DOI: 10.1111/j.1468-3083.2012.04569.x JEADV

ORIGINAL ARTICLE

# Matching physicians' treatment recommendations to patients' treatment preferences is associated with improvement in treatment satisfaction

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## Abstract

**Background** Dissatisfaction with treatment is common among those with psoriasis. While incorporating patients' preferences into the process of treatment decision-making may improve satisfaction, this relationship has not been clearly established.

**Objective** To assess the extent to which matching physicians' treatment recommendations to patients' treatment preferences is associated with improvement in treatment satisfaction in patients with moderate-to-severe psoriasis.

**Methods** This prospective cohort study design examined change from baseline to 3-month follow-up in four subscales of an established measure of treatment satisfaction. Separate multivariate regression models investigated the association of change in these subscale scores with an index measuring the match between physicians' treatment recommendations and patients' treatment preferences at the initial study visit.

**Results** A closer match between physicians' recommendations and patients' preferences was associated with greater improvement in treatment satisfaction over time in each of the four subscales: effectiveness ($\beta = 0.53$, $P < 0.001$), side-effects ($\beta = 0.25$, $P = 0.009$), convenience ($\beta = 0.78$, $P < 0.001$) and global satisfaction ($\beta = 0.49$, $P < 0.001$). Adjusted models explained as much as 76% of the variation in change in treatment satisfaction subscales over 3 months.

**Conclusions** Further efforts to incorporate patients' preferences in treatment decision-making appear justified given the strength of independent associations between preference matching and improved treatment satisfaction and the extent to which our models explained variation in this relationship. An approach based on preference matching shows promise for increasing satisfaction in the management of other chronic diseases.

Received: 29 November 2011; Accepted: 18 April 2012

## Conflict of interest

None.

## Funding/Support

None.

## Financial disclosure

None reported.

## Introduction

Psoriasis is a chronic and often debilitating skin disease.[1–4] Reductions in disease-specific quality-of-life associated with psoriasis are comparable to those of other chronic conditions, such as type 2 diabetes, malignancy and chronic respiratory disease.[5,6] In Germany, psoriasis is one of the most common chronic inflammatory conditions with a prevalence of 2–3%.[6,7]

Although no currently available treatment option can provide a complete cure,[7,8] patients who adhere to recommended treatments are often able to achieve skin that is clear of the disease and experience improvement in disease-specific quality-of-life.[7–10] However, poor treatment outcomes due to treatment non-adherence have been reported.[9] Reasons cited for non-adherence among psoriasis patients include dissatisfaction with treatment effectiveness, treatment convenience and the possibility of or actual occurrence of side-effects.[11]

To improve treatment outcomes through greater satisfaction and adherence with treatment, the Institute of Medicine and the German Institute for Quality and Efficiency in Healthcare encourage the incorporation of patients' preferences in treatment decision-making.[12] In other chronic illnesses, matching physician treatment recommendations to patients' treatment preferences has been associated with improved treatment outcomes. Previous work observes, for example, that preference matching is associated with improved treatment satisfaction and reduced treatment anxiety.[13–17] However, the methods used in these studies have important limitations. In the majority of studies, for example, participants were asked whether they preferred a particular treatment or they wished to be involved in a specific aspect of decision-making.[14,15,17] A yes/no response in these cases fails to account for the strength of a preference, its transitive nature (i.e. a person who prefers choice option x to y and y to z must prefer x to z) and does not allow for permissible trade-offs between the attributes of different treatments. As a result, the relative preference for a range of treatments or the magnitude of a preference for a single treatment option may be either underestimated or missed entirely. To gain a clearer understanding of the value of patients' treatment preferences, measures better suited to represent these aspects of clinical decision-making are needed.

In this study, we used a technique to elicit preferences that reflected their strength across a variety of treatments with differing attributes. Our objective was to examine change in treatment satisfaction when patients' preferences for a specific treatment were matched with physician recommendations. Satisfaction with care, a patient-centred measure of health care quality[15] has been previously associated with improved treatment outcomes and health status.[18]

## Methods

### Recruitment

This study was conducted from December 2009 to April 2011 at the outpatient psoriasis clinic in the Department of Dermatology at the University Medical Centre Mannheim, Heidelberg University. Recruitment of patients was carried out during outpatient psoriasis clinics held biweekly. Patients were approached before their medical appointments, provided with an information leaflet regarding the study and invited to participate.

*Inclusion criteria* Those who agreed to participate were screened and considered eligible if they were ≥18 years of age, diagnosed with moderate or severe psoriasis according to the criteria of the Committee for Medicinal Products for Human Use[19] [i.e. Psoriasis Area Severity Index (PASI) >10 and/or had involvement of the head, palmar and plantar surfaces],[20] or had psoriatic arthritis with skin involvement according to Classification of Psoriatic Arthritis (CASPAR) criteria.[21] We did not restrict eligibility on the basis of medication use to ensure that all currently available psoriasis treatment alternatives (e.g. light, topical, systemic or biological) might represent realistic treatment options. Furthermore, both new patients (i.e. first visit to outpatient clinic at $t_1$ with no documentation on previous treatment regime) and established patients (i.e. patients that had a change of treatment at $t_1$ and patients who had no change of treatment at $t_1$) were eligible.

*Exclusion criteria* Patients with psoriatic arthritis but no skin involvement were excluded as were those unable to provide responses independently to an online survey. This study was approved by the ethics committee of the Medical Faculty Mannheim, Heidelberg University. Study procedures followed the principles of the Helsinki Declaration.

### Data collection

Eligible patients were assigned unique codes to enable linkage of data provided at the initial study visit ($t_1$) and at 3-month follow-up ($t_2$). Data collection at $t_1$ involved completion of an online survey to elicit patients' treatment preferences before their medical appointment and abstraction of treatment recommendations from the medical record following the medical appointment using a standardized data extraction form. Treatment satisfaction was assessed at $t_1$ and $t_2$ using a previously validated self-reported measure described below.

### Study variables

The study primary independent variable was the Preferences Matching Index (PMI), a novel index that measures the level of matching between physicians' treatment recommendations and patients' treatment preferences. The PMI, ranging from 0 (no matching) to 1 (complete matching), was developed in three steps:

The first step involved elicitation of patients' treatment preferences for available psoriasis treatment options in terms of their attribute and attribute levels or categories using a choice-based conjoint analysis exercise. *Patient preferences* refer to the value patients attach to treatment attributes they are asked to choose from,[22] whereas *treatment attributes* refer to different features of available treatments (e.g. the duration of treatment benefit, treatment side-effects and treatment duration). *Treatment attribute level* refers to specific options within each treatment attribute. For example, the levels for the treatment attribute 'treatment location' might include 'at home', 'in the outpatient clinic', or 'as an inpatient'.

Currently available psoriasis treatment modalities were identified through consultations with dermatologists on the research team (AS and WP) and through review of the 'German Evidence-based Guidelines for the Treatment of Psoriasis.[23] These treatments modalities were then decomposed into commonly encountered treatment attributes and attribute levels (Table 1).[3,24–26] Four levels were specified for each treatment attribute to balance considerations of comprehensiveness with an interest in providing a modest range of options that would not overwhelm patients. Data from a pilot test of the conjoint analysis survey before the

**Table 1.** Treatment attributes and attribute levels used in the survey

| Treatment attributes | Levels | | | |
|---|---|---|---|---|
| Treatment duration | 5 min | 15–30 min | 1 h | 2 h |
| Treatment frequency | Once every 3 months | Once every 2 weeks | Two times each week | Twice daily |
| Treatment cost | 0 € per month | 50 € per month | 100 € per month | 200 € per month |
| Treatment location | At home | At home & follow-up at local doctor's | Outpatient clinic | Hospital for 3 weeks |
| Treatment delivery method | Topical | Tablets | Injection/intravenous infusion | Light therapy |
| Magnitude of beneficial effects | 100% reduction | 75% reduction | 50% reduction | 25% reduction |
| Duration of beneficial effects | 1 year or more | 6–8 months | 3–5 months | 2 weeks |
| Probability of side-effects | 100% | 50% | 10% | 1% |
| Probability of beneficial effects | 100% | 80% | 60% | 40% |
| Reversibility of side-effects | 100% | 80% | 60% | 40 |
| Side-effects severity | Temporary, minor discomfort on skin | Constant, moderate discomfort on skin | Temporary, moderate side-effects more than skin | Severe side-effects more than skin |

main data collection period were used to refine descriptions of attribute levels for clarity (Table 1).

We used choice-based conjoint analysis to elicit patients' preferences for the attributes of different psoriasis treatments. Conjoint analysis is regarded as the preference elicitation method that best simulates the way people make choices when faced with multiple options.[27] The conjoint analysis exercise involved asking patients to choose between 12 randomly selected pairs of treatment scenarios consisting of attributes and attribute levels from all possible combinations (Table 2). The survey instrument used to perform the conjoint analysis was designed using commercially available software (Sawtooth, Inc., Sequim, WA, USA). Hierarchical Bayes estimation generated individual preference scores for each treatment attribute and level. This allowed us to identify the most- and least-preferred treatments as those with the highest and lowest score values respectively. Although only a subset of randomly selected potential treatments was presented in the conjoint analysis exercise, the software algorithm extrapolated preference scores for all possible treatments and treatment attribute levels for each patient.

The second step used data abstracted from the medical records on recommended treatments. This process decomposed physicians' treatment recommendations into the same attributes and attributes levels found in Table 1.

The third step determined the level of matching between patient-preferred and physician-recommended treatment attributes and attribute levels using the patient-derived preference scores as the common metric. This process is illustrated through an example of preference scores in Table 3 derived from a conjoint analysis exercise involving a hypothetical patient. From the preference scores, the patient appears to most prefer an infusion (preference score = 18) at an outpatient clinic (preference score = 19) lasting between 15–30 min (preference score = 21). The patient's least-preferred treatment is light therapy (preference score = 8) as an inpatient (preference score = 3) lasting 2 h (preference score = 2). If the actual treatment recommended by the physician for this patient was an 'ointment', the attribute categories ascribed to this treatment would be: 'topical', 'taken at home' and '15–30 min to complete', corresponding to patient-derived preference scores of 9, 11 and 21 respectively.

Scores for patients' most- and least-preferred treatments and those for the physician-recommended treatment are then summed. In the example, these would be 58 (=18 + 19 + 21), 13 (=8 + 3+2) and 41 (=9 + 11 + 21) respectively. The PMI is calculated by dividing the difference between preference scores for the physician-recommended treatment and the patient's least-preferred treatment with the difference between the patient's most- and least-preferred treatments. In the example, the PMI is therefore [41–13/58–13] = 0.62 (28/45). A PMI of 0.62 represents a 62% match between the attributes of physician-recommended and patient-preferred treatments.

The dependent variable in this study was absolute change from $t_1$ to $t_2$ in Treatment Satisfaction Questionnaire for Medication (TSQM version 1.4) subscales. A psychometrically validated generic measure of treatment satisfaction with medication, the TSQM consists of four subscales including satisfaction with treatment effectiveness, treatment side-effects, treatment convenience and global satisfaction. Each subscale ranges from 0 (extremely unsatisfied) to 100 (extremely satisfied).[28]

Information on potential confounding characteristics was collected in the online survey, including gender, partnership status (single, couple living together, divorced or widowed), employment status (employed, not employed), age (in years), years of education/training (≤11 years, 12–15 years, >15 years), net monthly household income (<1500 €, 1500–3000 €, >3000 €), disease duration (in years) and treatment regime (new patients at $t_1$, patients that had a change of treatment at $t_1$ and patients who had no change of treatment at $t_1$), and selected important comorbidities known to be associated with psoriasis[29] (psoriatic arthritis, cardiovascular disease, diabetes and depression).[7,30,31]

**Table 2.** Example of a treatment scenario presented to the study participants in the conjoint analysis exercise

| **Imagine that you will be actively treating your psoriasis for the next 3 months. From each pair of treatment options A and B, please pick which treatment you will like to participate in** | |
|---|---|
| **Option A** | **Option B** |
| My treatments will take place at home | My treatments will take place while I stay in the hospital for 3 weeks |
| My treatments will occur twice daily | My treatment will occur twice daily |
| Each treatment will take 5 min to complete | Each treatment will take 15–30 min to complete |
| I may experience constant, moderate side-effects that can affect more than my skin | I may experience constant, minor discomfort on my skin |
| I have about 60% chance of experiencing a significant reduction in my psoriasis plaques | I have almost a 100% chance of experiencing a significant reduction in my psoriasis plaques |
| The improvement in my psoriasis will last for 2 weeks after completing all of my treatments | The improvement in my psoriasis will last for 1 year after completing all of my treatments |
| O | O |

**Table 3.** Example of preferences scores for treatment attributes and attribute levels for a hypothetical patient

| **Attributes** | **Attribute categories** | **Preference score** |
|---|---|---|
| Attribute 1. Treatment delivery method | Category 1. Topical | 9 |
| | Category 2. Tablets | 10 |
| | Category 3. Infusion | 18 |
| | Category 4. Light therapy | 8 |
| Attribute 2. Treatment location | Category 1. At home | 11 |
| | Category 2. At local doctor's office | 12 |
| | Category 3. At outpatient clinic | 19 |
| | Category 4. Hospital stay | 3 |
| Attribute 3. Treatment duration | Category 1. 5 min to complete | 20 |
| | Category 2. 15–30 min to complete | 21 |
| | Category 3. 1 h to complete | 4 |
| | Category 4. 2 h to complete | 2 |

### Statistical analysis

This study utilized a prospective cohort study design. After confirming that the distribution of the change scores for each of the four subscales of TSQM was sufficiently normal to permit parametric correlations, we used the Pearson correlation test to examine bivariate associations between PMI at $t_1$ with change (delta) scores for each of the four subscales of TSQM (i.e. effectiveness, side-effects, convenience and global satisfaction) from $t_1$ to $t_2$. The independent association of patients' PMI scores with each TSQM subscale was evaluated using separate linear regression models that included known confounders. Statistical analyses were conducted using either Sawtooth software (Sawtooth, Inc.) or SPSS statistical software version 19 (Chicago, IL, USA). The alpha level was set at 0.05. No adjustment for multiple comparisons was made.

## Results

### Patient characteristics

One hundred and thirty-two patients provided complete data at both assessment points. The characteristics of this sample are detailed in Table 4. The skewness and kurtosis of the TSQM subscales suggested sufficiently normal distributions. The mean and standard deviation of the change scores for the TSQM satisfaction subscales were 16.2 ± 35.5 (range = −100 to +100) for treatment effectiveness, 22.4 ± 34.1 (range = −89 to +93) for treatment side-effects, 20.6 ± 28.8 (range = −78 to +81) for treatment convenience and 10.6 ± 32.9 (−85 to +92) for global satisfaction respectively. Bivariate correlations indicated that matching physician treatment recommendation to patient treatment preferences was significantly correlated with higher satisfaction with treatment effectiveness ($r = 0.53$, $P < 0.001$), treatment side-effect ($r = 0.24$, $P < 0.002$), treatment convenience ($r = 0.66$, $P < 0.001$) and global satisfaction ($r = 0.50$, $P < 0.001$).

### Multivariate analysis

In regression models, PMI scores at $t_1$ were independently associated with increases over time in satisfaction with treatment effectiveness ($\beta = 0.53$, $P < 0.001$), treatment side-effect ($\beta = 0.25$, $P = 0.009$), treatment convenience ($\beta = 0.78$, $P < 0.001$) and global satisfaction ($\beta = 0.49$, $P < 0.001$) after controlling for important confounders. Furthermore, regression model 1 explained 37% of the variance in the change in satisfaction with treatment

**Table 4.** Characteristics of the study sample of analysis at 3-month follow-up

| Characteristics | $t_2$ ($n$ = 132) |
|---|---|
| Gender | |
| Women | 51 (38.6%) |
| Men | 81 (61.4%) |
| Age (years), Mean ± SD | 50.2 ± 14.2 |
| Marital status | |
| Single | 32 (24.2%) |
| Couple (living with a partner) | 80 (60.6%) |
| Divorced, Widowed, Separated | 20 (15.2%) |
| Years of education | |
| ≤11 | 24 (18.2%) |
| 12–15 | 77 (58.3%) |
| >15 | 31 (23.5%) |
| Net monthly household income (in Euros) | |
| <1500 | 44 (33.3%) |
| 1500 < 3000 | 60 (45.6%) |
| >3000 | 28 (21.2%) |
| Employment status | |
| Working | 79 (59.8%) |
| Not working | 53 (40.2%) |
| Disease duration (years), Mean ± SD | 18.3 ± 14.2 |
| Treatment regime | |
| New patients at $t_1$ | 21 (15.9%) |
| Change of treatment at $t_1$ | 42 (31.8%) |
| No change of treatment at $t_1$ | 69 (52.3%) |
| Comorbidities | |
| Psoriatic arthritis | 37 (28.0%) |
| Diabetes | 12 (9.1%) |
| Cardiovascular | 13 (9.8%) |
| Depression | 12 (9.8%) |
| Change_effectiveness_$t_1$-$t_2$, Mean ± SD (range) | 16.2 ± 35.5 (−100 to +100) |
| Change_side-effects_$t_1$-$t_2$, Mean ± SD (range) | 22.4 ± 34.1 (−89 to +93) |
| Change_convenience_$t_1$-$t_2$, Mean ± SD (range) | 20.6 ± 28.8 (−78 to +81) |
| Change_global-satisfaction_$t_1$-$t_2$, Mean ± SD (range) | 10.6 ± 32.9 (−85 to +92) |

effectiveness, model 2 explained 12% of the variance in change in the tolerability of side-effects, model 3 explained 76% of the variance in change in treatment convenience and model 4 explained 32% of the variance in change in global satisfaction (Table 5).

## Discussion

We demonstrated an independent association between a closer match in physicians' treatment recommendations and patients' treatment preferences and an increase over 3- month follow-up in all four subscales of the TSQM. We also observed that the adjusted models explained a significant proportion of the variance in the change in treatment satisfaction subscales, suggesting that we successfully identified relevant variables. The size of the beta coefficients for the PMI further suggests its relative importance to other model variables in explaining changes in patients' satisfaction.

### Implications for practice and research

Although we described a process of preference elicitation and analysis in the context of psoriasis management, the steps of this approach are straightforward, reproducible and should therefore extend to the management of other chronic diseases. We used a measurement approach, for example, that yielded a metric for preferences common to patients and their physicians. Preferences were determined for a randomly selected set of treatment attributes and attribute levels from a conjoint analysis exercise. Hierarchical Bayes estimation was then used to estimate preference scores for each individual across the full list of treatments. This, in turn, enabled measurement of the extent to which the attributes of the most-preferred treatment were matched to those recommended by their physician.

Chronic disease management may be characterized by complex medication regimes and poor treatment adherence.[32] Patients with chronic disease will have more sophisticated perceptions about the type of care they want and need. This may be because of more experience with care seeking and increasing recognition of the potential for poor disease outcomes sometimes regardless of the adequacy of care.[33] Within the framework of shared decision-making the incorporation of patients' preferences has been advocated, as this has been associated with improvement in patients' treatment adherence and satisfaction.[34] Methods described in this study offer one way by which physicians may promote the use of patients' preferences in different clinical approaches to managing chronic diseases.

Our results hold promise for creating an environment in which attainment of more desirable outcomes is possible through adoption of decision-making processes that are more patient-centred. This benefit accrues without placing undue limits on physician practice, given that options in treatment often exist: patients and their physician can trade between treatment attributes to arrive at treatment decisions with the highest likelihood of success, adherence and sustainability. The relative ease with which treatment options can be broken down into attribute and levels further support the feasibility of implementing this approach in clinical settings.

Preference matching may also benefit physicians. In a longitudinal observational study of 4,108 patients, it was observed that about 20% disenrolled from their primary care physicians' practice within a 3-year period. Factors, such as the quality of the physician-patient interaction, physician knowledge of patients' values and preferences, and patient involvement were identified as important correlates associated with disenrollment.[35] Using techniques that promote patient-centredness may work against these trends, as it requires explicit physician effort to assess, understand and incorporate patients' treatment preferences in treatment decision-making.

**Table 5** Multiple regression analyses examining the associations between Preferences Matching Index (PMI) and absolute change in satisfaction with treatment effectiveness, side-effect, convenience and global satisfaction

| Predictors | Effectiveness | | Side-effects | | Convenience | | Global satisfaction | |
|---|---|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
| | ß | *P* | ß | *P* | ß | *P* | ß | *P* |
| PMI (assessed at t1) | 0.539 | <0.001 | 0.257 | 0.014 | 0.779 | <0.001 | 0.494 | <0.001 |
| Effectiveness_t1 | 0.162 | 0.069 | – | – | – | – | – | – |
| Side-effects_t1 | – | – | −0.003 | 0.973 | – | – | – | – |
| Convenience_t1 | – | – | – | – | 0.012 | 0.588 | – | – |
| Global satisfaction_t1 | – | – | – | – | – | – | 0.058 | 0.516 |
| Gender (referent: Men) | | | | | | | | |
| Women | 0.033 | 0.730 | 0.129 | 0.025 | 0.003 | 0.904 | −0.009 | 0.927 |
| Age | −0.039 | 0.733 | 0.080 | 0.557 | −0.033 | 0.261 | 0.089 | 0.458 |
| Marital status (referent: Couple) | | | | | | | | |
| Single | −0.123 | 0.024 | 0.025 | 0.838 | 0.017 | 0.513 | −0.135 | 0.205 |
| Divorce, Widowed, Separated | 0.075 | 0.426 | −0.043 | 0.700 | −0.033 | 0.170 | 0.110 | 0.025 |
| Not working | −0.067 | 0.524 | −0.039 | 0.752 | −0.058 | 0.032 | 0.040 | 0.714 |
| Net monthly income (referent: 1500–3000) | | | | | | | | |
| <1500 | 0.006 | 0.954 | −0.156 | 0.018 | −0.026 | 0.317 | −0.131 | 0.205 |
| >3000 | −0.065 | 0.043 | −0.073 | 0.520 | −0.058 | 0.019 | −0.037 | 0.712 |
| Education (referent: 12–15 years) | | | | | | | | |
| ≤11 | 0.029 | 0.758 | −0.129 | 0.024 | 0.054 | 0.025 | −0.031 | 0.748 |
| >15 | 0.119 | 0.020 | −0.025 | 0.817 | 0.047 | 0.042 | −0.030 | 0.757 |
| Disease duration | −0.021 | 0.820 | −0.001 | 0.994 | −0.047 | 0.044 | −0.040 | 0.672 |
| Depression (referent: without depression) | −0.049 | 0.572 | 0.069 | 0.501 | 0.008 | 0.710 | −0.133 | 0.014 |
| Cardiovascular (referent without cardiovascular disorder) | 0.025 | 0.800 | 0.039 | 0.737 | −0.016 | 0.524 | 0.132 | 0.020 |
| Diabetes (referent: without diabetes) | 0.125 | 0.168 | −0.072 | 0.045 | 0.121 | <0.001 | 0.047 | 0.621 |
| Psoriasis arthritis (referent: without psoriasis arthritis) | −0.079 | 0.365 | 0.023 | 0.820 | 0.038 | 0.049 | −0.035 | 0.695 |
| Medication history (referent: No change of treatment at t1) | | | | | | | | |
| New patients_t1 | 0.085 | 0.335 | 0.044 | 0.672 | 0.026 | 0.247 | 0.045 | 0.626 |
| Change of treatment_t1 | 0.086 | 0.326 | 0.078 | 0.453 | −0.029 | 0.197 | 0.012 | 0.899 |
| Adjusted $R^2$ | 0.37 | | 0.12 | | 0.76 | | 0.32 | |

Our models explained a significant proportion of the variance for several of the treatment satisfaction subscales, suggesting that we were successful in identifying their key contributors. Specifically, the adjusted model for change in satisfaction with treatment convenience (model 3) explained as much as 76% of the variation. These results provide support for efforts to identify treatment preferences and incorporate them into treatment plans. Such efforts may also foster greater adherence behaviours, given a recognized correlation between adherence and satisfaction with treatment convenience.[36] However, success in explaining variation in satisfaction with treatment was not uniform. Our model for satisfaction with treatment side-effects, for example, explained a more modest proportion of variation and the beta coefficient for the PMI was relatively smaller. These findings are not surprising as previous work suggests that factors other than those included in our model may have more influence on the extent to which patients are satisfied with the side-effects they experience as part of treatment.[28,37] There may be unmeasured factors that explain why model variance differed from model to model. Future work that tests a broader pool of factors will be useful in expanding our understanding of potential mechanisms and potential points at which interventions can be targeted.

Although others have acknowledged that patients' values are influenced by both patients' knowledge and experience with medication,[38] we do not have data to examine this further in the present study. Furthermore, it may be argued that the extent to which physicians matched patients' preferences to treatment recommendation and the association of preference matching with treatment satisfaction is a reflection of either the nature and quality of the physician's interaction with patients or the availability of patient-preferred treatment options. Although beyond the scope of the current study, these are important empirical questions that need to be investigated in future research.

In general, these findings support increased research effort directed towards developing strategies that enable the incorporation of patients' preferences in treatment decision-making. For example, studies are needed that elicit treatment preferences at different time points to assess their stability. A confirmation that preferences are stable, should translate into a reduced frequency at which treatment preferences must be elicited, therefore reducing demands on time and resources. Studies are also needed that seek to establish a better understanding of physicians' preferences for shared decision-making, as these can be used to inform the development of strategies to enhance the success of this process.

### Comparison with other studies

To our knowledge, this is the first study to investigate the association of multiple dimensions of patient satisfaction and preference matching in patients with moderate and severe psoriasis. However, there are studies in other chronic illnesses that touch on this subject. For example, patients about to undergo cardiac catheterization were found to be less anxious when they were informed about the procedure in a way that matched their preference for information.[39] Patients undergoing preprosthetic oral surgery adapted better following surgery and reported lower pain and better satisfaction afterwards when their preferences were acknowledged.[13] Matching patients' preferences for involvement in treatment decision-making in cancer treatment and in ambulatory health care services has also been associated with improvement in treatment satisfaction and reduction in treatment anxiety.[14,15]

### Strengths and limitations

We developed an index that can be used to quantitatively assess the level of matching between physicians' treatment recommendations and patients' preferred treatments. In testing the associations of interest, we used the subscales of a psychometrically valid, generic measure of treatment satisfaction with medication. The application of this tool in a study involving psoriasis care is especially appropriate given the wide range of medications and treatment modalities available. The potential for "ordering effects" in conjoint analysis have been raised.[40] However, the random design used in this study ensured that each respondent saw a randomly generated set of choices, thus accounting for potential ordering effects. This expectation is further supported by previous work exploring this methodological issue in the application of conjoint analysis to health care.[12,40]

Despite its strengths, our study should be interpreted in light of several shortcomings. We used conjoint analysis, to assess treatment preferences assuming that all relevant information necessary to determine patients' preferences for treatment were measured.[27] To ensure that this was the case, we performed an exhaustive review of the characteristics of treatments listed in the German Evidence-based Guidelines for the Treatment of Psoriasis.[23,41] As a second step, we consulted with dermatologists (WP and AS) on the research team to confirm the lists of treatment attributes and attribute levels we generated to ensure their comprehensiveness. Our study was conducted in a university medical centre, raising the possibility that our sample may have included patients with more specialized care needs than the general population with psoriasis. Finally, our study is an observational study from which we cannot draw causal inferences; prospective randomized studies are needed to investigate the direct effect of preference matching on treatment outcomes. Such studies will further strengthen the evidence supporting the incorporation of patients' preferences in treatment decision-making.

## Conclusions

This study demonstrates that closely matching physician' treatment recommendations to patients' treatment preferences is associated with improvement in multiple domains of treatment satisfaction. These data suggest that physicians' efforts to identify patients' preferences for treatment and to tailor their management plan to these preferences holds the potential to improve patients' satisfaction with recommended treatment. Future work on strategies in health care delivery that promote the incorporation of patients' preferences in treatment decision-making is needed. Such efforts have the potential to increase patients' satisfaction and adherence with treatment recommendations in psoriasis and the management of other chronic diseases.

## Author contributions

Mr. Umar, Ms. Schaarschmidt, Dr. Schmieder, Dr. Peitsch, Dr. Schöllgen and Dr. Terris had full access to all of the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Mr. Umar, Ms. Schaarschmidt, Dr. Schmieder, Dr. Peitsch and Dr. Terris. Acquisition of data: Mr. Umar, Ms. Schaarschmidt, Dr. Schmieder, Dr. Peitsch and Dr. Terris. Analysis and interpretation of data: Mr. Umar, Dr. Schöllgen and Dr. Terris. Drafting of the manuscript: Mr. Umar, Dr. Schöllgen, Dr. Terris. Critical revision of the manuscript for important intellectual content: Mr. Umar, Ms. Schaarschmidt, Dr. Schmieder, Dr. Schöllgen, Dr. Peitsch and Dr. Terris. Statistical analysis: Mr. Umar, Dr. Schöllgen and Dr. Terris. Administrative, technical or material support: Mr. Umar, Dr. Terris. Study supervision: Dr. Peitsch, Dr. Terris.

## Acknowledgements

The authors thank David Litaker, MD PhD (Departments of Medicine, Epidemiology and Biostatistics, Case Western Reserve University, Cleveland Ohio, USA) for his valuable inputs, Ms. Anette Oberst (Department of Dermatology, University Medical Centre Mannheim) for helping with documentation and the doctors and nursing staff of the Department of Dermatology at the University Medical Centre Mannheim for support with patient recruitment.

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