond the severity of the medical case, waiting times were not related to sociodemographic characteristics, contrasting some studies outside of Austria.<sup>4,14–18</sup>

This study has potential limitations. Firstly, the study sample is not necessarily representative. Our sample included 196 elective hip and 204 elective knee replacements conducted in public, private not-for-profit or private for-profit hospitals. Overall, 26,183 hip and 20,296 knee replacement surgeries were conducted in publicly funded hospitals in Austria in 2019.<sup>42,e</sup> While all relevant orthopaedic rehabilitation centres in Austria were contacted, eleven centres in five out of the nine Austrian federal states participated in the study. These federal states cover 60% of the Austrian population, however, respondents' places of residence likely cover more federal states as patients are not restricted to rehabilitation centres in their own federal state. Secondly, due to the sample size and only moderate variation around the short median waiting time, the regression results may have been underpowered for some of the less frequently occurring covariates, such as the offers to reduce waiting times through informal payments.

The current study has three core strengths. Firstly, it is the first to provide evidence on waiting times for hip and knee replacement surgeries in Austria. Secondly, it documents a concerning prevalence of offers to shorten waits through informal payments. Thirdly, it connects a broad range of institution-related and patient-related factors with surgery waiting times and thus gives valuable insights into potential determinants of (un)equitable access to ES. Future studies should investigate the role of informal payments for waiting time shorting in more detail and extend this strand of research to other healthcare systems. Moreover, future studies should investigate the development of waiting times for ES and equitable access to ES in two regards: first, the impact of the COVID-19 pandemic, during which ES were frequently postponed and second, in the context of the worsening health workforce crisis.

## Conclusion

We find short median waiting times (around two months) for elective hip and knee replacement surgeries in Austria. Concerningly, around ten percent of patients indicated having been offered to shorten waiting times through some form of informal payment. Moreover, while prioritisation based on patients' pain and physical limitations seems to work well, there is also prioritisation of patients with private supplementary health insurance, even within publicly funded hospitals. In the international context, our findings point to the downsides of a public healthcare system that enables

hospitals and physicians to benefit from supplementary private health insurance payments and allows for physicians to augment their salary through earnings from a private practice. These healthcare system features entail unintended incentives for unequal treatment.

## Author statements

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Not applicable.

### Ethical approval

Mandatory ethics approval was not necessary: In Austria, approval by an ethics committee is necessary for the following four types of evaluations/interventions: 1) Clinical trial on human subjects according to the law on medicines – Arzneimittelgesetz (AMG), 2) Clinical trials on human subjects according to the law on medical products – Medizinproduktegesetz (MPG), 3) Clinical trial on human subjects according to the law on genetic engineering – Gentechnikgesetz (GTG), 4) New medical methods (e.g. new surgical techniques) as well as applied medical research according to the law of hospitals and sanatoriums – Krankenanstalten- und Kuranstaltengesetz (KAKuG). As none of the above categories applied to this research, approval by an ethics committee was not necessary.

Voluntary ethics approval was not possible: The Institute for Advanced Studies had not yet set up an ethic commission at the time of the study design and implementation.

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### Competing interests

The authors have no competing interests.

### Consent for publication

Not applicable as no personal information is published.

### Authors' contributions

Study conception and design: TC, MK, SM; methodology: TC, MK, SM, BS; data collection: MK, BS; formal analysis: BS, SM; interpretation of results: TC, MK, SM; funding acquisition and project administration: TC; writing – original draft: MK, BS, SM; writing – review & editing: TC, MK, SM, BS. All authors reviewed and approved the final version of the manuscript.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2024.08.007>.

<sup>e</sup> These numbers include elective as well as acute surgeries and cover only those conducted in public or private not-for-profit hospitals.

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