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Treatment Beliefs Underlying Intended Treatment Choices in Knee and Hip Osteoarthritis

Ellen M. H. Selten[1] · Rinie Geenen[2] · Henk J. Schers[3] · Frank H. J. van den Hoogen[1,4] · Roelien G. van der Meulen-Dilling[5] · Willemijn H. van der Laan[6] · Marc W. Nijhof[7] · Cornelia H. M. van den Ende[1] · Johanna E. Vriezekolk[1]

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Abstract
Purpose Patients' beliefs about treatment modalities for knee and hip osteoarthritis (OA) will underlie their treatment choices. Based on the Theory of Planned Behavior, it is hypothesized that patients' beliefs, subjective norm, and perceived behavioral control guide their treatment choices. Also, symptom severity and one's inherent tendency to approach or avoid situations are assumed to play a role. The objective of this study was to test whether these variables were associated with intended treatment choices in knee and hip OA.
Methods Patients with knee and hip OA were randomly selected from hospital patient records. They completed the Treatment beliefs in OsteoArthritis questionnaire to assess positive and negative treatment beliefs regarding five treatment modalities: physical activities, pain medication, physiotherapy, injections, and arthroplasty. Other measures were intention, subjective norm, perceived behavioral control (ASES), symptom severity (WOMAC), and the person's general tendency to approach or avoid situations (RR/BIS scales). Three models were tested using path analyses to examine the hypothesized associations.
Results Participants were 289 patients. Positive treatment beliefs and subjective norm were consistently associated with intended treatment choice across all treatment modalities. Negative treatment beliefs were associated with intended treatment choices for pain medication and arthroplasty. Other associations were not significant.
Conclusions This is the first study testing the Theory of Planned Behavior in the context of treatment choices in OA. Findings suggest that foremost positive beliefs about treatment modalities and the norms of one's social environment guide a specific treatment choice. Unexpectedly, symptom severity was not related to intended treatment choices.

Keywords Beliefs · Decision-making · Hip · Knee · Osteoarthritis · Treatment

✉ Ellen M. H. Selten
e.selten@maartenskliniek.nl

[1] Department of Rheumatology, Sint Maartenskliniek, Hengstdal 3, Ubbergen, 6574 NA Nijmegen, The Netherlands

[2] Department of Psychology, Utrecht University, Heidelberglaan 1, 3584 CS Utrecht, The Netherlands

[3] Department of Primary and Community Care, Radboud University Medical Center, Geert Grooteplein Zuid 10, 6525 GA Nijmegen, The Netherlands

[4] Department of Rheumatology, Radboud University Medical Center, Geert Grooteplein Zuid 10, 6525 GA Nijmegen, The Netherlands

[5] Physical Therapy and Manual Therapy Partnership Velperweg, Velperweg 71, 6824 HH Arnhem, The Netherlands

[6] Department of Rheumatology, Sint Maartenskliniek, Polanerbaan 2, 3447 GN Woerden, The Netherlands

[7] Department of Orthopedics, Sint Maartenskliniek, Hengstdal 3, Ubbergen, 6574 NA Nijmegen, The Netherlands

Introduction

In clinical practice of knee and hip osteoarthritis (OA), several available conservative and surgical treatment options are considered by the patient and healthcare provider. Conservative treatment options are physical therapy, pharmacological treatment, and education about physical exercise, pacing of activities, weight reduction, and other means to unload the damaged joint(s) [1–3]. Although recommendations specify that patients need to receive conservative treatment options before being referred to surgical treatment [1, 3], the use of

conservative treatment options is suboptimal in the management of knee and hip OA [4–6]. To optimize the timing and alignment of treatment, insight into potential determinants of the choice for treatment modalities is important.

Patients have an active role in management of OA, and patients' beliefs about various treatment modalities will—among other reasons—affect their treatment choices. This assumption is supported by health psychology theories, such as the Theory of Planned Behavior (TPB) [7] and qualitative studies indicating that patients' beliefs about the effectiveness and barriers of treatment influence their treatment choice [8–10]. The TPB assumes that an individual's behavioral intentions and behaviors are shaped by their attitude towards behavior, subjective norm (evaluation of the behavior by close others), and perceived behavioral control [7]. Specifically, the more favorable the attitude towards a behavior is, the stronger the individual's intention is to perform the behavior [11]. Many studies have provided empirical support for the TPB regarding health-related behaviors [12], such as exercise, alcohol consumption, dietary behavior [13], and treatment adherence [14]. This study examines treatment beliefs as reflection of attitudes. Whether one's treatment beliefs are associated with treatment choices in knee and hip OA is unknown. To date, no studies have tested the TPB in the context of treatment decision-making in OA. A better understanding of beliefs that facilitate or hamper treatment choices can help healthcare providers to guide patients in treatment decision-making, and when necessary, to overcome beliefs that act as a barrier for the use of conservative treatment.

Recently, the Treatment beliefs in OsteoArthritis (TOA) questionnaire was developed. This self-report instrument assesses patients' positive and negative beliefs about five treatment modalities for knee or hip OA: physical activities, pain medication, physiotherapy, injections, and arthroplasty (surgical treatment). Informed by ample empirical support that attitude, subjective norm, and perceived behavioral control affect the intended behavior, the current study investigates the hypotheses that positive treatment beliefs and subjective norm are associated with higher intended treatment choices and that negative treatment beliefs are associated with lower intended treatment choices in knee and hip OA. Also, based on the TPB and qualitative research indicating that the opinion of close others about the treatment matters in treatment decision-making in osteoarthritis [8, 9], this study hypothesizes that subjective norm (how close others evaluate the treatment) influences patients' intention to choose a treatment. There are some indications that perceived ability to manage different aspects of a chronic disease, such as pain and physical limitations, is associated with lower levels of health care utilization [15]. Therefore, it is hypothesized that a higher perceived behavioral control over pain is associated with a lower intention to choose any treatment modality.

Two additional factors to the three factors of the TPB are assumed to influence treatment choices. One factor is the severity of the OA as reflected in patient's level of pain, stiffness, and activity limitations. Patients with a higher symptom severity have a higher healthcare use [16, 17], suggesting that a higher severity of OA is associated with a higher tendency to choose any kind of treatment. Also, the person's general tendency to be motivated by positive (approach) or negative (avoidance) tendencies towards any situation may influence their positive and negative beliefs about treatment modalities. Gray's reinforcement sensitivity theory [18, 19] postulates that people differ in their general tendencies to approach or avoid situations. Some people's motivation will be predominantly determined by the anticipated positive consequences of the situation, while others' motivation will be primarily determined by the tendency to avoid negative consequences. Therefore, personality traits reflecting a general approach tendency are hypothesized to be associated with positive beliefs about OA treatment modalities, while personality traits reflecting a general avoidance tendency are hypothesized to be associated with negative beliefs about OA treatment modalities.

The aim of this study was to examine three conceptual models of determinants underlying treatment choices in knee and hip OA ((Fig. 1), model 1) whether treatment beliefs are associated with intended treatment choice ((the base model), model 2) whether treatment beliefs, subjective norm, and perceived behavioral control are associated with intended treatment choice ((the TPB model), model 3) whether over and above the TPB model, perceived symptom severity is associated with intended treatment choice, and whether patients' general tendencies to approach or avoid situations are associated with treatment beliefs (the extended TPB model).

Method

A cross-sectional design was used to examine whether treatment beliefs and other potential determinants were associated with intended treatment choices in patients with knee and hip OA. Preparatory analyses (confirmatory factor analyses) were conducted to test the structural validity of the TOA questionnaire.

Data Collection

Participants

Patients who were clinically diagnosed by their physician according to the American College of Rheumatology classification criteria for knee or hip OA were included in this study [20, 21]. Eligible patients aged >18 years were recruited via the departments of orthopedics and rheumatology at Sint Maartenskliniek, The Netherlands. From patients who visited these departments in 2015 or 2016, 700 were randomly

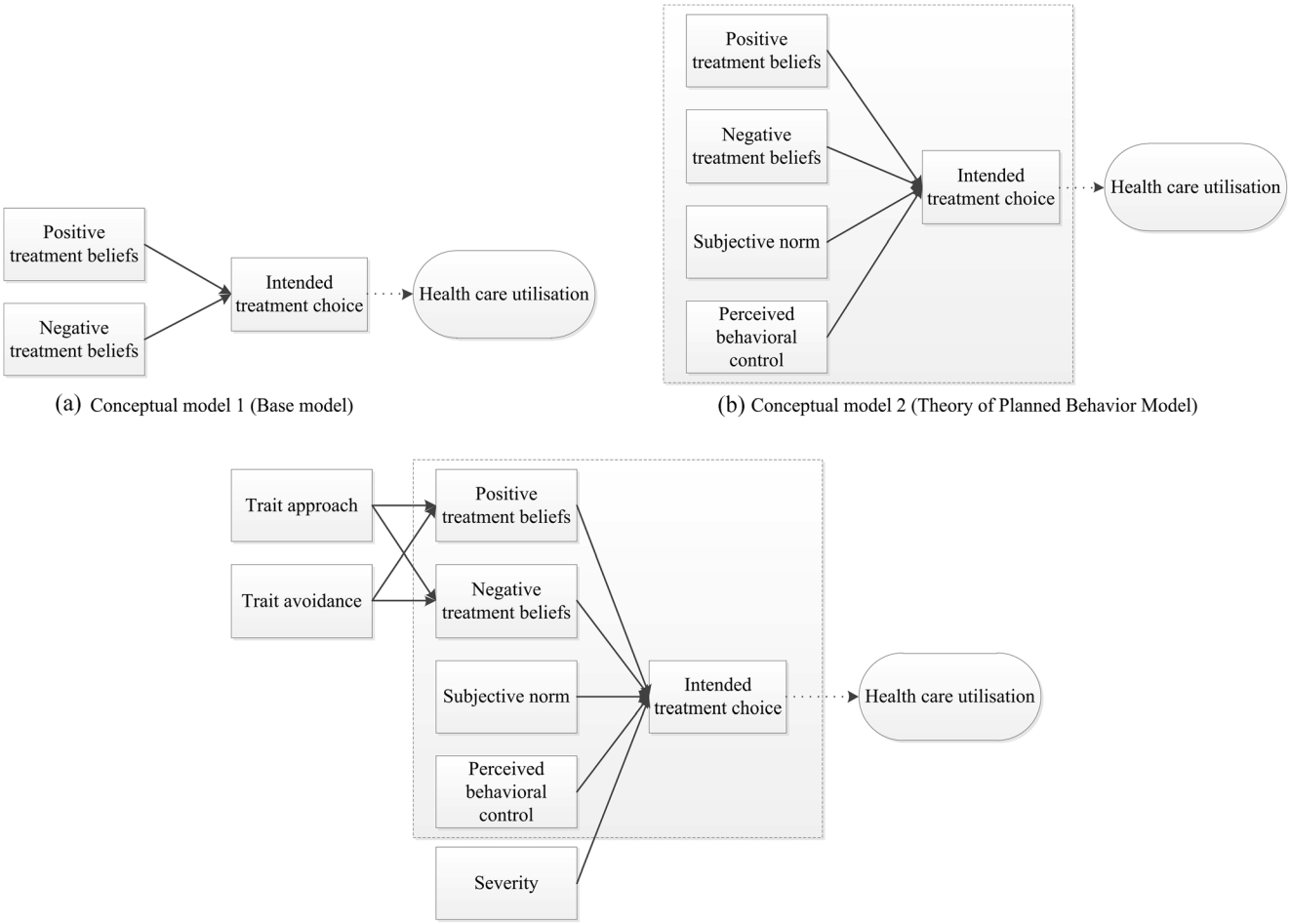

Fig. 1 Three conceptual models of determinants underlying intended treatment choices in knee and hip osteoarthritis

selected from the electronic patient record system and received an invitation letter, informed consent form, and a hard-copy questionnaire booklet via postal mail. If applicable, patients received a reminder after 2 weeks. The medical ethical board of the Radboud University Medical Center, Nijmegen, concluded that the Dutch Medical Research Involving Human Subjects Act did not apply to this study (2016–2605).

Measures

Patients filled out questionnaires measuring demographic and clinical variables, intended treatment choices, treatment beliefs, subjective norm, perceived behavioral control, perceived symptom severity, and personality traits.

Intended Treatment Choice The dependent variable intended treatment choice was measured with a single question per treatment modality (physical activity, pain medication, physiotherapy, injections, and arthroplasty), e.g., "In the future, the probability that I choose *pain medication* to diminish my OA symptoms is …". This question was not previously validated in the context of OA. The response format was a 7-point Likert scale ("very unlikely" to "very likely"). Although the difference between 5-point and 7-point Likert scales is generally small [22], we chose a 7-point instead of 5-point Likert scale for the dependent variable, because it was a new scale of which the score distribution was unknown and we wanted to cover the whole range from very unlikely to very likely that was anticipated to be present in this group of patients with osteoarthritis.

Treatment Beliefs Positive and negative treatment beliefs regarding five treatment modalities were measured with the TOA questionnaire (e.g., "My quality of life improves through using pain medication", "I think physical therapy causes pain"). The questionnaire includes a total of 60 items measured on a 5-point Likert scale ("disagree" to "agree") and showed good internal consistency and test-retest reliability (Selten, unpublished). In this study, Cronbach's alpha ranged from .84 to .90 for positive treatment beliefs and from .66 to .79 for negative treatment beliefs (Table 3).

Subjective Norm Subjective norm (i.e., how close others evaluate the treatment) was measured by two questions, entailing what important others think the respondent should choose and what important others would choose themselves [23, 24]. The questions were as follows: (1) This important person thinks that I should choose (*treatment modality*) to diminish my OA symptoms; (2) This important person would choose (*treatment modality*) himself to diminish his OA symptoms. These questions were not previously validated in the context of treatment choices in OA. A 5-point Likert scale from "disagree" to "agree" was used. A sum score was calculated for each treatment modality [24].

Perceived Behavioral Control Perceived behavioral control was measured with the Dutch version [25] of the subscale "pain" of the Arthritis Self-Efficacy Scale [26]. This scale measured patients' perceived ability to cope with pain on a 5-point Likert scale from "completely agree" to "completely disagree". The Arthritis Self-Efficacy Scale was shown to be valid and reliable in OA study populations [27, 28]. In the current study, Cronbach's alpha for the subscale "pain" of the Arthritis Self-Efficacy Scale was .77.

Severity Severity of OA was measured with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [29], a frequently used and valid self-report instrument in knee and hip OA [30]. The questionnaire measures pain, stiffness, and physical functioning on a 5-point Likert scale ("none" to "very much"). A standardized sum score was calculated, a higher score reflects higher disability. In this study, Cronbach's alpha for this score was .77.

Personality Traits The general tendencies to approach or avoid situations were measured by the Reward Responsiveness (RR) and Behavior Inhibition System (BIS) scale [31]. These scales measure two mechanisms that may control behavior: RR reflects trait approach behavior, and BIS reflects trait avoidance behavior. The RR and BIS scales were not validated in an OA population but in student populations [18, 31, 32]. The item-response format consists of a 4-point Likert scale ("completely agree" to "completely disagree"). In this study, Cronbach's alpha for the RR scale was .83 and for the BIS scale .73.

Data Analysis

Preparatory Analyses: Structural Validity

Confirmatory principal axis factor analysis (CFA) was used to examine the structural validity of the TOA questionnaire. Based on a previous exploratory factor analysis (Selten, unpublished), it was tested whether each treatment modality of the TOA questionnaire comprised two latent constructs: "positive treatment beliefs" and "negative treatment beliefs". With small samples sizes, an adequate model fit is reflected by an insignificant chi-squared test result ($p > 0.05$). Because the chi-squared value is sensitive to sample size, additional goodness of fit indicators were used to test an adequate model fit: a Root Mean Square Error of Approximation (RSMEA) between 0.05 and 0.08, a Standardized Root Mean Square Residual (SRMR) <0.08, and a Comparative Fit Index (CFI) >0.90 [33, 34]. Modification Indices were evaluated to see whether changes to the model would lead to a better model fit. Cronbach's alphas were calculated for each subscale (latent construct) to assess the internal consistency, where a Cronbach's alpha >0.70 was considered good [35, 36].

Model Testing

Path analysis was used to test the three conceptual models of relationships between potential determinants and intended treatment choices [33]. Path analysis is an extension of multiple regression analysis. It examines a priori formulated conceptual models by testing if variables are significantly related [37] and is recommended for testing relationships among constructs in health behavior [13]. Statistical assumptions of normality, linearity, homoscedasticity, and multicollinearity were investigated. The three conceptual models (Fig. 1) were tested for each of the five treatment modalities separately with maximum likelihood estimation. Standardized path coefficients and standard errors were calculated to determine if and how the variables were significantly related. For each model the *R*-squared value for each of the subscales was computed.

Sample Size

For conducting CFA, a minimum of 4–10 cases per item is required [35]. The treatment modality with most items on the TOA questionnaire was 14 items, indicating that 140 respondents were required. For path analysis, 10 respondents per parameter are required. In the most extensive conceptual model (model 3), each of the 8 observed variables (depicted in ovals) had 3 parameters (a path coefficient, variance, and disturbance term), indicating a sample size of at least 240 respondents.

Missing Values

For the independent variables treatment beliefs, perceived behavioral control and personality traits, missing items were substituted by the mean score on that subscale when the total number of missing items on the subscale was <25%. When a respondent had >25% missing items on a subscale, these were treated as missing values in analyses. Missing values did not exceed 5% for these variables. For the dependent variable "intention", missing values ranged from 5.9 to 9.7% and for the independent variable "subjective norm", missing values

ranged from 12.8 to 15.9%. Patients with missing values on the dependent variable intended treatment choice were significantly older [$t(284) = -3.57$, $p < .001$] and had a significant lower education level [χ^2 (2, $N = 284$) = 14.22, $p = .001$] compared to patients without missing values on this variable. Patients did not significantly differ on the independent variables, therefore missing data were considered missing at random in path analyses.

Analyses were performed using STATA 13.1. For descriptive statistics, after inspection of score distributions, the response categories 1–7 on intended treatment choices were combined into unlikely (response category 1–2), ambivalent (response category 3–5), and likely (response category 6–7). In path analyses, responses were considered as continuous variables.

Results

Of the 700 invited respondents, 289 filled out the questionnaire (response rate = 41%). Table 1 describes the sociodemographic, clinical, and personal characteristics of the study sample. In Table 2, descriptives of positive treatment beliefs, negative treatment beliefs, subjective norm, and intended treatment choice are presented for each treatment modality.

Preparatory Analyses: Structural Validity

Table 3 presents indicators for structural validity of the TOA questionnaire with several goodness of fit indices. The treatment modalities "physical activities" and "physical therapy" showed adequate goodness of fit indices, while fit indices of the treatment modalities "pain medication", "injections", and "joint replacement surgery" just failed to reach the adequate cut-off of RSMEA, CFI, and SRMR. Following the criteria [35, 36], Cronbach's alpha showed good internal consistency for the subscale positive treatment beliefs and acceptable internal consistency for the subscale negative treatment beliefs. Change of the model guided by modification indices did not significantly increase the model fit. Therefore, the original well-interpretable factors were maintained.

Model Testing

For each of the three conceptual models (Fig. 1), the total explained variance of the model and standardized path coefficients for each variable are presented in Table 4.

Model 1

Positive treatment beliefs were significantly associated with intended treatment choices for all five treatment modalities. Negative treatment beliefs were significantly negatively associated with intended treatment choices for physical activities and pain medication.

Table 1 Characteristics of the study sample ($N = 289$)

Demographic characteristics	
Age (years), *M (SD)*	62.6 (10.7)
Gender (female), *n* (%)	186 (64)
Married or cohabiting, *n* (%)	225 (78)
Currently employed, *n* (%)	102 (36)
Education level, *n* (%)[a]	
Low	79 (28)
Middle	133 (46)
High	75 (26)
Clinical characteristics	
Body Mass Index (BMI) (kg/m^2), *n* (%)	
Normal weight (BMI < 25)	69 (24)
Overweight (BMI 25–30)	139 (49)
Obese (BMI > 30)	77 (27)
Duration of OA symptoms (years), *M (SD)*	
< 1 year	12 (4.2)
1–5 years	106 (36.9)
5–10 years	76 (26.5)
> 10 years	93 (32.4)
Affected joint(s), *n* (%)	
Hip	50 (17)
Knee	149 (52)
Hip and knee	88 (31)
Severity, unstandardized mean *(SD)*, theoretical range	
WOMAC subscale pain	9.6 (4.6), 0–20
WOMAC subscale stiffness	4.7 (2.1), 0–8
WOMAC subscale functioning	32.1 (15.8), 0–68
WOMAC total score	46.5 (21.3), 0–96
Comorbidities, *n* (%)[b]	
No comorbidities	78 (27)
High blood pressure	88 (31)
Cardiovascular disease	31 (11)
Diabetes	27 (9)
Lung disease	23 (8)
Personality and psychological characteristics	
Perceived behavioral control, *M (SD)*, theoretical range	15.9 (4.9), 5–25
Personality traits	
Approach behavior[c], *M (SD)*, theoretical range	14.1 (4.1), 8–32
Avoidance behavior[d], *M (SD)*, theoretical range	15.8 (3.1), 7–28

[a] Low = no education, primary school, lower vocational education; Middle = secondary school, middle vocational education; High = university of applied sciences, university

[b] More than 1 answer possible

[c] Measured with the RR (Reward Responsiveness) Scale

[d] Measured with the BIS (Behavior Inhibition System) Scale

Table 2 Descriptives of the variables treatment beliefs, subjective norm, and intended treatment choice for the five treatment modalities

Variables Treatment modalities	Physical activities	Pain medication	Physical therapy	Injections	Joint replacement surgery
Positive treatment beliefs, *M (SD)*, theoretical range	34.2 (7.4), 5–45	18.4 (5.1), 5–25	21.5 (6.3), 5–30	20.5 (6.2), 5–30	31.4 (6.1), 5–40
Negative treatment beliefs, *M (SD)*, theoretical range	10.7 (4.0), 5–20	24.1 (5.8), 5–35	6.6 (2.9), 5–15	15.8 (4.8), 5–30	22.2 (5.1), 5–30
Subjective norm, *M (SD)*, theoretical range	4.1 (0.9), 1–5	3.7 (1.0), 1–5	3.9 (1.0), 1–5	3.3 (1.1), 1–5	3.8 (1.1), 1–5
Intended treatment choice					
Unlikely (%)	6	22	12	29	15
Ambivalent (%)	27	25	36	33	25
Likely (%)	67	53	52	38	60

High scores on treatment beliefs represent strong positive or negative beliefs about the efficacy, risks, and concerns of a treatment modality. High scores on subjective norm represent a strong perceived influence of close others on the treatment choice. High scores on intended treatment choice represent a high intention to choose that treatment modality. The response categories 1–7 on intended treatment choices were combined into unlikely (response category 1–2), ambivalent (response category 3–5), and likely (response category 6–7)

Model 2

For all five treatment modalities, this model was most parsimonious; it had the highest explained variance of the three conceptual models with as few variables as possible (Table 4). In particular, subjective norm and positive treatment beliefs were significantly associated with intended treatment choices in all five treatment modalities. Perceived behavioral control was only associated with the intention to choose pain medication. Negative treatment beliefs were negatively associated with the intention to choose pain medication and joint replacement surgery. In contrast to model 1, negative treatment beliefs were no longer significantly associated with the intention to not choose physical activities.

Model 3

Adding the variables severity and personality traits (approach and avoidance) to the model did lower the total explained variance of the model. Perceived severity of OA symptoms was associated with the intention to choose an injection, but no association was found between severity and intention on the other four treatment modalities. Except for the modality physical therapy where an avoidant approach was negatively associated with negative treatment beliefs, no associations between the two personality variables and treatment beliefs were found.

Post hoc Analyses

Because, unexpectedly, no relationship was found between symptom severity and intended treatment choices for most treatment modalities, two post hoc analyses were conducted. In the first, results of path analysis were compared between a group of patients with less severe OA symptoms (WOMAC <39 [38], $n = 79$) and a group of patients with more severe OA symptoms (WOMAC ≥39 [38], $n = 198$). In none of the subgroups a significant association between symptom severity and intention to choose one of the treatment modalities was found. In a second post hoc path analysis, the association between symptom severity and treatment beliefs was examined. Small to moderate significant associations were found between symptom severity and both positive ($\beta = -.37$) and negative ($\beta = .39$) treatment beliefs about physical activities, between

Table 3 Fit indices and Cronbach's alpha across five treatment modalities after confirmatory factor analysis

Treatment modality	Chi-square statistic		Goodness of fit indices			Cronbach's alpha	
	χ^2 (df)	*p*	RSMEA	CFI	SRMR	Positive treatment beliefs	Negative treatment beliefs
Physical activities	177.43 (64)	<.001	0.08	0.91	0.06	0.86	0.73
Pain medication	245.24 (53)	<.001	0.12	0.86	0.09	0.87	0.79
Physical therapy	67.87 (26)	<.001	0.08	0.96	0.05	0.90	0.66
Injections	180.96 (53)	<.001	0.10	0.90	0.09	0.89	0.69
Joint replacement surgery	455.55 (76)	<.001	0.14	0.74	0.10	0.84	0.76

Adequate model fit when a low and insignificant chi-square value (χ^2), a Root Mean Square Error of Approximation (RSMEA) between 0.05 and 0.08, a Comparative Fit Index (CFI) >0.90, and a Standardized Root Mean Square Residual (SRMR) <0.08

Table 4 Standardized path coefficients with 95% confidence intervals and percentages of explained variance of the three models for each of the 5 treatment modalities

Model	Path	β [95% CI]				
		Physical activities	Pain medication	Physical therapy	Injections	Joint replacement surgery
1	Positive treatment beliefs → Intention	.62* [.54, .70]	.52* [.44, .60]	.61* [.54, .68]	.55* [.47, .63]	.41* [.32, .51]
	Negative treatment beliefs → Intention	−.11* [−.21, −.01]	−.14* [−.24, −.04]	−.08 [−.18, .02]	−.08 [−.18, .02]	−.10 [−.21, .01]
	Explained variance (R^2)	45%	31%	41%	31%	19%
2	Positive treatment beliefs → Intention	.58* [.48, .68]	.39* [.28, .49]	.41* [.31, .52]	.30* [.20, .41]	.21* [.09, .32]
	Negative treatment beliefs → Intention	−.03 [−.14, .08]	−.15* [−.25, −.05]	−.06 [−.16, .04]	−.09 [−.19, .01]	−.11* [−.22, −.01]
	Subjective norm → Intention	.14* [.04, .25]	.29* [.18, .40]	.34* [.23, .45]	.47* [.37, .57]	.42* [.31, .53]
	Perceived behavioral control → Intention	−.01 [−.11, .09]	.13* [.03, .23]	−.04 [−.14, .06]	.02 [−.09, .12]	.02 [−.09, .13]
	Explained variance (R^2)	45%	39%	45%	44%	32%
3	Positive treatment beliefs → Intention	.59* [.49, .70]	.42* [.31, .54]	.47* [.35, .59]	.34* [.23, .46]	.25* [.12, .38]
	Negative treatment beliefs → Intention	−.02 [−.14, .10]	−.17* [−.28, −.06]	−.09 [−.20, .02]	−.10 [−.21, .00]	−.10 [−.21, .01]
	Subjective norm → Intention	.15* [.03, .27]	.30* [.18, 41]	.35* [.22, .47]	.50* [.40, .61]	.42* [.30, .53]
	Perceived behavioral control → Intention	.02 [−.10, .15]	.08 [−.05, .22]	−.10 [−.23, .03]	−.09 [−.22, .04]	−.01 [−.15, .13]
	Severity → Intention	−.08 [−.22, .05]	.08 [−.05, .21]	.12 [−.01, .25]	.18* [.06, .31]	.06 [−.08, .20]
	Approach → Positive treatment beliefs	−.10 [−.24, .04]	.05 [−.09, .18]	.04 [−.10, .17]	−.08 [−.22, .06]	−.11 [−.24, .03]
	Avoidance → Positive treatment beliefs	−.03 [−.11, .16]	−.06 [−.20, .07]	−.03 [−.16, .11]	−.04 [−.18, .10]	−.01 [−.15, .12]
	Approach → Negative treatment beliefs	.07 [.06, .21]	.05 [−.08, .19]	.11 [−.03, .24]	.04 [−.10, .18]	.08 [−.06, .21]
	Avoidance → Negative treatment beliefs	−.03 [−.17, .10]	−.08 [−.22, .06]	−.18* [−.31, −.05]	−.04 [−.18, .10]	−.06 [−.20, .08]
	Explained variance (R^2)	6%	15%	19%	32%	21%

*significant path ($p < .05$)

symptom severity and negative treatment beliefs about physical therapy ($\beta = .19$), and between symptom severity and positive treatment beliefs ($\beta = -.15$) about injections.

Discussion

Guided by the TPB, the associations between treatment beliefs and intended treatment choices with regard to physical activity, pain medication, physical therapy, injection, and joint replacement surgery were examined in patients with knee or hip OA. Especially patients' positive beliefs about the treatments and the opinion of important others about treatment modalities (subjective norm) were associated with intended treatment choices. Negative beliefs were associated with intended treatment choices in some modalities. No or only weak associations between perceived behavioral control, perceived symptom severity, or personality traits with intended treatment choice were found.

A treatment choice will generally depend on weighing both positive and negative consequences. In our study, for all treatment modalities, positive beliefs about a treatment modality were related to the intention to choose this treatment modality. In contrast, negative treatment beliefs were only associated with the tendency to not use pain medication and to not choose joint replacement surgery (model 2). The findings are in line with results about medication use [39, 40] and doing physical activities [41, 42]. Results of this study indicate that emphasizing positive aspects of (conservative) treatment options and the potential negative consequences of joint replacement may facilitate the use of conservative treatment modalities before being referred to surgical treatment, which is in agreement with current recommendations about management of OA [1, 3].

Subjective norm was consistently associated with intended treatment choices across all treatment modalities. This means that patients value the opinion of important others when faced with a treatment decision. Subjective norm was especially strongly associated with intended treatment choices for the more invasive modalities (injections and joint replacement surgery). Some other studies found only a small association between subjective norm and behavior, which might be due to the type of measurement, operationalization, or behavior examined [11, 13, 14]. In line with previous qualitative research among OA patients [8, 9], the findings of this study suggest that the opinion of close others (e.g., friends and family) should be taken into account when exploring invasive treatment options.

Contrary to our hypothesis and other studies, perceived behavioral control of pain was not associated with intended treatment choices, except for the intention to use pain medication that was positively related to perceived behavioral control. Tentatively, our findings may suggest that the relationship between the ability to control pain and healthcare use is not

mediated by the intention to choose a treatment. Ajzen [7] argued that when perceived behavioral control approximated actual control, it should predict behavior without being mediated by the intention to perform the behavior. In this line of reasoning, the perceived ability to control pain may affect healthcare use directly. However, in the current study it was not possible to examine the direct effect of perceived behavioral control on health care utilization.

An unexpected finding was that perceived symptom severity was not related to intended treatment choices, except for the association between symptom severity and intention to choose an injection. Trying to explain this lack of association, two post hoc analyses were conducted. One post hoc analysis indicated an association between symptom severity and treatment beliefs, patients with higher symptom severity had more negative beliefs about treatments that require an active participation (physical activities and physical therapy) and less positive beliefs about the effectiveness and benefits of physical activities and injections. The lack of an association for most treatment modalities suggests that patients' intention to choose a treatment is less motivated by the severity of symptoms than by treatment beliefs of self and close others. However, the association between symptom severity and healthcare utilization was demonstrated in previous studies [16, 43, 44]. Likely severity is an important factor but findings of this study suggest that other factors, especially treatment beliefs and subjective norm, are more important in intended treatment choices. These determinants are therefore a potential means to optimize the use of conservative care in knee and hip OA.

The hypothesis that a person's general tendency to approach or avoid situations would be related to specific positive and negative beliefs regarding treatment modalities was rejected. The only significant (negative) association in the model between behavioral inhibition (avoidance) and negative treatment beliefs was even opposite to the hypothesis based on Gray's reinforcement sensitivity theory [19]. Thus, results of this study indicated that the general tendency of individuals to approach or to avoid situations is not associated with specific treatment beliefs in OA.

This is the first study examining an extensive model of the relationships between treatment beliefs and intended treatment choices in OA. A core role for treatment beliefs as assessed with the TOA questionnaire is suggested. Because for each treatment modality, between 25% and 36% of patients scored ambivalent regarding their intention to choose this treatment (Table 1), presumably this group of patients might be inclined to be supported in medical decision-making by identifying their treatment beliefs. However, future studies are needed to probe the findings with respect to actual treatment choices. Also, the TOA questionnaire could be evaluated in other samples, i.e., primary care or non-Dutch samples and regarding other aspects of validity, especially criterion validity. Some limitations of this study need to be discussed. Path analysis is useful to test conceptual models, but causal relationships cannot be determined based on the cross-sectional data. Although relevant variables were included in the model, there may be other relevant variables influencing treatment choices that were not taken into account in this study, such as previous treatment experiences. Another limitation was the relatively high percentage of missing values for the measures subjective norm (13–16%) and intention for treatment choice (6–10%). Presumably, the number of missing values did not affect the results, as post-hoc analyses showed that patients with missing values on intended treatment choice did not significantly differ on the other study variables. For measuring subjective norm and intention, no validated measures are available in the literature [11]. To increase the reliability of the measurement of subjective norm, two questions were used [24]. In this study, intention was measured with a single question. With multiple questions, reliability could have been tested [24].

To our knowledge, this is the first study to find empirical support for the relationship between treatment beliefs as measured with the TOA questionnaire and intended treatment choices. The findings suggest that particularly positive beliefs about treatment modalities and the opinion of close others guide a specific treatment choice for knee and hip OA.

Compliance with Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent All participants provided informed consent.

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