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Patient preferences for psoriasis treatments: impact of treatment experience

M.-L. Schaarschmidt,[†,1] N. Umar,[‡,1] A. Schmieder,[†] D.D. Terris,[‡,§] M. Goebeler,[†,¶] S. Goerdt,[†] W.K. Peitsch[†,*]

[†]Department of Dermatology, University Medical Center Mannheim and [‡]Medical Faculty Mannheim, Mannheim Institute of Public Health, Social and Preventive Medicine, Heidelberg University, Mannheim, Germany
[§]Department of Health Policy and Management, College of Public Health, University of Georgia, Athens, GA, USA
[¶]Department of Dermatology, University of Würzburg, Würzburg, Germany
*Correspondence: W.K. Peitsch. E-mail: wiebke.ludwig@umm.de

Abstract

Background Patient preferences for psoriasis treatments can impact treatment satisfaction and adherence and may therefore influence clinical outcome.

Objective To assess the impact of treatment experience (satisfaction with current treatment, number of prior visits, disease duration, number of preceding therapies and currently prescribed treatment modalities) on treatment preferences.

Methods A computer-based conjoint analysis experiment was conducted to analyse preferences of patients with moderate or severe psoriasis (n = 163) treated at a German University Medical Center for outcome (probability, magnitude and duration of benefit; probability, severity and reversibility of side effects) and process attributes (location, frequency, duration, delivery method, individual cost) of psoriasis treatments. Relative importance scores (RIS) were calculated for each attribute and compared using ANOVA, *post hoc* test and multivariate regression analysis.

Results Participants with longer disease duration attached significantly greater importance to duration of benefit (β = 0.206, P = 0.018), whereas participants on oral therapy were more concerned about magnitude of benefit by trend (β = 0.218, P = 0.058). Participants receiving injectables not only set higher value to probability of benefit (RIS = 32.80 vs. 21.89, P = 0.025) but also to treatment location (RIS = 44.74 vs. 23.03, P = 0.011), delivery method (RIS = 43.75 vs. 19.29, P = 0.019), treatment frequency (RIS = 31.24 vs. 16.89, P = 0.005) and duration (RIS = 32.54 vs. 16.57, P = 0.003) when compared with others. Treatment satisfaction was significantly higher in participants on infusions or injections compared with those on phototherapy and mere topical therapy.

Conclusions Treatment preferences may change over time course and with treatment experience. Participants on injectables attach great importance to efficiency and convenience of therapies, and are highly satisfied with their treatment.

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Conflict of interest

Ms Schaarschmidt received financial support for participation in conferences from Abbott. Dr Schmieder conducted clinical trials for Abbott and Wyeth/Pfizer and received support for conferences from Wyeth/Pfizer. Prof. Goebeler served as investigator for Abbott and Wyeth/Pfizer; gave presentations for Abbott, LEO Pharma, Merck Serono and Wyeth/Pfizer, and received support for conferences from Abbott, Janssen-Cilag, LEO Pharma, Merck Serono, MSD and Wyeth/Pfizer. Prof. Goerdt was supported for conferences from Abbott, Janssen-Cilag, LEO Pharma, Merck Serono, MSD and Wyeth/Pfizer. Dr Peitsch served as investigator for Abbott and Wyeth/Pfizer; obtained lecture fees from Abbott and Janssen-Cilag and received support for conferences from Abbott, Janssen-Cilag, LEO Pharma, MSD and Wyeth/Pfizer. Mr Umar and Dr Terris have no conflict of interest to declare. The study presented here was not supported by pharmaceutical companies.

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[1]Both authors contributed equally.

Introduction

Several treatment options are available for moderate and severe psoriasis, including a variety of topical therapies, phototherapy, oral antipsoriatic medications and biologicals. To find an efficient therapy with minimal side effects at reasonable costs, physicians often use a stepwise approach, starting with topical therapy and phototherapy and escalating first to oral antipsoriatic medications (methotrexate, fumaric acids, acitretin or cyclosporine) and then biologicals if preceding approaches were ineffective or not well tolerated.[1] However, recommended treatments may not fit well with patients' preferences and individual needs. If multiple treatments are applied before an effective, patient-acceptable therapy is identified, patients may become frustrated. Indeed, levels of dissatisfaction[2–8] and non-adherence to prescribed treatments are high among patients with psoriasis, reaching up to 40%.[9–12] Treatment satisfaction is largely dependent not only on therapeutic success and side effects but also on the process attributes associated with recommended treatments.[4,5] Therefore, assessing patient preferences for psoriasis treatments and integrating these preferences into shared decision-making may prove essential in improving treatment satisfaction, adherence and clinical outcome.[13,14]

Health state utilities in psoriasis have been assessed with visual analogue scales, time trade-off, willingness to pay and standard gamble methods.[15–18] Moreover, we and others have recently used conjoint analysis (CA) to investigate patient preferences for psoriasis treatments based on treatment attributes.[19–22] In our previous conjoint analyses, we showed that attributes associated with treatment process, in particular, treatment location and delivery method, can outweigh outcome attributes, and that participants were willing to accept side effects to receive an efficient, but also convenient treatment that may be more compatible with their personal and professional life.[20] Participants' preferences were also found to depend on socio-demographic and socio-economic characteristics (e.g., age and income)[20] and on concomitant diseases (e.g., psoriatic arthritis, cardiovascular disease and depression).[21]

Using the same patient cohort and methodology as in our previous studies,[20,21] we investigated the impact of treatment experience on participants' current treatment preferences. We hypothesized that treatment preferences will be significantly influenced by disease duration and by multiple components of prior treatment experience, including satisfaction with current treatment, the number of prior visits to our department, the number of preceding therapies and the currently prescribed treatment modalities.

Materials and methods

Study participants

Patients with moderate or severe psoriasis treated at the Department of Dermatology at the University Medical Center Mannheim, Germany, as outpatients between December 2009 and September 2010 were recruited for study participation. Inclusion criteria were age ≥ 18 years and moderate or severe psoriasis according to the criteria of the Committee for Medicinal Products for Human Use[23] (for details, see[21]). Furthermore, all patients currently treated with systemic antipsoriatic medication were eligible, as they were assumed to suffer from moderate to severe psoriasis. The study was performed according to the principles of the Declaration of Helsinki and approved by the Ethics Committee of the Medical Faculty Mannheim.

Data collection

After providing written informed consent, participants were asked to complete a computer-based survey containing CA exercises while waiting for their dermatologist appointment. Generation of the CA exercises and the method for data collection were previously described in detail.[20] Briefly, currently available treatment options for psoriasis were decomposed into generalized outcome (probability, magnitude and duration of benefit; probability, severity and reversibility of side effects) and process attributes (treatment location, frequency, duration, delivery method and cost for the individual) and attribute levels (Table 1). Theoretical treatment options based on random combinations of the identified attributes and levels were created using commercially available software (http://www.sawtoothsoftware.com). Preferences for treatment attributes were collected by repetitively asking participants to choose their preferred option among pairs of theoretical treatment options (for examples, see[20]). To avoid information overload, attributes were separated into two groups (for details, see[20]). Cost was part of both groups to test for internal consistency and to allow comparison between groups. Twelve pairs of scenarios of each group were presented to each participant.

The computer-based survey also included questions on gender (male/female), age (in years), disease duration (≤ 1 year, 2–10 years, 11–20 years, ≥ 20 years), prior visits to our department (yes/no; yes = repeated visit, no = first visit), number of preceding therapies (≤ 3 or >3) and currently prescribed treatment modalities (topical therapy yes/no, phototherapy yes/no, tablets yes/no, injections yes/no, infusions yes/no, with more than one modality possible) and incorporated the Treatment Satisfaction Questionnaire for Medication (TSQM)[24] and Dermatology Life Quality Index (DLQI).[25] The Psoriasis Area and Severity Index (PASI)[26] for each participant was determined by two of the investigators (either MS or AS). Current treatments were recorded in interviews and abstracted from participants' medical records.

Statistical analysis

Relative attribute importance Part-worth utilities for each attribute level were computed using logit regression and scaled to sum to zero within each attribute. Attribute importance was

Table 1 Outcome and process attributes and attribute levels used in the conjoint analysis survey

Treatment attribute	Attribute levels
Outcome attributes and levels	
Probability of benefit I have	**1** Almost a 100% chance of experiencing a significant reduction in my psoriasis
	2 About an 80% chance of experiencing a significant reduction in my psoriasis
	3 About a 60% chance of experiencing a significant reduction in my psoriasis
	4 About a 40% chance of experiencing a significant reduction in my psoriasis
Magnitude of benefit I will likely experience	**1** Almost a 100% reduction in the size of my psoriasis
	2 About a 75% reduction in the size of my psoriasis
	3 About a 50% reduction in the size of my psoriasis
	4 About a 25% reduction in the size of my psoriasis
Duration of benefit The improvement in my psoriasis will last	**1** For 1 year or more after completing all of my treatments
	2 For 6–8 months after completing all of my treatments
	3 For 3–5 months after completing all of my treatments
	4 For 2 weeks after completing all of my treatments
Probability of side effects There is	**1** Almost a 100% chance that I will experience side effects from the treatment
	2 About a 50% chance that I will experience side effects from the treatment
	3 About a 10% chance that I will experience side effects from the treatment
	4 Less than 1% chance that I will experience side effects from the treatment
Reversibility of side effects If side effects occur, there is	**1** Almost a 100% chance that I will completely recover once my treatments are stopped
	2 About an 80% chance that I will completely recover once my treatments are stopped
	3 About a 60% chance that I will completely recover once my treatments are stopped
	4 About a 40% chance that I will completely recover once my treatments are stopped
Side effect severity I may experience	**1** Temporary, minor discomfort on my skin
	2 Constant, moderate discomfort on my skin
	3 Temporary, moderate side effects that can affect more than my skin
	4 Severe side effects that can affect more than my skin
Process attributes and levels	
Location My treatment will take place	**1** At home
	2 At home with a follow-up at my local doctor's office
	3 At an outpatient clinic
	4 While I stay in the hospital for 3 weeks
Frequency My treatment will occur	**1** Once every 3 months
	2 Once every 2 weeks
	3 Two times each week
	4 Twice daily
Delivery method My treatment will occur by	**1** Applying medication on my skin
	2 Taking tablets
	3 Having an injection/intravenous infusion
	4 Light therapy
Duration Each treatment will	**1** Take 5 min to complete
	2 Take 15–30 min to complete
	3 Take 1 h to complete
	4 Take 2 h to complete
Cost I will have to pay	**1** Nothing to cover the cost of my treatments
	2 An additional 50 € per month to cover the cost of my treatments
	3 An additional 100 € per month to cover the cost of my treatments
	4 An additional 200 € per month to cover the cost of my treatments

determined by calculating the range between the highest and the lowest part-worth utility for each attribute. To allow comparison between different attributes, a relative importance score (RIS) was calculated for each attribute as a percentage by dividing each attribute's range by the sum of all attribute ranges and multiplying by 100 (for further details, see[20]). A RIS for each attribute was individually calculated for each participant, and afterwards averaged across the sample.

Subgroup analysis Subgroup analysis was performed based on treatment satisfaction levels (very satisfied, satisfied, undecided, dissatisfied, very dissatisfied), TSQM scores (0–100, 101–200, 201–300 and 301–400; 0 = maximal dissatisfaction, 400 = maximal satisfaction), prior visits to our department (first vs. repeated visit), disease duration (≤ 1 year, 2–10 years, 11–20 years, ≥ 20 years), number of preceding therapies (≤ 3 or >3) and currently prescribed treatment modalities. Current treatment modalities that were prescribed either as the only treatment or as combinations are shown in Table 2. Most participants (74.8%) received topical therapy, including skin care products, 37.4% in combination with other modalities and 37.4% as the only kind of treatment. The subgroup analysis based on treatment modalities focused on individual modalities and did not include combinations. Participants treated exclusively with topical therapy were included in the category 'topical therapy only'. All participants receiving phototherapy, either exclusively or in combination with another therapy were grouped in the category 'phototherapy', all participants on oral therapy in the category 'oral therapy', all participants on injectable therapies in the category 'injections' and all participants on infusions in the category 'infusions'. Two participants obtained both oral therapy and injections, six participants both oral and phototherapy. Each of these participants was included into two subgroups, i.e., oral therapy and injections or oral therapy and phototherapy. Differences in RIS between subgroups were tested for significance using analysis of variance (ANOVA) for dichotomous variables and *post hoc* tests for variables with ≥ 2 categories.

Multivariate linear regression analysis For the multivariate linear regression analysis, the choice-based CA data from SAWTOOTH software was imported into SPSS statistical software (http://www.spss.com). One model was created for each treatment attribute, using the function $RIS = \beta_0 + \beta_1 sex + \beta_2 age + \beta_3 PASI + \beta_4 DLQI + \beta_5 prior\ visits + \beta_6 TSQM + \beta_7 disease\ duration + \beta_8 topical\ therapy\ only + \beta_9 phototherapy + \beta_{10} oral\ therapy + \beta_{11} injections$, with β_0 being a constant for neglected factors and β_{1-10} coefficients being estimated. β indicates how the value of the RIS changes when one of the independent variables is varied and the other independent variables are held constant. Standardized regression coefficients were calculated to allow comparison of the impact of each independent variable on attributes' RIS despite different measurement units. R^2 coefficients of determination were calculated for each model. Infusion therapy with infliximab was not included in regression analyses because the number of participants receiving infliximab was too low (n = 8, 4.9%). The number of preceding therapies was not included because of high correlation of this variable with disease duration.

Table 2 Monotherapies and combination therapies currently applied by the study participants (n = 163)

	Currently applied treatment	*n*
No therapy (3.7%)		6
Monotherapy (58.3%)	Topical therapy	61
	Phototherapy	2
	Oral therapy	12
	Injections	14
	Infliximab infusions	6
Combination therapy (38.0%)	Topical therapy and phototherapy	15
	Topical therapy and oral therapy	25
	Topical therapy, oral therapy and phototherapy	6
	Topical therapy and injections	12
	Oral therapy and injections	1
	Topical therapy, oral therapy and injections	1
	Topical therapy and infusions	2

Results

Throughout the study period, 197 outpatients were asked to participate; 16 (8.1%) declined, with most reporting lack of time, and 18 did not fulfil the inclusion criteria. A total of 163 participants (41.1% women; mean age 49.3 years) were recruited and all completed the study survey. As the vast majority of participants (92.6%) received antipsoriatic therapy at the time of data collection, the mean PASI was relatively low (5.6; Table 3). The mean DLQI was 7.6, corresponding to moderate disease-related impairment of quality of life. The mean disease duration was 17.9 years [range 1–62, standard deviation (SD) 13.6]. 37.4% of the participants currently received exclusively topical therapy, 14.1% phototherapy, 27.6% oral therapy, and 17.2% injections (for details on the prescribed medication, see Table 3).

Treatment satisfaction

Based on a choice between five options ranging from 'very satisfied' to 'very dissatisfied', 63.1% of the participants identified themselves as satisfied or very satisfied, whereas 14.7% were undecided and 20.2% dissatisfied or very dissatisfied (Fig. 1a). The average TSQM score was 270.3 (range 37–400, SD 74.1). Almost half of the sample (47.2%) had TSQM scores between 200 and 300, and 35.6% had TSQM scores > 300, reflecting relatively high satisfaction with current treatment (Fig. 1b). Only 17.1% of the participants reported TSQM scores < 200.

Influence of prior treatment experience on treatment preferences

When the influence of treatment satisfaction on RIS of treatment outcome and process attributes was studied, neither satisfaction levels (not shown) nor TSQM scores (Fig. 2a) were found to impact preferences. However, comparison based on prior visits at our department showed that participants attending their first appointment deemed the probability of benefit significantly more important than those who had been previously seen (RIS = 17.99

Table 3 Socio-demographic, disease-related and treatment-related characteristics of the study participants (n = 163)

Socio-demographic and disease-related features		
Sex [female : male; n (%)]	67 (41.1) : 96 (58.9)	
Age (mean ± SD)	49.3 ± 14.13 y (range 18–80 y)	
PASI (mean ± SD)	5.6 ± 5.5 (range 0–32.8)	
DLQI (mean ± SD)	7.6 ± 6.9 (range 0–29)	
Treatment experience	**Groups**	***n* (%)**
Number of visits	First	28 (17.2)
	Repeated	135 (82.8)
Disease duration	≤ 1 y	14 (8.6)
	2–10 y	50 (30.7)
	11–20 y	43 (26.4)
	>20 y	56 (34.4)
Number of previous treatments	≤ 3	101 (62.0)
	>3	62 (38.0)
Currently applied treatment modality	Topical therapy only	61 (37.4)
	Phototherapy	23 (14.1)
	UVB 311 nm	15 (65.2)
	Topical PUVA	8 (34.8)
	Oral therapy	45 (27.6)
	Fumaric acids	25 (55.6)
	Acitretin	12 (26.7)
	Oral methotrexate	6 (13.3)
	Other	2 (4.4)
	Injections	28 (17.2)
	S.c. methotrexate	8 (28.6)
	Adalimumab	7 (25.0)
	Etanercept	8 (28.6)
	Ustekinumab	5 (17.9)
	Infliximab infusions	8 (4.9)

DLQI, Dermatology Life Quality Index; PASI, Psoriasis Area and Severity Index; PUVA, psoralen plus ultraviolet A phototherapy; S.c., subcutaneous; y, years.

vs. 22.56, P = 0.038, Fig. 2b). When participants were stratified according to disease duration, those with psoriasis for >10 years were significantly more concerned about the duration of benefit when compared with participants with shorter disease duration (2–10 years vs. 11–20 years: P = 0.034; 2–10 years vs. >20 years: P = 0.003, Fig. 3a). In contrast, participants with psoriasis for >10 years attributed less importance to the severity of side effects when compared with participants with newly diagnosed psoriasis (≤ 1 year vs. 11–20 years: P = 0.016; ≤ 1 year vs. >20 years: P = 0.027). Participants who had received >3 prior treatments were significantly more concerned about the duration of benefit than participants who had tried ≤3 treatments (RIS = 18.17 vs. 15.26, P = 0.040, Fig. 3b).

Comparing participants with respect to the currently applied treatment modality, preferences of participants treated exclusively with topical therapy did not differ significantly from preferences of others (Fig. 4a). Participants on phototherapy had a tendency to care less about all process attributes than those without phototherapy; however, differences did not achieve significance (Fig. 4b). Participants receiving oral antipsoriatic medication were significantly more concerned about the magnitude of benefit when compared with those without oral therapy (RIS = 21.91 vs. 17.18, P = 0.010; Fig. 4c). Remarkably, participants who currently received injectables (subcutaneous methotrexate, adalimumab, etanercept or ustekinumab) had largely different preferences when compared with others. They considered the probability of benefit significantly more important (RIS = 32.80 vs. 21.89, P = 0.025), but they also attached greater importance to all process attributes except cost, i.e., treatment location (RIS = 44.74 vs. 23.03, P = 0.011), delivery method (RIS = 43.75 vs. 19.29, P = 0.019), frequency of application (RIS = 31.24 vs. 16.89, P = 0.005) and treatment duration (RIS = 32.54 vs. 16.57, P = 0.003; Fig. 4d). In contrast, participants receiving infliximab infusions tended to care less about these process attributes (Fig. 4e), although differences were not significant, possibly due to the small number of patients on infliximab (n = 8).

Multivariate linear regression analysis

Multivariate linear regression analysis was performed separately for each treatment attribute; significant findings are shown in Table 4. Participants with longer disease duration continued to attach significantly greater importance to the duration of benefit (β = 0.206, P = 0.018). In addition, participants on oral therapy remained more concerned about the magnitude of benefit by trend (β = 0.218, P = 0.058). Preferences of participants on injectables were no longer observed to differ significantly from those of other participants. However, participants on phototherapy attached significantly less importance to individual cost than those without phototherapy (β = −0.193, P = 0.050; Table 4).

Treatment satisfaction is higher in participants on injectables and infusions

Assessing the impact of the currently applied treatment modality on treatment satisfaction, 75.0% of the participants receiving infusions reported very high satisfaction with their current treatment compared with 50.0% on injections, 31.1% on oral therapy, 21.7% on phototherapy and 18.0% on mere topical therapy (Fig. 5a). Mean satisfaction levels were 1.25, 1.68, 2.00, 2.52 and 2.95 for participants treated with infusions, injections, oral therapy, phototherapy or mere topical therapy (1 = very satisfied, 5 = very dissatisfied; P < 0.001 in ANOVA analysis, Fig. 5a′). Group-wise comparisons with *post hoc* tests indicated significantly lower mean satisfaction levels in participants on mere topical therapy compared with those on oral medication (P < 0.001), injections (P < 0.001) and infusions (P < 0.001). Furthermore, participants on phototherapy had lower mean satisfaction levels than those on injections (P = 0.011) and infusions (P = 0.008). TSQM scores > 300 were reported by 87.5% of the participants on infusions and 60.7% of the participants on injections, but only 40.0% on oral medication, 30.4% on phototherapy and 23.0% on mere

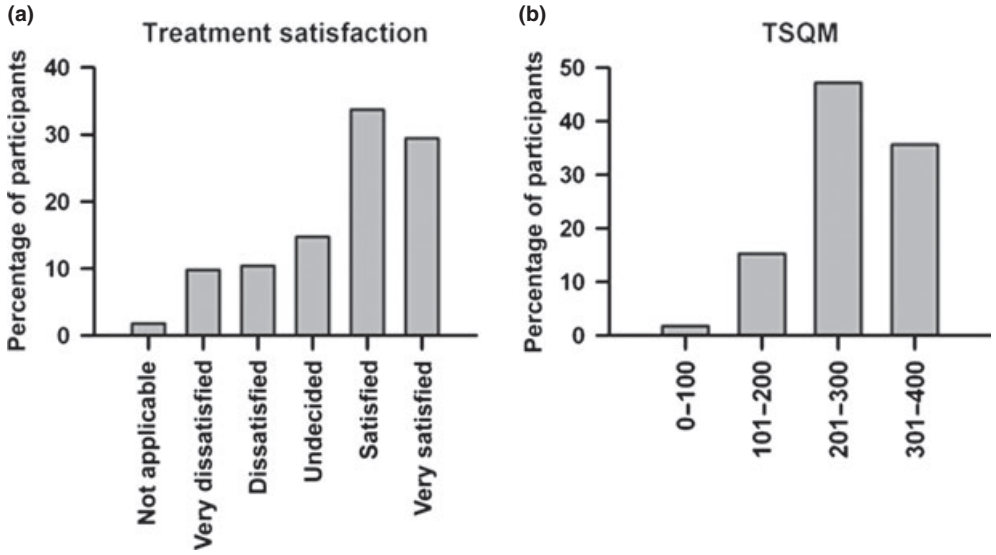

Figure 1 Satisfaction levels (a) and Treatment Satisfaction Questionnaire for Medication (TSQM) scores (b) for the study sample. 29.4% of the participants identified themselves as very satisfied and 33.7% as satisfied with their currently applied treatment, whereas only 20.2% were dissatisfied or very dissatisfied (a). TSQM scores > 200 (midpoint of the scale) were observed in the vast majority of participants (77.8%) and TSQM scores > 300 in more than one-third (35.6%) (b).

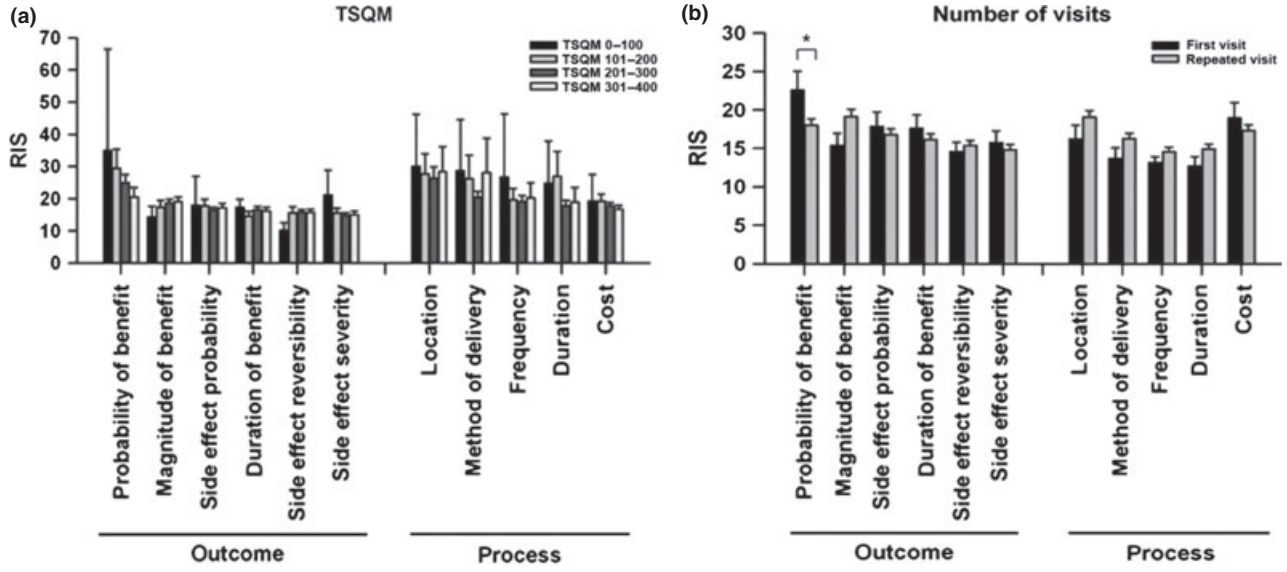

Figure 2 Treatment preferences of participants stratified according to Treatment Satisfaction Questionnaire for Medication (TSQM) scores (a) and according to the number of visits to our department (b). Differences in relative importance scores (RIS) of the outcome and process attributes were tested for significance using *post hoc* tests (for TSQM scores) and ANOVA analyses (for number of visits). RIS did not depend on TSQM scores (a). However, first-time visitors set greater value on the probability of benefit than participants coming for follow-up visits (b). Bars: standard error of the mean (SEM). $^*P < 0.05$.

topical therapy (Fig. 5b). Mean TSQM scores were 341.8, 304.8, 278.7, 272.0 and 245.1 for participants on infusions, injections, oral therapy, phototherapy or mere topical therapy ($P < 0.001$ in ANOVA analysis, Fig. 5b′). In group-wise comparisons, participants on oral medication, injections and infusions reported significantly higher mean TSQM scores than those on mere topical therapy ($P = 0.015$, $P < 0.001$ or $P < 0.001$, respectively, in *post hoc* tests). Moreover, mean TSQM scores were significantly higher in participants on infusions compared with those on tablets ($P = 0.019$) or phototherapy ($P = 0.015$).

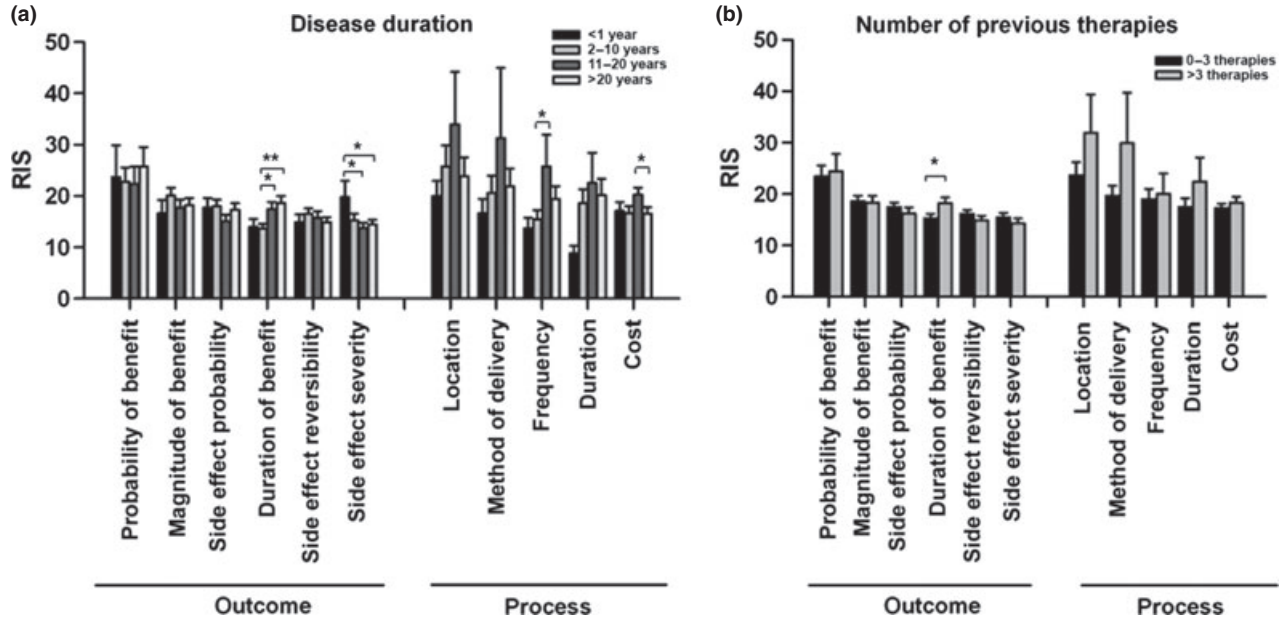

Figure 3 Treatment preferences based on disease duration (a) and number of preceding therapies (<3 or >3) (b). *Post hoc* tests (for disease duration) and ANOVA analyses (for number of previous therapies) were used to test differences in relative importance scores (RIS) for significance. Participants with psoriasis for >10 years were significantly more concerned about the duration of benefit than those with disease duration between 2 and 10 years (a). In contrast, they were less worried about severe side effects than participants with recent diagnoses (<1 year). Participants with a disease duration between 11 and 20 years considered treatment frequency more important than those affected for 2–10 years, and individual cost more important than those with disease duration >20 years. Participants who had received >3 different treatments in the past attached greater importance to the duration of benefit than participants with ≤3 preceding therapies (b). Bars: standard error of the mean. $^{*}P < 0.05$, $^{**}P < 0.01$.

Discussion

Using CA to assess patients' preferences for psoriasis treatments, we have previously reported that study participants attached great importance to attributes related to the treatment process, in particular, treatment location and delivery method.[20] Herein, we show that preferences vary significantly upon treatment experience.

Descriptive analyses suggested that participants visiting our department for the first time regarded the probability of benefit as significantly more important than follow-up visitors. Psoriasis patients seeking advice at centres with special competence in psoriasis for the first time are likely to have high expectations regarding therapeutic benefit. For example, they might expect to be started on relatively novel and cost-intense therapies such as biologicals. Moreover, centres specialized in psoriasis are considered to offer participation in clinical trials featuring innovative and potentially promising therapies. According to experience, many patients have been informed about these opportunities by referring physicians, psoriasis networks or through internet research.

Patients' preferences also shifted with longer disease duration. Participants suffering from psoriasis >10 years were more interested in longer lasting benefit compared with those with shorter disease duration, but less concerned about the severity of side effects, indicating that they might be willing to accept side effects to obtain longer lasting benefit. They might have understood that good long-term control of their disease may require systemic therapy, which may be associated with side effects. Similarly, participants with >3 previous therapies were highly interested in long-standing benefit. As the number of preceding therapies was highly correlated with disease duration, we could not include both variables in our regression analysis. However, it would not be surprising if individuals who have tried multiple therapies in the past, along with individuals who have experienced psoriasis over many years, have greater appreciation for longer-term control of their disease. Conversely, this finding may reflect frustration with the perceived short-term effectiveness of previous treatments. For example, both phototherapy and topical therapy with dithranol, which is still common in Germany, have good short-term effectiveness, but often do not provide long-standing benefit.[13,27]

Perhaps, the most interesting finding of our study is that preferences depended on the application mode of the current therapy. Participants on oral medication attached greater importance to the magnitude of benefit than others. Oral therapies are known to effectively control psoriasis in a relatively high percentage of patients, as 50–75% of the patients treated with fumaric acids,

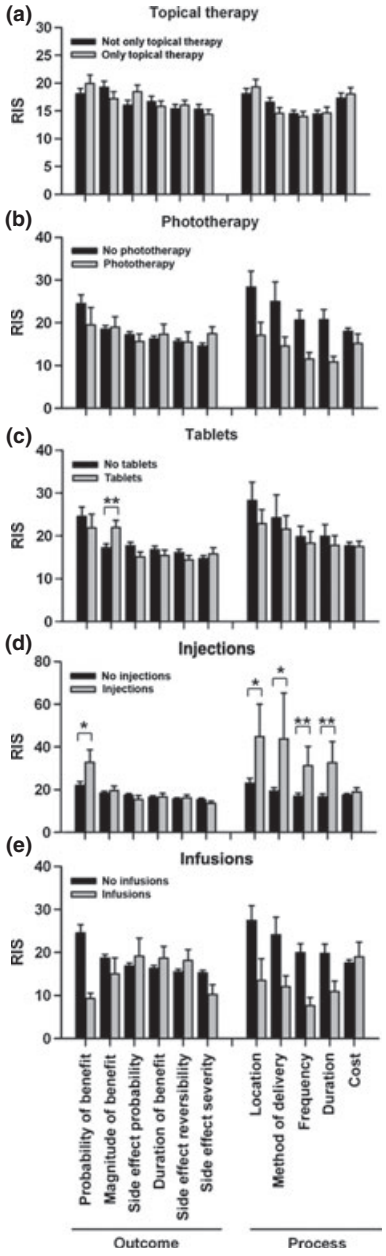

Figure 4 Preferences vary significantly dependent on the modality of the current treatment. Preferences of participants treated exclusively with topical therapy did not differ significantly from others (a). Participants on phototherapy tended to care less about all process attributes when compared with participants without phototherapy (b). Participants on oral therapy were significantly more concerned about the magnitude of benefit than others (c). Participants receiving injections not only set higher value to the probability of benefit but also to treatment location, method of delivery, treatment frequency and treatment duration when compared with others (d). Participants treated with infliximab infusions had the tendency to care less about all process attributes except individual cost (e). Significance was assessed using ANOVA analyses. Bars: standard error of the mean. $^{*}P < 0.05$, $^{**}P < 0.01$.

methotrexate and cyclosporine achieve PASI 75 response rates.[13,28–30] What remains unknown from our study is whether the importance placed on magnitude of benefit was present before participants started oral therapy or was influenced by the outcomes achieved during oral therapy.

Remarkably, participants receiving injections were highly concerned not only about probability of benefit, but also about all process attributes, except cost. This group comprised participants on subcutaneous methotrexate ($n = 8$) and injectable biologicals ($n = 20$), highly efficient treatments leading to PASI 75 response rates around 50–60% (etanercept)[31–33] or 70–80% (adalimumab, ustekinumab)[34–37] and providing the great advantage of home-based application. Emphasizing the benefits of biologicals both in terms of effectiveness and home-based application, it was shown that the most troublesome aspects of antipsoriatic treatment are ineffectiveness and expenditure of time.[6] Time needed for treatment was recently identified as the major predictor of quality of life in psoriasis.[38] Therefore, it is not surprising that biological therapy leads to significant gain in quality of life.[39–41] We cannot predict whether high preferences for a convenient and effective treatment influenced the decision to prescribe injectables or whether participants receiving injectables developed high preferences for these features during the course of their treatment, because they learnt to appreciate its convenience and effectiveness. It seems likely that one the one hand, pre-existing preferences influenced therapeutic decision-making, and on the other hand, positive treatment experience impacted preferences.

In contrast to participants on subcutaneous injections, participants receiving infliximab infusions tended to care less about process attributes. However, they were highly satisfied with their treatment, probably due to its high effectiveness.[37,42] Indeed, infliximab can substantially improve health-related quality of life, paralleled by improvement of the PASI.[43,44]

Preferences for different kinds of antipsoriatic therapies were assessed by a number of studies. However, the available evidence is surprisingly limited, and data are sometimes conflicting.[45] For example, phototherapy with psoralen plus ultraviolet A (PUVA) was preferred over methotrexate, cyclosporine and acitretin in three studies,[6,7,46] but scored lowest in a fourth study based on a hypothetical treatment scenario.[18] Methotrexate was often preferred over other traditional systemic therapies.[6,7,46] In a recent study comparing preferences for biologicals, oral antipsoriatic medications and PUVA, the subgroup of participants previously treated with biologicals had high preferences for biological therapy.[46]

Regarding treatment satisfaction, only 20.1% of our participants were dissatisfied or very dissatisfied and only 17.1% reported TSQM scores < 200 compared with other studies reporting dissatisfaction in up to 40% of respondents.[3,4,46] This difference in overall satisfaction rates may be explained by the facts that our cohort was treated at a competence centre for psoriasis and that most participants were follow-up visitors.

Table 4 Multiple linear regression models demonstrate influence of prior treatment experience on current preferences based on relative importance scores (RIS) for treatment attributes

	Outcome attributes				Process attributes	
	Model 1		Model 2		Model 3	
	Magnitude of benefit		Duration of benefit		Cost	
	β	*P*	β	*P*	β	*P*
Sex	−0.008	0.923	0.037	0.652	−0.021	0.798
Age	−0.043	0.614	0.005	0.955	−0.087	0.298
PASI	−0.004	0.966	−0.015	0.871	−0.017	0.852
DLQI	0.025	0.806	0.070	0.488	**0.235**	**0.019**
TSQM	−0.034	0.739	0.107	0.298	0.112	0.266
Repeated visit*	−0.124	0.158	0.057	0.514	0.059	0.491
Disease duration	−0.040	0.643	**0.206**	**0.018**	−0.030	0.723
Topical therapy only†	0.115	0.389	−0.077	0.560	0.054	0.678
Phototherapy†	0.074	0.463	−0.072	0.467	**−0.193**	**0.050**
Oral therapy†	***0.218***	***0.058***	−0.129	0.258	0.088	0.431
Injections†	0.116	0.306	−0.129	0.251	0.100	0.365
R^2‡	0.049		0.061		0.094	

RIS was defined as the dependent variable; gender, age, PASI, DLQI, TSQM, the number of prior visits to our department, disease duration and currently prescribed treatment modalities were included as independent variables.

β is the standardized regression coefficient. In the case of binary variables, a positive β value signifies that an attribute is more important for the respective category. In the case of linear variables, a positive value indicates that the attribute gains importance when the characteristic increases. Significant findings are highlighted in bold, trends in italics.

*The reference category for 'repeated visit' contains participants attending their first appointment.

†The categories 'topical therapy only', 'phototherapy', 'oral therapy' and 'injections' indicate the currently applied treatment modalities. Reference groups comprise participants who are currently not obtaining the respective treatment.

‡R^2 is the coefficient of determination calculated for each model.

PASI, Psoriasis Area and Severity Index; DLQI, Dermatology Life Quality Index; TSQM, Treatment Satisfaction Questionnaire for Medication.

Comparing treatment satisfaction according to the currently prescribed treatment modality, participants receiving exclusively topical treatment were least satisfied, indicating that despite relatively low mean PASI scores, they might feel undertreated and supporting better integration of patient-reported outcome into treatment decision-making.[47] Indeed, a relatively large proportion of patients with psoriasis consider their treatment as not aggressive enough.[3] Highest treatment satisfaction was reported by participants of our study receiving injectables or infusions. Well in accordance with our results, a Canadian online survey found that 63% of the respondents taking injectables were very satisfied with their treatment, compared with 38% on oral medication and 21% on phototherapy.[5] Larger satisfaction with biologicals than with other therapies was also shown by other groups.[4,5,48–50] Reflecting great treatment satisfaction, adherence to biologicals is higher compared with other treatments.[51]

A limitation of this study is the relatively small cohort size that may explain why some results obtained in descriptive analyses did not remain significant in regression models. As our study is an explorative analysis using a relatively new methodology, we did not perform multiple significance testing, the relevance of which is a matter of debate.[52,53]

Our study only included patients with moderate or severe psoriasis treated in a German University Medical Center. Therefore, our findings need to be verified in larger and more diverse patient samples, including individuals with mild psoriasis and individuals from other ethnic and cultural backgrounds and health care systems, before generalizations can be made.

Eight of our study participants received combinations of oral and phototherapy or oral therapy and injections. For analyses of RIS and treatment satisfaction, these participants were included into two different treatment groups, which may have biased the results. However, the number of these participants is probably too small to have significant impact on our findings.

A further limitation is that we assessed preferences for different application modalities, but not for specific therapies. Therefore, we cannot predict whether the preferences of participants on subcutaneous biologicals and subcutaneous methotrexate are indeed identical. Compared with biologicals, methotrexate therapy requires more frequent laboratory workups, at least at the beginning of the treatment.[30,37] Furthermore, the application frequency of subcutaneous biologicals is quite variable. For example, etanercept is injected once to twice weekly, but ustekinumab only once every 12 weeks. In conjoint analyses comprising larger patient

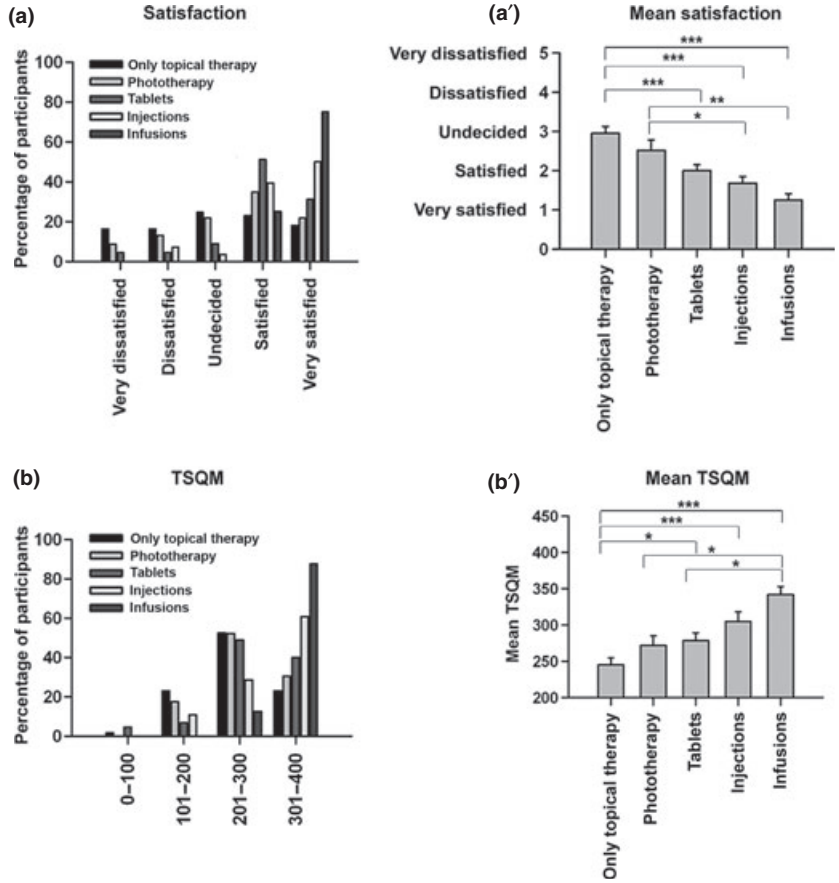

Figure 5 Treatment satisfaction depends on the currently prescribed application form. When satisfaction was assessed by choice between five categories from 'very satisfied' to 'very dissatisfied', higher percentages on participants treated with infusions or injections than participants treated with oral therapy, phototherapy or mere topical therapy were very satisfied with their treatment (a). Mean satisfaction levels (1 = very satisfied, 5 = very dissatisfied), indicating lower satisfaction for participants on mere topical therapy (2.95), phototherapy (2.52) or oral medication (2.00) than for those on injections (1.68) or infusions (1.25) (a′). Comparison of Treatment Satisfaction Questionnaire for Medication (TSQM) scores showed scores >300 in 87.5% of the participants on infusions and 60.7% on injections compared with 40.0% on oral medication, 30.4% on phototherapy and 23.0% on mere topical therapy (b). Mean TSQM scores of participants receiving infusions were significantly higher than mean TSQM scores of participants on oral therapy, phototherapy or mere topical therapy (b′). Moreover, participants treated with oral antipsoriatic medication or with injections had significantly higher mean TQSM scores than those treated exclusively with topical therapy. Significance was assessed with *post hoc* tests. Bars: standard error of the mean. $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

cohorts, it will be interesting to compare preferences for specific medications. Moreover, it will be important to compare preferences of participants who are satisfied with a specific application form or medication to preferences of participants dissatisfied with the same treatment.

Participants treated with injectables or infusions are more likely to suffer from long-lasting, severe psoriasis than participants on mere topical treatment or phototherapy. In addition, they are more likely to have experience with different kinds of treatments and medications, as failure of or contraindications against traditional systemic therapies are prerequisites for prescription of biologicals in Germany. All these factors may have influenced their preferences for treatment attributes.

Moreover, treatment preferences are influenced by a wide variety of other factors, e.g., socio-demographic and socio-economic characteristics and comorbitities.[20,21] Therefore, our models could only explain a relatively small proportion of variation in preferences.

Taken together, conjoint analyses provide a unique tool for capturing preferences, as they realistically mirror decision-making scenarios faced in daily practice. With this relatively novel approach, we have shown that preferences for a convenient treatment process are overall high, but outstanding in a certain subgroup, i.e. participants on injectable treatments. Integrating this knowledge into shared decision-making may present an opportunity to improve treatment satisfaction, adherence and clinical outcome.

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