Health literacy – a new piece of the puzzle in psoriasis care?

A CROSS SECTIONAL STUDY

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What is already known about the topic?

- Health literacy (HL) has increasingly been acknowledged as essential component of an individual's resources and competency to self-manage chronic conditions such as psoriasis
- HL negatively impacts healthcare utilization
- HL has not yet been investigated in patients with psoriasis

What does this study add?

- The first comprehensive HL assessment of psoriasis
- Patients with psoriasis who have participated in Climate Helio Therapy (CHT) have lower HL scores compared to people with other chronic conditions.
- Factors associated with lower HL in people with psoriasis include lower educational attainment, lower psoriasis severity, lack of knowledge, lower self- efficacy, fewer comorbidities, shorter disease duration and lower quality of life.
- Assessing HL in psoriasis may guide and help tailor self-management support interventions.

Summary:

Background:

Health literacy (HL), the ability to seek, understand and utilize health information, is important for good health. Suboptimal HL has been associated with poorer health outcomes in other chronic conditions, although this has not previously been studied in patients with psoriasis.

Objectives: The aim of this study was to investigate the HL strengths and weaknesses of a cohort of patients with moderate to severe psoriasis. Another aim was to examine possible associations between patients' quality of life, their demographic, clinical and self-management characteristics and dimensions of HL.

Methods: A cross-sectional study was conducted. Data were collected from a cohort of patients with psoriasis who had participated in climate helio therapy from 2011-2016 (N= 825). HL was assessed by the Health Literacy Questionnaire (HLQ). The association between HL domains, demographic, clinical and self-management variables was analysed using bivariate correlation and a four-step linear multiple regression model.

Results: The scores on all HLQ dimensions indicate lower health literacy compared to other populations. The linear regression models showed a significant association between HL, quality of life and self-management variables, with higher HL predicting higher quality of life, self-efficacy, and psoriasis knowledge. Sex, educational attainment, age and disease severity had less influence on health literacy.

Conclusions: Improving HL may be a useful strategy for reducing disparities in self-management skills for patients with psoriasis. Interventions that aim to reduce disease severity and increase psoriasis knowledge, self- efficacy and quality of life may positively increase HL.

Key words: Psoriasis, health literacy, knowledge, quality of life and self- efficacy

Introduction

The worldwide prevalence of psoriasis ranges between 0.09% [1] and 11.9% [2] making psoriasis a substantial global problem. Psoriasis leads to disfiguration, disability and marked loss of productivity according to WHO`s "Global Report on psoriasis" [3]. There is also a significant negative impact on mental well-being, including higher rates of depression[4] and other burdens across the lifespan [5,6]and on society overall[7]. Thus, for many, a life with psoriasis includes physical[8,9], psychological [6,10] and economic[11] challenges. The cumulative impact of comorbidity risks related to psoriasis[12,13], in addition to time consuming skin treatments may also make treatment concordance and self-management difficult for the patients[14]. Given this biopsychosocial complexity and that of modern healthcare systems, the demands on these individuals in terms of self-management, healthcare system navigation, and communication with different healthcare professionals appear to have increased[5,15,16].

Among the numerous biopsychosocial factors, which may explain poor self-management in psoriasis, health literacy (HL), defined as an individual's capacity to seek, understand, and utilize health-information[17], has not yet been investigated. Suboptimal HL in people with chronic conditions such as asthma[18], diabetes [19] and COPD [20] is reported to be associated with limited disease knowledge[21], poor self-management skills [22] limited understanding of health information and lower engagement with

healthcare providers [23]. These factors also appear important for management of psoriasis, signifying that an investigation of HL among individuals with psoriasis is warranted.

Seeking treatment for psoriasis may be complex. Individuals may consult several healthcare professionals, consider multiple treatment options and receive large amounts of information on psoriasis, treatment, comorbidities and life style recommendations [24,25] The latter might be contradictory and delivered in a manner that the individual cannot easily understand. Patients' general knowledge of psoriasis is known to be low [26], especially knowledge related to the role of comorbidities [27,28]. Efficacious psoriasis care may require HL skills such as collaborative communication with healthcare providers[29,30], taking an active part in shared-decision making [16] and participation in self-management and goal setting [31-33] Yet people with HL weaknesses may lack the skills to accomplish such tasks and find it difficult to access and understand healthcare information and implement the recommended behaviours.

Conceptually, adequate health literacy in the context of psoriasis includes a constellation of skills that are critical for patients to manage their condition and navigate the health-care environment effectively. To the best of our knowledge, there are no specific HL studies of people with psoriasis, certainly none that have used the recently developed e comprehensive HLmeasures that include HL related to critical appraisal, social and communication skills[34]. Hence, the aim of the present study was to describe the HL of people with psoriasis using the Health Literacy Questionnaire (HLQ) a robust nine dimensional assessment tool. The study sought to investigate associations between HL and demographic, clinical, self-management related variables (such as self-efficacy and psoriasis knowledge) andquality of life in a cohort of patients with moderate to severe psoriasis.

Patients and methods

This paper is based on data from a cross sectional study with a cohort of 1275 adults who all had previously (once or several times from 2011 to 2017) participated in the Norwegian Climate Helio therapy (CHT) programme in Gran Canaria . Norwegian patients with psoriasis have been offered CHT since 1976 and the cost of the therapy is covered by the Norwegian Health Authorities. Climate therapy is offered to patients who may require hospitalization and frequent intensive outpatient care. CHT may also be part of a sequential or tailored treatment regimen for many patients [35]. Hence, CHT is a routine part of Norwegian psoriasis care. All participants aged 18 to 85 who had previously participated in CHT were invited by postal mail to participate and were sent the information, the consent form and the survey questionnaire including questions on health and demographics to their

home address. A late return/reminder letter was sent six weeks following the first mail-out. The data collection took place from March to August 2017. A total of 825 patients completed the questionnaire package (65% response rate).

Ethics

The study was approved by the Regional Committee for Medical Research Ethics for South East Norway (ID 2016/1745) and conducted in accordance with the Helsinki Declaration. The study was also approved by the administrative heads of the Section for Climate Therapy at Oslo University Hospital and the Centre for Privacy and Information Security at Oslo University Hospital.

Measures

The Health Literacy Questionnaire (HLQ) is a widely used measure of HL that has been translated and used in many countries.[34] The HLQ includes 44 items over nine independent scales, each representing a different element of the overall HL construct (Table 1). Each scale include four to six items. The first five scales comprise items asking the respondents to indicate level of agreement (ranging from strongly disagree to strongly agree (range 1 to 4)). The remaining scales (6–9) have domains of self-reported capability (range 1 to 5: 'cannot do' to 'very easy'). The questionnaire has no total score, as that could potentially mask individual needs in specific HL domains.[34] The HLQ appears robust for its intended purpose of assessing HL in a range of settings, and has shown excellent reliability.[36-38]

Self-Administrated Psoriasis Area and Severity Index (SAPASI)

SAPASI is a structured instrument that allows subjects to assess accurately the severity of their psoriasis. The questionnaire uses the same criteria as the Psoriasis Area and Severity Index (PASI), but is presented using non-professional terminology [39]. SAPASI scores range from 0 to 72 where higher score indicate a more severe illness (Cronbach alpha: 0.74).

Medical comorbidity is measured using an adapted and simplified version of the Self-Administered Comorbidity Questionnaire (SCQ-18) [40,41], where higher scores indicate a more severe comorbidity profile.

The Psoriasis Knowledge Questionnaire (PKQ) [42] assesses psoriasis knowledge based on 44 statements about psoriasis. The responses are reported as valid, uncertain or invalid, and the total calculated score range is 0–44, where higher scores indicate higher levels of knowledge (Cronbach alpha: 0.86).

The Dermatology Life Quality Index (DLQI) measures quality of life (QoL). It contains 10 questions concerning symptoms and feelings, daily activities, personal relationships and treatment [43] and is a frequently used QoL instrument in dermatology [44]. The scores for individual items (0–3) are added to yield a total score (0–30), where higher scores indicate greater impairment of a patient's QoL (Cronbach alpha: 0.90).

The **General Self-efficacy (GSE) scale** assesses the beliefs that one can perform novel or difficult tasks in life or cope with hardship [45]. The scale has 10 items with a response range from 1 (not at all true) to 4 (exactly true). Correspondingly, sum scores range from 10 to 40, where a higher score means higher self-efficacy (Cronbach alpha: 0.85).

Statistical analysis

Descriptive statistics report characteristics of the study population. The expectation maximization (EM) algorithm was used to impute missing HLQ item scores [46]. For all HLQ scales, assumptions of normal distribution were met.

To investigate associations between variables, bivariate correlation analysis (Pearson`s r) and hierarchical linear multiple regression analysis (enter method) were used. In the hierarchical multiple regression analyses the nine HLQ scales were used as the dependent variables, with four steps (presented in Table 2). In the result presentation the final step 4 is reported. Residuals had approximately normal distribution,, and tests for linearity were not statistically significant, indicating that all associations were approximately linear. All statistical analyses were performed using SPSS® version 25, p-values <0.05 were considered statistically significant.

Results

Descriptive data

The patient demographics are shown in Table 3. The mean (SD) age of participants was 53.3 years (SD 12.4), range 21 to 83, with 39 % of participants aged below 50 years. Females comprised 47.4 % of the sample and 14.3 % of the participants were currently receiving biological medicines. Previous histories of depression were noted in 35.5 % and 67% reported joint pain following psoriasis. The mean SAPASI and DLQI scores were 7.5 (SD 4.9) and 9.7 (SD 7.0) respectively. The participants reported medium 4.4 (SD 2.50) comorbidities ranging from 0 to 13.

The health literacy scales

Mean scores for each HLQ scale are shown in Table 4. The highest overall score was seen for scale 3. 'Actively managing health' (mean score 2.78 (SD 0.51)). The lowest score was for scale 5. 'Appraise health information' (mean score 2.54 (SD 0.54)).

For scale 6 to 9, highest and lowest scores were for scale 9. 'Ability to understand health information well enough to know what to do' (mean score 3.56 (SD 0.62)) and 7. 'Ability to navigate the healthcare system' (mean score 3.10 (SD 0.71)), respectively.

A total of 32 participants had missing data across one or more HLQ scales after the imputation procedure: no statistically significant differences were seen between those missing and not missing HLQ data, except that these 32 were significantly older: -6.46 (CI: -11.35, -1.57), p= 0.01.

Associations between health literacy domains and quality of life, demographic-, clinical- and self-management variables

The bivariate associations between demographic, clinical and self- management variables and QoL are presented in the first row of Table 5. The last step (i.e.4) in the analyses show the main results.

Regarding the demographic variables, age was not a significant predictor in any of the HL domains, and sex was only significant in the equation where scale 3. 'Actively managing my health' was the predicted variable. In this equation, men scored lower on actively managing their health (standardized beta (β) = .10**). A higher educational level was a significant predictor for HL in scale 8. 'Ability to find good health information' (β = .13**) and 9. 'Ability to understand health information well enough to know what to do' (β = .12**).

Concerning the clinical variables, less years with psoriasis was significant with higher HL in scale 8. 'Ability to find good health information', (β = -.08*). Less comorbidity was significantly related to higher HL in scales; 4. 'Having social support for health' (- β =.12**) and 7. 'Ability to navigate the healthcare system' (β = -.10***), while more comorbidity was related to higher HL in the first scale 'Feeling understood and supported by healthcare providers', (β = .08*). Higher disease severity measured by SAPASI showed a significant relationship to higher HL in scale 9. 'Ability to understand health information….'), (β = .08*) while numbers of Climate Helio Treatments attended was not related to any of the HLQ scales.

Higher QoL measured by DLQI was a significant predictor of higher HL in seven of the nine HLQ scales (β from = -.13*** to -.23***). Only the scales 3. 'Actively managing health' and 5.' Critical appraisal' were not related.

In terms of the self-management variables, higher self-efficacy showed a significant association with higher HL in all nine HLQ scales (β from = .20*** to .28***). Regarding psoriasis knowledge, the PKQ was a significant predictor in seven of the scales; only the scales 3. 'Actively managing health' and 4. 'Social support for health' was not related to higher psoriasis knowledge.

The fourth and final step in the linear regression model explained from 9.6 % to 22.1% of the variance in the HLQ scales (Table 5).

Discussion

This study provides the first step toward understanding the relationships connecting HL with sociodemographic and clinical variables, self-efficacy, knowledge and QoL in psoriasis. The demographics showed that this large psoriasis cohort was middle-aged with a relatively long disease duration and a rather high comorbidity profile. They had a mean SAPASI that indicated moderate illness severity, and their disease related QoL indicates that their lives are considerably affected by psoriasis [44].

Results suggest that this population has HL weaknesses. Their scores on HLQ appear to be lower than those shown in other studies with different populations from other countries [47-49], and included other chronic diseases [23,50]. It is concerning that a significant proportion of this psoriasis population reports lower scores in so many domains of HL. Especially, given that this study was undertaken in Norway, which has a universal healthcare system with numerous strategies encouraging patient centred care, patient participation and health communication. It seems particularly concerning with regard to the domains associated with understanding health information and navigating the healthcare system. This appears important since people with chronic conditions are increasingly expected to self-manage their own health [29,51].

A positive association between HL and disease severity (measured by SAPASI) was evident in the scale 9. 'Ability to understand health information well enough to know what to do'. This seems somewhat counterintuitive, however patients with severe psoriasis are likely to have had a long term

engagement with specialist care [52] and have received more education related to their treatment. The results showed significant associations between more comorbidity and lower HL with regard to scales 4. 'Have social support for health' and 7. 'Ability to navigate the healthcare system'. Given that most information available to patients is based on single disease guidance, this finding is not surprising. People with multiple conditions may find that two or more of their conditions have conflicting procedures and treatment recommendations [53] and may require more support to self-manage. With only 24% of individuals in this study having fewer than three comorbid diseases, the problem of single disease guidelines presents a significant challenge to an individual's cognitive capacity, and their capability ability to be suitably health literate about their conditions. For instance, a large Danish study of people with other long-term conditions found that having more than one long-term condition was associated with more difficulties engaging with healthcare providers and understanding health information [23]. Several studies identified that patients with psoriasis do not receive follow-up tailored to living with a complex long term disease [54,55], including a substantial cardiovascular burden [9,55]. Previous psoriasis research highlights that patients experience difficulties in relation to healthcare providers, especially doctors [56-58]. Concurrently, a rigid healthcare system with deficiency of communication across departments and specialties and different health service organization may also increase the burden for patients with multiple disorders and challenge HL[59].

Quality of life (QoL) was strongly associated with seven of the HLQ scales throughout the regression analyses. Several studies have explored the relationship between HL and QoL, but the results seem inconclusive. For example HL has no impact on HRQoL in patients with rheumatic diseases [60] or among frequent users of health care services [61] In contrast, a large cohort study of General Practices in the UK, found that poor HL was associated with lower scores of QoL (i.e. physical, psychological, social relationships and environment) [62]. In light of these conflicting results, it seems possible that the relationship between HL and QoL depends on certain aspects such as specific chronic diseases, cultural characteristics or other aspects of QoL. It seems plausible that interventions to strengthen HL in psoriasis may also have an additional positive impact on the participants' quality of life.

We found a significant association between HL and self-efficacy in all the HLQ scales. Knowing the value of self-efficacy to attain self-management [63] this is an important finding that supports previous research[22,64,65]. Patients with higher HL may feel more confident in their ability to pursue self-management behaviours and may be more likely to actually perform them[66]. Importantly one study that found self-efficacy to be the most important predictor of diabetes self-care, also found that although HL was positively associated with self-efficacy, and self-efficacy was positively associated with self-care behaviours, the correlation between HL and self-care behaviours was statistically insignificant. These results indicate that HL may be a possible antecedent to self-efficacy and that the influence of HL on self-care behaviours may be mediated through self-efficacy [67]. This possible association needs more research.

Better psoriasis knowledge, measured by the PKQ, was strongly correlated with higher HL in seven of the HLQ scales and predicted a relevant R^2 change in all HL scales. Similar results have been found in research investigating a variety of disease conditions [67-69]. Previous studies in psoriasis have demonstrated knowledge gaps concerning treatment and self-management [26,27,29], but the relationships to HL are not yet addressed. Findings from a study in patients with rheumatoid arthritis indicate that HL was independently associated with medication knowledge but not medication adherence [71]. In a review exploring the impact of HL on self-management skills in 31 chronic disease studies, a consistent association was found between low HL and poorer disease-related knowledge in the case of respiratory diseases, diabetes, and multiple disease categories [22]. A previous study within the same psoriasis population has shown that being a woman, higher education, higher PASI score and previous CHT participation were significantly associated with greater psoriasis-related knowledge [42]. It seems reasonable to expect that people with higher HL may be more aware of the importance of psoriasis knowledge to keep symptoms under control and also more prone to participate in patient education and self-management programmes. For patients with psoriasis with lower HL levels it may be difficult to adhere to complex treatment modalities and navigate lifestyle changes related to optimal self-management [14].

Unlike the prevailing literature [47,72,73], we did not find that lower education was associated with lower health literacy, other than in scale; 8. 'Ability to find good health information' ' and 9'. Ability to understand health information well enough to know what to do'. Since these scales indicate an ability to be an 'information explorer', using several informational sources and an ability to understand written information and adequately complete forms [46], the relationship with educational level seems obvious. Van der Heide et al[74] found in their mediation analysis that HL plays a larger role among those with lower education than among those with higher education.

To our knowledge, the present study is the first to relate the HLQ to psoriasis in primary care. An additional strength is the large sample size and representativeness of the sample, as well as the use of the comprehensive and valid measure HLQ[75].
Second, a little over two-thirds of all eligible patients (65%) agreed to take part in this study. This response rate is high, compared to the response rates for previous studies using similar methods within chronic care[62,76].

It is a limitation that HL was measured using a paper-based questionnaire, which by design, excluded illiterate individuals. Additionally, we only provided the Norwegian language version. This may have reduced the response rate from people with a non-Norwegian background. The study is also limited by the self-reported survey, without clinical verification of health conditions, such as the number of comorbidities or verified psoriatic arthritis, and these values could differ from information held in

medical records. Another limitation is the somewhat limited sample. All participants have undergone CHT and even though their ages ranged from 18 to 84 years, they were to a high degree middle-aged. This may reduce the generalizability of the results.

Initiatives for strengthening patients' role in healthcare may be improved by paying more attention to patients' HL. Health literacy enables people to build their knowledge, skills and potential to make positive behavioural changes and for example the teach-back method encourages patients to use their own words to describe what they have learned [77]

A systematic review [78] found that very different intervention types and settings were associated with changes in health literacy (in 73% of all studies). The review showed that both group and individual interventions of varying intensity in primary health care and community settings are useful in supporting sustained change in health literacy to foster change in behavioural risk factors. Unfortunately, HL interventions also tend to lack rigorous study design and therefore it may be premature to try to select the optimal interventions[79]. Improving health literacy training for health care professionals has received increasing emphasis in recent years[80]. However, the existing literature seems to be heavily skewed toward the field of medicine[81]. In psoriasis, based on our findings, improving HL may be a useful strategy for reducing disparities in self-management skills, self-efficacy and QoL. However, it appears that more research is needed to uncover the complex relationships and factors that interfere between these mechanisms, before we can tailor efficient interventions and improve healthcare.

ACKNOWLEDGEMENTS

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Table 1: Health Literacy questionnaire (HLQ) scales with indication of number of items and range of response categories (Norwegian version)

HLQ scales	Number of items	Response categories
1.Feeling understood and supported by healthcare providers	4	1:Strongly disagree, 2:Disagree, 3: Agree, 4: Strongly agree
2.Having sufficient information to manage my health	4	
3.Actively managing my health	5	
4.Social support for health	5	
5. Appraisal of health information	5	
6. Ability to actively engage with healthcare providers	5	1:Cannot do, 2: Very difficult; 3: Quite difficult; 4:Quite easy; 5: Very easy
7. Navigating the healthcare system	6	
8. Ability to find good health information	5	
9. Understanding health information well enough to know what to do.	5	

Table 2: The independent variables added in the four steps of the regression model

Step 1	age, sex, years living with psoriasis, educational attainment
Step 2	+ additional diseases, number of Climate helio therapy (CHT) treatments, disease severity (SAPASI) and Quality of life (DLQI)
Step 3	+ Self-efficacy (GSES)
Step 4	+ Psoriasis Knowledge (PKQ)

Table 3. Demographic and clinical characteristics from Norwegian patients with psoriasis participating in climate helio therapy (CHT) 2011-2016. (N= 825)

	N (%) / mean(SD) / Median (Range)
Female sex	390 (47.3%)
Age (years)	53.3 (12.4)
	(Range 18-83)
Marital status:	
Married/cohabiting	544 (66 %)
Unmarried/ Single	128 (15.5 %)139
Divorced/separated/widowed	(16.9 %)
Others	12 (1.4 %)
Level of education (N= 822)	
Prim/secondary school ≤ 10 years	94 (11.4%)
Vocational-/ High school ≤ 13 years	407 (49.3%)
College/university < 3years	182 (22.1%)
College/university ≥ 3years	139 (16.9%)
Duration of disease in years	27 (0 -77)
Health condition (VAS scale 0 -100),	60.11 (SD19.6)
Self-assessed health status (1–5 = poor - excellent)	3.33 (SD 0.92)
Current smoker **YES** (N=822)	193 (23.9%)
Number of CHT treatment	2 (1-39)
Biological medicines (N=811) **YES**	115 (14.2%)
Joint pain **YES**	551 (66.8%)
Joint pain & PsA affirmed by rheumatologist **YES**	254 (46.5%)
BMI	28.64 (5.30)
Number of comorbidities	4.4 (2.50)
SAPASI (0-72; higher score = more serious disease)	7.51 (4.93)
DLQI (0-30; higher score more impairment)	9 (0-30)
PKQ (0-44; higher score = more knowledge)	24.6 (7.26)
GSE (10- 40; higher score = higher self- efficacy)	30.20 (4.58)

PsA= Psoriasis arthritis, Body Mass Index (BMI), Self-Administrated Psoriasis and Severity Index (SAPASI), The Dermatology Life Quality Index (DLQI), Psoriasis Knowledge Questionnaire (PKQ), General Self efficacy Scale (GSE)

Table 4. Distribution of the Health Literacy Score scales (N=825)

HLQ scales	Range	N	Mean	SD
(1) Feeling understood and supported by healthcare providers	1-4	804	2.72	0.65
(2) Having sufficient information to manage my health	1-4	804	2.64	0.53
(3) Actively managing my health	1-4	804	2.78	0.51
(4) Social support for health	1-4	805	2.55	0.60
(5) Appraisal of health information	1-4	804	2.54	0.54
(6) Ability to actively engage with healthcare providers	1-5	798	3.39	0.73
(7) Navigating the healthcare system	1-5	798	3.10	0.71
(8) Ability to find good health information	1-5	797	3.40	0.64
(9) Understanding health information enough to know what to do	1-5	797	3.56	0.62

HLQ: The Health Literacy Questionnaire

Table 5. Relationship between independent and dependent variables by hierarchal multiple regression analysis (n=825) (r, standardized beta weights, adjusted R^2 and significance level)

Independent variables	(1) Feeling understood and supported by healthcare providers					(2) Having sufficient information to manage my health					(3) Actively managing health				
	r	Step 1 (β1)	Step 2 (β2)	Step 3 (β3)	Step 4 (β4)	r	Step 1 (β1)	Step 2 (β2)	Step 3 (β3)	Step 4 (β4)	r	Step 1 (β1)	Step 2 (β2)	Step 3 (β3)	Step 4 (β4)
Age (years)	.029	.01	-.02	-.02	.01	.04	.03	-.00	-.01	.04	.05	.05	.05	.05	.06
Sex (0=men, 1=women)	.016	-.00	.01	.02	.01	-.00	-.02	.01	.03	.01	.09**	.08*	.09*	.10*	.10**
Educational level 1-4 (higher score= higher level of education	.068*	.09*	.08*	.03	-.00	.18***	.18***	.15***	.08*	.04	.15***	.15***	.14***	.08*	.07
Years with Psoriasis	.040		.05	-.05	-.07	.056		-.01	-.01	-.04	.03		-.03	-.03	-.04
Quantity of comorbidities (higher score = more comorbidity)	-.002		.04	.08	.08*	-.16***		-.12**	-.06	-.07	-.03		-.04	.01	.01
SAPASI (Higher score = more severe disease)	-.07*		.02	-.01	.02	-.14***		-.06	-.07	-.06	-.05		-.027	-.04	-.03
Numbers of CHT (higher score= more climate treatments)	.11*		.12*	.11	.07	.10*		.12*	.10**	.06	.07		.08	.06	.05
Quality of life (DLQI)	-.16***		-.18***	-.17***	-.16***	-.21***		-.15**	-.14*	-.13**	-.05		-.01	.00	.00
Self-Efficacy (GSE) (higher score – better self-efficacy)	.22***			.21***	.20***	.34***			.29***	.28***	.26***			.25***	.24***
Psoriasis knowledge (PKQ) (Higher score = higher PSO knowledge)	.16***				.12**	.24***				.15***	.14***			.07	.05
Adjusted R^2		.00	.03	.07	.10		.03	.09	.16	.18		.03	.03	.08	.08
R^2 change			.04***	.04***	.01**			.06***	.07***	.02***				.06***	

Independent variables	(7) Ability to navigate the health care system		(8) Ability to find good health information		(9) Ability to understand health information well enough to know what to do

Independent variables	(4) Have social support for health					(5) Appraise health information					(6) Ability to actively engage with healthcare providers				
	r	Step 1 ($β_1$)	Step 2 ($β_2$)	Step 3 ($β_3$)	Step 4 ($β_4$)	r	Step 1 ($β_1$)	Step 2 ($β_2$)	Step 3 ($β_3$)	Step 4 ($β_4$)	r	Step 1 ($β_1$)	Step 2 ($β_2$)	Step 3 ($β_3$)	Step 4 ($β_4$)
Age (years)	.02	-.00	-.03	-.01	-.02	-.06*	-.07	-.07	-.07	-.01	.03	.03	-.00	.01	.03
Sex (0=men, 1=women)	.00	-.01	.05	.05	.06	.03	.01	.01	.03	-.01	-.06	-.07	-.04	-.02	-.03
Educational level 1-4 (higher score= higher level of education	.07	.07	.03	-.02	-.04	.14***	.14***	.14***	.08*	.02	.14***	.15***	.12**	.05	.02
Years with Psoriasis	.04		.01	.03	-.002	-.03		-.04	-.04	-.08*	.049		.00	-.01	-.02
Quantity of comorbidities (higher score = more comorbidity)	-.19***		-.17***	-15***	-.12**	-.02		.00	.06	.05	-.13***		-.08*	-.03	-.03
SAPASI (Higher score = more severe disease)	-.05		-.07	-.04	-.06	-.05		-.06	-.07	-.06	-.08*		-.03	-.02	.02
Numbers of CHT (higher score= more climate treatments)	.08		.09	.07	.06	.07		.10**	.08*	.02	.08		.08*	.065	.04
Quality of life (DLQI)	-.19***		-.20***		-,19***	-.01			.04	.05	-.22***		-.21***	-.19***	-.18***
Self-Efficacy (GSE) (higher score – better self-efficacy)	.29***			.26***	.25***	.29***		.02	.29***	.27***	.33***			.28***	.28***
Psoriasis knowledge (PKQ) (Higher score = higher PSO knowledge)	.12**				.05	.27***				.23***	.17***				.12**
Adjusted R²		.00	.07	.12	.12		.02	.02	.10	.14		.02	.07	.14	.15
R² change			.07***	.057***				.03**	.08***	.04***			.03***	.05***	.07***	.01**

	r	Step 1 (β1)	Step 2 (β2)	Step 3 (β3)	Step 4 (β4)	r	Step 1 (β1)	Step 2 (β2)	Step 3 (β3)	Step 4 (β4)	r	Step 1 (β1)	Step 2 (β2)	Step 3 (β3)	Step 4 (β4)
Age (years)	.04	.04	-.01	-.02	.02	-.06	-.06	-.08	-.08	-.01	-.05*	-.05	-.05	-.05	.00
Sex (0=men, 1=women)	-.03	-.04	.00	.02	.00	-.002	-.03	-.00	.02	-.01	.02	-.01	.03	-.05	.03
Educational level 1-4 (higher score= higher level of education	.16***	.17***	.12**	.07	.04	.27***	.28***	.25***	.19***	.13**	.26***	.26***	.23***	.18***	.12**
Years with Psoriasis	.09**		.03	.03	.01	-.02		-.04	-.04	-.08*	-.02		-.05	-.06	-.09*
Quantity of comorbidities (higher score = more comorbidity)	-.19***		-.14***	-.010*	-.10***	-.14***		-.07	-.02	-.03	-.14***		-.09*	-.05	-.05
SAPASI (Higher score = more severe disease)	-.15***		-.01	-.021	-.02	-.12**		-.01	-.08	-.01	-.02		.08	.07	.08*
Numbers of CHT (higher score= more climate treatments)	.11*		.12*	.10**	.07	.04		.08*	-.06	.00	.07		.10*	.08*	.02
Quality of life (DLQI)	-.29***		-.25***	-.24***	-.23***	-.21***		-.18***	-.17***	-.16***	-.14***		-.16**	-.14***	-.13*
Self-Efficacy (GSE) higher score – better self-efficacy)	.30***			.23***	.23***	.32***			.25***	.23***	.31***			.24***	.23***
Psoriasis knowledge (PKQ) (Higher score = higher PSO knowledge)	.20***				.13**	.33***				.26***	.29***				.22***
Adjusted R2		.03	.13	.17	.18		.07	.11	.17	.22		.06	.09	.14	.18
R2 change			.11***	.05***	.01*			.05***	.06***	.05***			.04***	.05***	.04***

Step1: Standardized beta weights using **age, sex and educational attainment** as independent variables. Step 2: Standardized beta weights using age, sex, educational attainment, **years living with psoriasis, additional diseases, SAPASI, numbers of CHT and quality of life (DLQI)** as independent variables. Step 3: Standardized beta weights using age, sex, educational attainment, years living with psoriasis, additional diseases, SAPASI, numbers of CHT, quality of life and **self- efficacy (GSE)** as independent variables. Step4: Standardized beta weights using age, sex, years living with psoriasis, educational attainment, additional diseases, SAPASI, numbers of CHT, quality of life, self-efficacy and **Psoriasis Knowledge (PKQ)** as independent variables. *Significant at the .05 level, ** Significant at the .01 level, ***Significant at the .001 level