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Gender differences in the decision-making process for undergoing total knee replacement

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ABSTRACT

Objective: To assess gender differences in the decision-making process for treatment of knee osteoarthritis (OA).
Methods: A secondary analysis of a randomized trial was conducted (n = 193). Knowledge of OA and total knee replacement (TKR), decisional conflict, satisfaction with the decision-making process, treatment preference and TKR uptake 6 months later were compared by gender. Multivariate regression models were developed to identify gender-specific predictors.
Results: Women showed less knowledge (MD = −7.68, 95% CI: −13.9, −1.46, p = 0.016), reported less satisfaction (MD = −6.95, 95% CI: −11.7, −2.23, p = 0.004) and gave more importance to avoiding surgery (U = 2.09, p = 0.019). In women, more importance attributed to the time needed to relieve symptoms significantly reduced the odds of surgery (OR = 0.76, p = 0.016).
Conclusion: The provision of information and/or promotion of shared decision-making could be of lower quality in female patients, although other explanations such as differences in information needs or preference for involvement in decision-making cannot be ruled out with the current evidence. Given the study's limitations, especially regarding the sample size, further confirmation is needed.
Practice implications: A systematic, shared decision-making approach in consultation is needed to avoid potential gender-based biases.

1. Introduction

Knee osteoarthritis (OA) is the leading cause of disability in developed countries [1] and its prevalence has doubled since the mid-20th century [2]. Currently, recommended treatments to manage the symptoms of knee OA include biomechanical interventions, exercise, strength training, weight management, painkillers and anti-inflammatory drugs, whereas the efficacy of other treatment options such as glucosamine, chondroitin, intra-articular corticosteroids, hyaluronic acid and platelet-rich plasma remains unclear [3–5]. Total knee replacement (TKR) is the main option when pain and functional limitations persist despite the use of conservative treatments [6]. The prevalence of TKR is estimated to be around 1.5%, exceeding 10% at around 80 years of age [7]. Some projections expect these procedures to double by 2030 and even quadruple by 2040 [8].

Many studies have investigated gender differences in the prevalence, incidence and severity of OA [9–11]. Prevalence, clinical pain and inflammation is greater in women [12–14] and they use more health care

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before undergoing TKR [15]. Although most studies have not found significant gender differences in willingness to undergo TKR [16–18], it has been proven to be used significantly less frequently in women, who show worse post-operative outcomes [19–22]. Differences in the use of TKR may be explained by personal factors such as different beliefs, expectations, and treatment preferences, but also by contextual factors, such as interactions with health professionals [20]. Nonetheless, studies assessing gender differences in the patient-physician interaction when making decisions about OA treatment are scarce. Results have shown that women discuss TKR with a physician to a lesser extent than men [16,23]. One study in Canada with standardized patients showed that physicians applied fewer informed decision-making elements and showed poorer interpersonal skills when the patient was female [23,24]. Studies evaluating whether doctors are less likely to recommend surgery to women have yielded mixed results [18,23,25].

The aim of this study is to investigate whether there are gender differences in variables related to the decision-making process for knee OA treatment in patients facing the decision to undergo TKR: decisional conflict, satisfaction with the decision-making process, preference for surgery and uptake of TKR.

2. Methods

We performed a secondary analysis of the data obtained from a randomized controlled trial conducted at one hospital and nine primary care centers in Tenerife (Spain) in 2018 [26]. The trial aimed to assess the effectiveness of a decision aid for patients with knee OA as compared to usual care. Patients were candidates for TKR facing the decision of joining the waiting list for surgery or delaying that decision and continuing with conservative treatment. The results showed post-intervention improvements in knowledge of OA and TKR, decisional conflict and satisfaction with the decision-making process. These improvements were not significantly different by gender, although the analyses were post-hoc.

The trial did not include a baseline assessment (i.e., the intervention and control groups completed the questionnaires only once following application of the decision aid in the former). Therefore, these post-intervention data were used in this study, along with the rate of TKR observed 6 months after the decision aid intervention.

Study variables included:

- Sociodemographic variables: age, gender, education (dichotomized into no studies/primary vs. secondary/university).
- Health-related quality of life, measured with the Spanish version of the EuroQol questionnaire (EQ-5D-5 L) [27]. Derived health utilities range from 0 (worst possible health) to 1 (perfect health).
- Self-perceived general health, assessed with the visual analogue scale (VAS) of the EQ-5D-5 L (range 0–100).
- Knowledge of OA and TKR, assessed with a 7-item questionnaire in which the number of correct answers represents the total score, transformed to a 0–100 scale.
- Importance given to certain characteristics and potential outcomes of OA treatments: avoiding severe adverse effects, avoiding mild adverse effects, reducing pain, being able to perform daily activities, avoiding the need for additional treatment, time needed to experience symptom relief, avoiding surgery, avoiding injections, and avoiding drugs (pills). Each item is graded by the patient from 0 (not important at all) to 10 (extremely important).
- Satisfaction with the decision-making process, assessed with the 12-item scale developed by Barry et al. [28]. Scores are transformed to a 0–100 scale, with higher values indicating greater satisfaction.
- Decisional conflict, measured with the Decisional Conflict Scale [29,30], which includes 16 items with a Likert scale ranging from 0 (totally agree) to 5 (totally disagree), transformed to a 0–100 scale.
- Treatment preference (unsure, drugs, injections or TKR).
- Undergoing TKR in the following 6 months (yes/no).

Data were managed and analyzed using SPSS version 25. Descriptive statistics (means, standard deviations, and percentages) were calculated and compared by gender with t-tests and chi-square tests for continuous and categorical variables, respectively. Knowledge, decisional conflict, and satisfaction with the decision-making process were analyzed both continuously and categorically. For the latter analysis, the variables were dichotomized based on a score of 60 for knowledge (previous studies have used this value [31] or 66 [32] to define an adequately informed patient) and 37.5 for decisional conflict (higher values are associated with delaying decisions [29]). For satisfaction, we also used a score of 60 as a threshold.

Differences in the motives for choosing treatment were analyzed by means of Mann-Whitney's U test, since most items showed highly asymmetric distributions. A principal component analysis (PCA) was carried out on the 6 items assessing the importance of treatment outcomes/characteristics (i.e., serious and mild adverse effects, pain relief, being able to perform daily activities, recovery time, need for further treatment) in order to reduce the number of variables introduced in the subsequent regression models. The remaining three items (i.e., avoiding surgery, injections, and medication, respectively) were introduced individually.

Multiple regression models were constructed for the whole sample and separately by gender to analyze the predictors of decisional conflict, satisfaction with the decision-making process (linear regression for both), preference for TKR (after dichotomizing the variable into TKR vs. other) and undergoing TKR in the following 6 months (logistic regression for both). The motive of "avoiding surgery" was only included in the models for decisional conflict and satisfaction, and these two latter variables were included as predictors in the models of preference for TKR and surgery uptake. To assess gender-specific predictors, the interaction term of sex with each of the independent variables was introduced successively in the multiple regression models for the whole sample; a significant value for the interaction indicates that beta coefficients for women and men differ.

The study was approved by the Ethical Committee of the Hospital Universitario Nuestra Señora de la Candelaria, Tenerife (Spain) (ref.: PI-24/16). It was carried out according to the principles of the Declaration of Helsinki, and local and national regulations on data protection and anonymity.

3. Results

The study included 193 participants, whose characteristics are shown in Table 1. Mean age was 66.8 (SD = 8.42), most participants were women (72%) and 77.2% had received only primary education or no formal studies. No significant differences by gender were found for age or education. The sample showed a low to moderate level of decisional conflict (36.8), values around 50 (on a 0–100 scale) in knowledge of OA/TKR, and satisfaction with the decision-making process. Women scored significantly lower on these two variables (knowledge: MD = −7.68, 95% CI: −13.9, −1.46, p = 0.016; satisfaction: MD = −6.95, 95% CI: −11.7, −2.23, p = 0.004). Categorical analyses also yielded significant results: the rate of adequately informed women (knowledge score $\geq$ 60) was lower than that of men (38.8% vs. 59.3%, p = 0.010), as well as the rate of those scoring $\geq$ 60 in satisfaction (23.7% vs. 51.9%, p < 0.001).

Approximately half of the sample (48.7%) preferred TKR as a treatment option, whereas 18.8% were unsure about their preference. At 6 months, 26.3% of participants had undergone TKR. There were no significant gender differences in these variables.

Table 2 shows the relevance of the different motives when deciding about treatment options. The most important were being able to perform daily activities (mean 9.64), reducing pain (9.52) and avoiding severe adverse effects (8.99). Only one significant difference was observed: women gave more importance to avoiding surgery than men (U = 2.09, p = 0.019). The PCA of the 6 items dealing with treatment

Table 1
Characteristics of the sample.

	Total (n = 193)	Women (n = 139)	Men (n = 54)	p-value
Age (years), mean (SD)	66.8 (8.42)	67.3 (8.22)	65.4 (8.87)	0.069
Education, n (%)				0.973
No studies	49 (25.4)	35 (25.1)	14 (25.9)	
Primary studies	100 (51.8)	73 (52.5)	27 (50)	
Secondary studies	32 (16.6)	23 (16.5)	9 (16.7)	
University studies	12 (6.2)	8 (5.9)	4 (7.4)	
EQ-5D-5 L, mean (SD)	0.62 (0.23)	0.60 (0.24)	0.65 (0.20)	0.228
EQ-5D-5 L VAS, mean (SD)	66.6 (18.1)	65.6 (19.3)	69.2 (14.4)	0.154
Knowledge, mean (SD)	56.1 (19.9)	54.0 (20.4)	61.6 (17.6)	0.016
SAT, mean (SD)	53.24 (15.2)	51.3 (14.7)	58.2 (15.3)	0.004
DCS, mean (SD)	36.8 (12.9)	37.1 (13.0)	35.9 (12.6)	0.406
Treatment of preference, n (%)				0.603
Unsure	36 (18.7)	28 (20.1)	8 (14.8)	
Drugs	30 (15.5)	21 (15.1)	9 (16.7)	
Injections	32 (16.6)	25 (18.0)	7 (13.0)	
TKR	95 (49.2)	65 (46.8)	30 (55.5)	
Operated at 6 months (n = 190)	50 (26.3%)	38 (27.9%)	12 (22.2%)	0.419

SD = Standard deviation.

Table 2
Relevance of motives for decision.

	Total (n = 193)	Women (n = 139)	Men (n = 54)	p-value
Avoiding severe adverse effects, mean (SD) median	8.99 (1.95) 10.0	9.14 (1.75) 10.0	8.63 (2.37) 10.0	0.193
Avoiding mild adverse effects, mean (SD) median	7.59 (2.03) 8.00	7.71 (1.87) 8.00	7.28 (2.37) 8.00	0.385
Being able to perform daily activities, mean (SD) median	9.64 (0.99) 10.0	9.66 (0.98) 10.0	9.57 (0.98) 10.0	0.224
Avoiding the need for recurring or additional treatment, mean (SD) median	8.03 (2.31) 9.00	8.16 (2.20) 9.00	7.70 (2.56) 9.00	0.192
Reducing pain, mean (SD) median	9.52 (1.14) 10.0	9.55 (1.16) 10.0	9.43 (1.09) 10.0	0.106
Time needed to experience symptom relief, mean (SD) median	7.51 (2.16) 8.00	7.47 (2.17) 8.00	7.63 (2.13) 8.00	0.592
Avoiding surgery, mean (SD) median	5.51 (3.66) 5.00	5.76 (3.65) 7.00	4.54 (3.53) 4.00	0.019
Avoiding injections, mean (SD) median	6.34 (3.15) 7.00	6.42 (3.08) 7.00	6.13 (3.31) 7.00	0.491
Avoiding drugs (pills), mean (SD) median	6.36 (2.52) 7.00	6.55 (2.45) 7.00	5.87 (2.63) 6.00	0.097

SD = Standard deviation.

characteristics and outcomes yielded 3 components with eigenvalues greater than 1, which explained 76.6% of the variance (Table 3). The first component included the importance of reducing pain and being able to perform daily activities (thus labeled "Symptoms and function improvement"). The second (labeled "Avoiding adverse effects") included avoiding both severe and mild adverse effects. The third component included the time needed to experience relief and avoiding the need for further treatment (labeled "Rapid and durable recovery").

Table 3
Principal component analysis of items assessing the relevance attributed to treatment outcomes/characteristics.

	Components			h^2
	1	2	3	
Reducing pain	**0.905**	-0.034	0.098	0.83
Being able to perform daily activities	**0.873**	0.248	-0.007	0.82
Avoiding mild adverse effects	-0.051	**0.880**	0.116	0.79
Avoiding serious adverse effect	0.274	**0.835**	0.044	0.78
Recovery time	-0.059	0.021	**0.849**	0.73
Needing additional treatment	0.150	0.129	**0.782**	0.65

Kaiser-Meyer-Olkin = 0.543; Bartlett sphericity test: $\chi^2 = 236.9,\ p < 0.001$.

These components were included in the regression models.

Tables 4–7 show the multivariate models for each outcome. For the whole sample, significant predictors of decisional conflict (Table 4) were the importance attributed to symptoms and function improvement (B = 1.26, p = 0.013) and lesser knowledge (B = −0.13, p = 0.006). There were no gender-specific predictors.

Regarding satisfaction with the decision-making process, significant predictors were gender (confirming the result of the previous univariate analysis), education (B = 6.98, p = 0.004) and a lower level of decisional conflict (B = −0.51, p < 0.001) (Table 5). The importance attributed to a rapid and durable recovery showed a significant interaction with gender (t = 2.61, p = 0.010): its association with satisfaction was negative and non-significant for women (B = −0.34, p = 0.344) and positive for men (B = 1.46, p = 0.022).

Preference for TKR was significantly predicted by poorer quality of life (OR = 0.05, p = 0.001), greater importance attributed to symptoms and function improvement (OR = 1.57, p < 0.001), desire to avoid injections (OR = 1.22, p = 0.004), lower relevance of a rapid and durable recovery (OR = 0.78, p < 0.001), greater knowledge (OR = 1.05, p < 0.001) and lower decisional conflict (OR = 0.95, p = 0.006). The importance attributed to avoiding adverse effects showed a significant interaction with gender (Wald = 6.48, p = 0.011): it was non-significantly related to a lower preference for TKR in women (OR = 0.93, p = 0.312), whereas the opposite occurred in men (OR = 2.65, p = 0.051).

Finally, uptake of TKR 6 months after assessment was significantly predicted by poorer quality of life (OR = 0.11, p = 0.011), lower relevance of a rapid and durable recovery (OR = 0.90, p = 0.032), lower decisional conflict (OR = 0.95, p = 0.006) and lower satisfaction (OR = 0.95, p = 0.002). When preference for TKR was included in the model, it had a strong significant effect (OR = 8.55, p < 0.001), and quality of life and relevance of a rapid and durable recovery were no longer significant, indicating a mediating effect of preference for surgery (data not shown).

None of the interaction terms with sex was significant, although two variables obtained p-values lower than 0.10: quality of life (p = 0.082), with a stronger effect in men (OR = 0.00, p = 0.022) than in women (OR = 0.22, p = 0.099), and the importance of a rapid and durable recovery (p = 0.075), which was significantly related to a lower uptake of TKR in women (OR = 0.84, p = 0.009 vs. OR = 1.09, p = 0.592 for men). When the two items that form this latter variable (i.e., time to relief and need for further treatment) were introduced separately, the interaction with sex was significant only for the importance of the time needed to experience relief (p = 0.022); it was related to a lower likelihood of TKR in women (OR = 0.76, p = 0.016), whereas a non-significant opposite result was observed in men (OR = 1.78, p = 0.128).

Fig. 1 shows a theoretical model based on the results obtained (excluding preference for surgery so as not to increase the complexity of the model).

Table 4
Multiple linear regression analysis for decisional conflict.

	Total (n = 193)		Women (n = 139)		Men (n = 54)		Difference[a]	
	B[b]	p	B	p	B	p	t	p
Gender	0.36	0.865						
Age	-0.02	0.875	0.02	0.909	-0.30	0.198	-0.62	0.539
Education	0.07	0.977	-0.27	0.923	-3.26	0.468	0.38	0.707
Self-perceived general health (EQ-5D-5 L VAS)	-0.08	0.156	-0.05	0.429	-0.28	0.058	-0.98	0.328
Health-related quality of life (EQ-5D-5 L)	1.91	0.660	-1.24	0.800	14.33	0.152	0.94	0.351
Relevance: Avoiding adverse effects	0.15	0.606	0.06	0.867	0.71	0.183	0.12	0.903
Relevance: Symptoms and function improvement	1.26	0.013	1.40	0.017	-0.16	0.888	-0.87	0.383
Relevance: Rapid and durable recovery	-0.53	0.052	-0.30	0.383	-1.58	0.003	-1.23	0.219
Relevance: Avoiding injections	-0.07	0.814	-0.06	0.868	-0.26	0.634	0.38	0.703
Relevance: Avoiding drugs	0.23	0.553	0.34	0.470	-0.47	0.525	-0.47	0.641
Knowledge	-0.13	0.006	-0.16	0.007	-0.02	0.819	1.12	0.263

EQ-5D-5 L: EuroQol questionnaire (5 dimensions, 5 levels); VAS: Visual analogue scale.
[a] t and p-value of the interaction between the corresponding variable and sex, introduced in the multiple regression model for the whole sample. Significant values indicate that beta coefficients for women and men differ.
[b] Unstandardized coefficients.

Table 5
Multiple linear regression analysis for Satisfaction with the decisional process.

	Total (n = 193)		Women (n = 139)		Men (n = 54)		Difference[a]	
	B[b]	p	B	p	B	p	t	p
Gender	6.23	0.006						
Age	0.02	0.869	0.18	0.252	-0.09	0.732	-1.64	0.103
Education	6.98	**0.004**	7.10	0.013	10.23	0.043	0.55	0.586
Self-perceived general health (EQ-5D-5 L VAS)	0.03	0.662	0.01	0.829	0.12	0.473	-0.45	0.650
Health-related quality of life (EQ-5D-5 L)	1.89	0.679	2.98	0.551	-1.62	0.884	0.41	0.680
Relevance: Avoiding adverse effects	0.11	0.710	0.34	0.355	-0.57	0.342	-0.66	0.509
Relevance: Symptoms and function improvement	-0.36	0.508	0.26	0.668	-1.07	0.399	-1.48	0.140
Relevance: Rapid and durable recovery	0.13	0.663	-0.34	0.344	1.46	0.022	2.61	0.010
Relevance: Avoiding injections	-0.13	0.686	-0.16	0.687	-0.01	0.986	-0.21	0.833
Relevance: Avoiding drugs	0.19	0.632	0.02	0.967	0.98	0.236	1.03	0.306
Knowledge	-0.00	0.987	0.04	0.513	-0.14	0.213	-1.38	0.169
Decisional conflict	-0.51	**< 0.001**	-0.53	< 0.001	-0.33	0.053	0.27	0.786

EQ-5D-5 L: EuroQol questionnaire (5 dimensions, 5 levels); VAS: Visual analogue scale.
[a] t and p-value of the interaction between the corresponding variable and sex, introduced in the multiple regression model for the whole sample. Significant values indicate that beta coefficients for women and men differ.
[b] Unstandardized coefficients.

Table 6
Multiple logistic regression model for preference for surgery.

	Total (n = 193)		Women (n = 139)		Men (n = 54)		Difference[a]	
	OR	p	OR	p	OR	p	Wald	p
Gender	0.67	0.386						
Age	1.03	0.349	1.01	0.723	1.23	0.080	0.60	0.440
Education	0.76	0.580	0.71	0.577	0.12	0.229	0.26	0.614
Self-perceived general health (EQ-5D-5 L VAS)	1.01	0.415	1.01	0.623	1.12	0.094	1.41	0.235
Health-related quality of life (EQ-5D-5 L)	0.05	0.001	0.06	0.008	0.00	0.075	0.29	0.591
Relevance: Avoiding adverse effects	1.03	0.671	0.93	0.312	2.65	0.051	6.48	0.011
Relevance: Symptoms and function improvement	1.57	< 0.001	1.53	0.003	1.75	0.389	0.26	0.614
Relevance: Rapid and durable recovery	0.78	< 0.001	0.78	0.004	0.45	0.050	0.07	0.786
Relevance: Avoiding injections	1.22	0.004	1.21	0.026	1.31	0.159	0.05	0.829
Relevance: Avoiding drugs	1.11	0.225	1.07	0.542	1.27	0.431	0.74	0.390
Knowledge	1.05	< 0.001	1.06	< 0.001	1.08	0.105	1.05	0.305
Decisional conflict	0.95	0.006	0.96	0.079	0.88	0.065	1.06	0.303
Satisfaction with the decisional process	1.00	0.964	1.00	0.807	1.09	0.173	0.83	0.363

EQ-5D-5 L: EuroQol questionnaire (5 dimensions, 5 levels); OR: Odds ratio; VAS: Visual analogue scale.
[a] Wald statistic and p-value of the interaction between the corresponding variable and sex, introduced in the multiple regression model for the whole sample. Significant values indicate that beta coefficients (log OR) for women and men differ.

4. Discussion and conclusion

4.1. Discussion

Although many studies have evaluated gender differences in the epidemiology of knee OA and the outcomes of TKR, showing worse results for women, the research on gender differences in the decision-making process about OA treatment is scarce. Our study was not designed for that aim, and therefore it has an exploratory nature and low internal validity. However, we think that the results are relevant enough

Table 7
Multiple logistic regression model for TKR uptake at 6 months.

	Total (n = 190)		Women (n = 136)		Men (n = 54)		Difference[a]	
	OR	p	OR	p	OR	p	Wald	p
Gender	1.27	0.601	—	—	—	—	—	—
Age	0.96	0.170	0.96	0.239	0.98	0.784	0.57	0.451
Education	0.99	0.988	1.01	0.991	0.19	0.247	0.03	0.870
Self-perceived general health (EQ-5D-5 L VAS)	1.02	0.055	1.02	0.095	1.06	0.156	0.06	0.801
Health-related quality of life (EQ-5D-5 L)	0.11	0.011	0.22	0.099	0.00	0.022	3.03	0.082
Relevance: Avoiding adverse effects	1.20	0.131	0.89	0.083	0.89	0.445	2.08	0.150
Relevance: Symptoms and function improvement	0.92	0.154	1.20	0.162	1.33	0.527	0.33	0.568
Relevance: Rapid and durable recovery	0.90	0.032	0.84	0.009	1.09	0.592	3.18	0.075
Relevance: Avoiding injections	1.03	0.633	1.01	0.888	1.10	0.548	0.27	0.601
Relevance: Avoiding drugs	1.07	0.371	1.06	0.534	1.42	0.094	0.72	0.395
Knowledge	1.01	0.507	1.01	0.655	1.02	0.524	0.27	0.602
Decisional conflict	0.95	0.006	0.96	0.024	0.94	0.233	0.48	0.488
Satisfaction with the decisional process	0.95	0.002	0.95	0.007	0.93	0.083	0.28	0.595

EQ-5D-5 L: EuroQol questionnaire (5 dimensions, 5 levels); OR: Odds ratio; VAS: Visual analogue scale.
[a] Wald statistic and p-value of the interaction between the corresponding variable and sex, introduced in the multiple regression model for the whole sample. Significant values indicate that beta coefficients (log OR) for women and men differ.

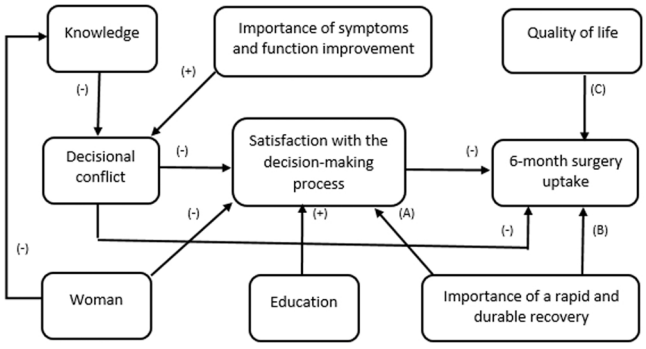

Fig. 1. Theoretical model based on the results obtained (preference for surgery not included). (-): negative association; (+): positive association; (A): possible interaction with gender (positive for men, negative non-significant for women); (B): possible interaction with gender (negative for women, positive non-significant for men): (C) possible interaction with gender (negative for both, stronger in men, non-significant in women).

to merit confirmation in a representative sample of the appropriate size.

Our results indicate that women have lower objective knowledge of TKR than men. The difference is small from a continuous perspective (7.7 points in a 0–100 scale), but when the variable is dichotomized, the rate of adequately informed women (score $\geq$ 60) is 35% lower than that of men. A patient's good, objective knowledge of the disease and treatments is a fundamental requirement for any approach to medical decision-making that aims to be informed or shared. Although a knowledge-based decision does not necessarily have to be "better" or wiser than a decision just based on the trust in the professionals' expertize, it can only be autonomous and concordant with the patient's preferences if they have adequate knowledge of treatment characteristics and potential outcomes.

The difference observed in our data is not explained by differences in education or disease severity. Assuming the non-spurious nature of this result, one possible explanation is that women are less interested in being informed or actively participating in the decision-making process. In OA, research on information needs and participation preferences has been mostly qualitative and has not investigated gender differences [33]. Two recent studies, one with rehabilitation patients (two-thirds orthopedic, although the specific disease is not reported) and the other with non-OA orthopedic surgery patients, did not find significant differences in participation preferences [34,35]. Nor was gender a significant predictor of elderly patients' preference for involvement in the decision about taking analgesics for acute musculoskeletal pain [36]. In rheumatoid arthritis, the results available have shown a greater desire for information and decision involvement in women [37]. Nor does the research support that women engage less than men in seeking out health information from sources other than their health provider, such as the Internet or friends; in fact, it is quite the contrary [38–40]. Therefore, the observed gap could be explained, at least to some extent, by unconscious gender biases in the provision of information and/or the promotion of shared decision-making by health professionals. In a study with standardized OA patients (thus controlling for individual preferences), Borkhoff et al. (2013) observed that physicians implemented shared decision-making elements to a lesser extent and displayed worse communication skills when the patient was a woman [24]. Experimental studies have shown that, compared to men, women's pain is underestimated by health care providers [41] and lay people [42] and that this underestimation is related to gender stereotypes about pain expression [42]. Participants also judged women as relatively more likely to benefit from psychotherapy instead of medication [41,42]. In other health conditions, it has been observed that women need to report higher pain levels than male patients to make healthcare professionals document their symptom [43], and that physicians tend to inquire about them less frequently [44]. In our study, this interpretation is supported by the significantly worse result for women in satisfaction with the decision process; however, this variable was not significantly related to objective knowledge. Another explanation could be that the provision of information is adequate but there are gender differences in other aspects of physicians' communication, such as affective ones [45,46], that could negatively affect women's information recall. Future studies should include the appropriate variables to answer these questions (e.g., information needs and sources, verbal and non-verbal interaction between patient and doctor, trust in the doctor).

The analysis of gender-specific predictors of the dependent variables yielded few significant results, although these analyses have low statistical power and definitive conclusions cannot be drawn. The importance attributed to a rapid and durable recovery was related to more satisfaction with the decision-making process in men but not in women. The same occurred with the association between the importance attributed to avoiding adverse effects and the preference for TKR; in men, the more importance given to avoiding adverse effects, the more likely they are to prefer surgery. This could be related to different beliefs or expectations about adverse effects of conservative treatment and complications of TKR [23,47].

In women, greater importance attributed to the time needed to experience relief significantly reduced the odds of surgery, whereas in men the odds were 78% higher (although non-significant, probably due to the small sample size). This suggests that women may be concerned about interrupting their daily activities due to the recovery time needed

after TKR, independently from their functional status. This is in line with previous studies showing that women, compared with men, are more concerned about the interference that surgery and the recovery period could have on their caregiving roles [47–50]. In Spain, although gender disparities have been reduced over the past decades, women still spend more time than men performing unpaid work (i.e., housework, care of children, elderly and people with disabilities), and this difference is more pronounced in an older population such as knee OA patients [51]. This population still has a low education level on average, and most women have always been exclusively responsible for housework, whereas many men are retired and have less time restrictions. Lastly, poorer quality of life was a stronger predictor of TKR uptake after 6 months in men than in women. Although the interaction did not reach statistical significance ($p = 0.087$), the result is in line with the hypothesis that in women the decision to undergo surgery depends less exclusively on health status. Future studies should also include OA-specific quality of life measures.

4.1.1. Limitations

This study is a secondary and exploratory analysis and therefore it has many limitations. The main one is the limited sample size, especially in the case of men. This results in low statistical power, principally for the interaction analyses in the regression models. Along with the fact that most patients were treated by male professionals, the small sample size also precludes the analysis of the interaction between the gender of patients and professionals. The sample included mostly individuals with a low education level; although it seems representative of the OA population (i.e., middle aged and elderly) in a region with a low socioeconomic level, the results should not be generalized to more educated populations. The knowledge questionnaire is short, and future studies should assess more specific aspects of both conservative and surgical OA treatment options. The follow up was not long enough to observe high TKR rates since waiting lists are long in our region, and this could affect to some extent the analysis of TKR uptake predictors. We did not assess relevant variables that could influence the decision-making process, such as information needs, trust in the physician or patients' affective variables (e.g., anxiety, depression, stress).

4.2. Conclusion

The conclusions are conditioned by the exploratory nature of the study and its limited internal validity. Women show a lower level of knowledge of OA/TKR and satisfaction with the decision-making process, and their concerns about the recovery time needed after surgery could be a barrier to undergoing TKR. Although explanations based on potential gender differences in information needs and preferences for involvement cannot currently be ruled out, the results may indicate a gender bias in the provision of information and/or promotion of shared decision-making by health professionals. Studies with adequate statistical power and more refined measurement instruments are required to confirm whether this bias actually exists in this population.

4.3. Practice implications

It is important that professionals systematically apply a shared decision-making approach adapted to the patients' need for information and their desired level of involvement. Patients' objective knowledge must be adequately checked to avoid misunderstandings and false beliefs about medical procedures. The standardized use of tools like patient decision aids could help to reduce the variability of clinical practice and improve the quality of patient-physician interaction and the provision of information, thus avoiding potential biases based on gender or other patient characteristics. In the case of older women facing TKR, the involvement of their families in the decision-making process could help them to plan their daily activities after surgery.

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Data statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest

The authors disclose no conflicts of interest.

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