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Original article

Telepharmacy follow-up using electronic patient-reported outcome measures in moderate-to-severe psoriasis

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ABSTRACT

Introduction: Psoriasis is a chronic immune-mediated disease with a substantial impact on health-related quality of life (HRQoL), particularly in moderate-to-severe cases requiring systemic treatment. The integration of electronic patient-reported outcome measures (ePROMs) into telepharmacy platforms has emerged as a valuable approach for longitudinal monitoring and patient-centered care. The TELEPROMpsoriasis study aimed to evaluate the 12-month evolution of HRQoL and symptom burden in patients with moderate-to-severe psoriasis treated with biologic or small-molecule inhibitors and followed through a telepharmacy program, to assess the achievement of predefined HRQoL targets (DLQI ≤1 and PSSD-7 days <20), and to explore differences according to treatment history and sex.

Methods: A multicenter, prospective study was conducted using the NAVETA telepharmacy platform within the Spanish National Health System. Adult patients with moderate-to-severe plaque psoriasis initiating or switching biologic or immunomodulatory therapy were included. HRQoL was assessed using the Dermatology Life Quality Index (DLQI) and the Psoriasis Symptoms and Signs Diary (PSSD-7 days) at baseline and at months 1, 3, 6, and 12. Longitudinal analyses were performed using non-parametric tests, accounting for variable response rates across follow-up visits.

Results: A total of 210 patients were enrolled; 188 provided at least one validated ePROMs response and were eligible for longitudinal analyses. Both DLQI and PSSD-7 day scores showed significant and progressive improvement over 12 months, with a strong correlation between instruments throughout follow-up ($r = 0.74$ at month 12). Biologic-naïve patients achieved higher rates of clinically relevant HRQoL improvement than biologic-experienced patients, particularly at later follow-up visits. Women consistently reported higher symptom burden and lower HRQoL than men. No significant differences in HRQoL trajectories were observed across pharmacological classes. By month 12, more than half of the cohort achieved optimal HRQoL targets. Adherence to questionnaire completion was 71%, and overall satisfaction with the telepharmacy program was high (9/10).

Conclusions: Telepharmacy-supported monitoring using validated ePROMs effectively captures longitudinal changes in HRQoL and symptom burden in patients with moderate-to-severe psoriasis. The achievement of

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predefined HRQoL targets supports their clinical relevance in real-world settings. These findings highlight the value of PROM-based, patient-centered digital follow-up and suggest that biologic-experienced patients and women may benefit from more tailored monitoring strategies.

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Seguimiento mediante telefarmacia utilizando cuestionarios electrónicos de resultados comunicados por los pacientes en psoriasis moderada a grave

Palabras clave:
Telefarmacia
Psoriasis
Medidas de resultados comunicados por los pacientes (PROMs)
Calidad de vida
NAVETA
Terapia biológica
Telemedicina

R E S U M E N

Introducción: La psoriasis es una enfermedad inflamatoria crónica mediada por el sistema inmunitario que tiene un impacto significativo en la calidad de vida relacionada con la salud (CVRS), especialmente en los casos moderados y graves que requieren tratamiento sistémico. La integración de medidas de resultados comunicados por los pacientes en formato electrónico (ePROMs) en plataformas de telefarmacia ha adquirido relevancia como herramienta para el seguimiento longitudinal y la atención centrada en el paciente. El estudio TELEPROMpsoriasis tuvo como objetivo evaluar la evolución de la CVRS y la carga de síntomas durante 12 meses en pacientes con psoriasis moderada-grave tratados con fármacos biológicos o pequeñas moléculas y seguidos mediante un programa de telefarmacia, analizar el logro de objetivos clínicos de CVRS (DLQI ≤1 y PSSD-7 días <20) y explorar diferencias según el historial terapéutico y el sexo.

Métodos: Se realizó un estudio multicéntrico y prospectivo utilizando la plataforma de telefarmacia NAVETA en el Sistema Nacional de Salud. Se incluyeron pacientes adultos con psoriasis en placas moderada-grave que iniciaban o cambiaban tratamiento biológico o inmunomodulador. La CVRS se evaluó mediante el Dermatology Life Quality Index (DLQI) y el Psoriasis Symptoms and Signs Diary (PSSD-7 días) en el momento basal y a los 1, 3, 6 y 12 meses. Los análisis longitudinales se realizaron mediante pruebas no paramétricas, teniendo en cuenta la variabilidad en la tasa de respuesta a lo largo del seguimiento.

Resultados: Se incluyeron 210 pacientes, de los cuales 188 aportaron al menos una respuesta válida a los ePROMs y fueron elegibles para los análisis longitudinales. Tanto el DLQI como el PSSD-7 días mostraron una mejoría significativa y progresiva durante los 12 meses de seguimiento, con una fuerte correlación entre ambos instrumentos a lo largo del tiempo ($r = 0{,}74$ a los 12 meses). Los pacientes biológicamente naïve alcanzaron mayores tasas de mejora clínicamente relevante de la CVRS en comparación con los pacientes con experiencia previa en biológicos, especialmente en los meses finales del seguimiento. Las mujeres informaron de forma consistente una mayor carga de síntomas y peor CVRS que los hombres. No se observaron diferencias significativas en la evolución de la CVRS entre las distintas clases farmacológicas. Al finalizar el seguimiento, más de la mitad de la cohorte alcanzó objetivos óptimos de CVRS. La adherencia a la cumplimentación de los cuestionarios fue del 71% y el grado de satisfacción global fue elevado (9/10).

Conclusiones: El seguimiento mediante telefarmacia apoyado en ePROMs validados permite capturar de forma eficaz la evolución longitudinal de la CVRS y la carga sintomática en pacientes con psoriasis moderada-grave en la práctica clínica real. El logro de objetivos predefinidos de CVRS confirma su relevancia clínica. Estos resultados refuerzan el valor de la atención digital centrada en el paciente y sugieren que determinados subgrupos, como los pacientes con experiencia previa en biológicos y las mujeres, podrían beneficiarse de estrategias de seguimiento más personalizadas.

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Introduction

Psoriasis is a chronic, immune-mediated inflammatory skin disease that affects approximately 2–3% of the global population. Clinically, it is characterized by well-demarcated erythematous plaques with silvery scales, often involving the scalp, elbows, knees, and lower back. The disease course is typically chronic and relapsing, with variable severity across individuals. Severity is commonly classified as mild, moderate, or severe based on the Psoriasis Area and Severity Index (PASI), the Body Surface Area (BSA) affected, and the Physician's Global Assessment (PGA), which are also standard measures in pivotal clinical trials assessing therapeutic efficacy.[1]

Around one-third of patients present with moderate-to-severe forms of the disease,[1] which often require either traditional systemic therapies (e.g., methotrexate, cyclosporine) or biologic agents and small-molecule inhibitors, as topical treatments and phototherapy are usually insufficient at these stages. Beyond its cutaneous manifestations, psoriasis significantly affects patients' health-related quality of life (HRQoL), interfering with daily activities, impacting physical appearance, and contributing to social stigmatization.[2] In Spain, the estimated prevalence of psoriasis is approximately 2.3% of the population, with no significant differences between sexes,[3] reflecting a considerable disease burden at the national level as well.

Improvements in patient-reported outcomes may vary depending on patient characteristics and treatment type.[4] Differences related to gender have been observed, with women generally reporting greater impairment in HRQoL compared to men, even at equivalent levels of clinical severity.[2] Other demographic and clinical factors may also influence both the initial impact of psoriasis and the treatment response.[5,6]

Regarding therapeutic approaches, biologic and immunomodulatory therapies have significantly improved HRQoL outcomes in moderate-to-severe psoriasis.[7] Indeed, the proportion of patients achieving a DLQI score of 0–1 (indicating no impact on daily life) increases markedly after the initiation of biologic agents compared to traditional systemic treatments.[8] However, the magnitude of this benefit can vary between therapeutic classes. Evidence from multiple comparative clinical trials and meta-analyses indicates that therapies targeting the IL-17 and IL-23 pathways achieve greater improvements in both clinical severity and patient-reported outcomes compared with TNF-α inhibitors.[9–11]

Indeed, the proportion of patients achieving a DLQI score of 0–1 (indicating no impact on daily life) increases markedly after the initiation of biologic agents compared to traditional systemic treatments 4.[12,13] In pivotal clinical trials, therapies targeting IL-17 and IL-23 pathways (such as secukinumab, ixekizumab, or guselkumab) have shown PASI 90 response rates above 70%, alongside consistent HRQoL improvement, confirming their superiority over earlier TNF-α inhibitors.[14]

In recent decades, the systematic use of Patient-Reported Outcome Measures (PROMs) has transformed the evaluation of health outcomes, particularly in domains related to HRQoL, by incorporating the patient's perspective into clinical practice and research.[2] PROMs were developed to complement clinician-reported measures, capturing the subjective impact of disease and treatment on daily functioning and well-being. Their implementation has progressively expanded across multiple chronic conditions, including dermatological diseases.[15] In psoriasis, PROMs have been increasingly adopted in clinical trials and real-world studies to quantify the burden of symptoms and to evaluate therapeutic benefit beyond clinical signs. Although early pivotal trials primarily focused on objective outcomes such as the Psoriasis Area and Severity Index (PASI), more recent studies have integrated PROMs as secondary or even co-primary endpoints, underscoring their relevance in assessing patient-centered outcomes.[16]

To objectively assess this impact and longitudinally monitor therapeutic outcomes, PROMs are widely used. The Dermatology Life Quality Index (DLQI) is one of the most validated and internationally utilized PROMs for evaluating the burden of psoriasis on patients' quality of life.[8] Additionally, the Psoriasis Symptoms and Signs Diary (PSSD) is a psoriasis-specific PROM that records, over a seven-day period, the intensity of key symptoms (e.g., itching, pain, burning) and signs (e.g., redness, scaling, cracking).[9] Further information and practical recommendations on the use of PROMs in dermatology and psoriasis can be found in international guideline and consensus documents.[17,18]

In recent years, the role of telepharmacy has emerged as an innovative tool to improve the follow-up of patients with psoriasis and other chronic diseases. Internationally, telepharmacy is increasingly implemented across various healthcare settings and has been evaluated in numerous studies, showing improvements in clinical outcomes, patient satisfaction, and healthcare efficiency.[2,19] Telepharmacy applies telemedicine principles to pharmacy practice, allowing safe, flexible, and patient-centered pharmaceutical care delivery remotely. Through information technologies, close pharmacotherapeutic follow-up can be maintained, including remote monitoring of clinical parameters and electronic collection of PROMs (ePROMs) to assess patient progress, as clearly emphasized in a recent MAPEX guidance document published by the Spanish Society of Hospital Pharmacy (SEFH).[20] In accordance with this framework, SEFH has defined key domains for telepharmacy —including therapeutic monitoring, patient education, multidisciplinary collaboration, and remote medication delivery—that support the structured integration of ePROMs into routine care. This comprehensive model reinforces equity and personalization in patient follow-up, offering a solid foundation for implementing telepharmacy strategies in the management of psoriasis.

Within this context, the TELEPROMpsoriasis study aimed to evaluate the evolution of HRQoL and cutaneous symptoms over 12 months in a cohort of patients with moderate-to-severe plaque psoriasis treated with biologic or small-molecule inhibitors and monitored through the NAVETA telepharmacy platform. The study employed two validated ePROMs—the DLQI and PSSD-7 days—to longitudinally monitor clinical response and patient well-being. Additionally, it explored the achievement of predefined clinical thresholds (DLQI ≤1 and PSSD-7 days <20) and assessed whether these outcomes differed by treatment history (biologic-naïve vs biologic-experienced) or gender. Finally, the study examined the correlation between the two instruments to evaluate their concurrent validity in remote patient monitoring.

Methods

Ethics Approval: TELEPROMpsoriasis study is part of a wider project with approval by the Research Ethics Committee of the Balearic Islands (IB 4542/21 EOm).

Study design and recruitment

This multicenter, prospective, observational study was conducted within the Spanish public health system. Adult patients with moderate-to-severe plaque psoriasis were recruited during outpatient pharmacy consultations and were prospectively followed for 12 months. The study period extended from May 2022 to March 2025.

Inclusion and exclusion criteria

Eligible participants in the TELEPROMpsoriasis study were adult patients with moderate-to-severe plaque psoriasis, initiating or switching to treatment with biologic or small-molecule inhibitors (e.g., TNF-α, IL-12/23, IL-17, IL-23 inhibitors). Inclusion required basic digital literacy and access to electronic devices to interact with the NAVETA platform. All participants provided written informed consent prior to enrollment. Exclusion criteria included age under 18, inability to provide clinical data, or lack of informed consent, ensuring the ethical and methodological integrity of the study population.

Study parameters, data collection, and evaluation tools

Baseline demographic, clinical, and lifestyle data were collected using a standardized questionnaire integrated into the NAVETA platform. Variables included age, sex, BMI (body mass index), employment, education, lifestyle habits (alcohol, tobacco, physical activity), comorbidities (e.g., psoriatic arthritis), housing, and patient association membership. NAVETA, developed with FARUPEIB (Farmacéuticos de Unidades de Pacientes Externos de Illes Balears [Pharmacists of Outpatient Units of the Balearic Islands]) and BiblioPRO, operates independently of EMRs (electronic medical records) and complies with EU and Spanish data protection laws. A detailed description of the NAVETA telemonitoring system is available elsewhere.[21] As all data fields in NAVETA were non-mandatory, the number of valid responses (n) varied across variables due to occasional missing entries.

The NAVETA platform also included a secure chat module enabling bidirectional communication between patients and hospital pharmacists for treatment-related inquiries, adherence reinforcement, or technical assistance. Patient satisfaction with the telepharmacy service was assessed at month 6 through a 0–10 Likert-type scale.

Data were collected at baseline and at months 1, 3, 6, and 12. Patients interacted asynchronously via NAVETA's integrated chat, with engagement assessed by patient-initiated messages. Missing data were managed with automated reminders and selective exclusion from analyses requiring unavailable variables. Outliers were retained to preserve population variability, and analyses used unadjusted raw values. Two validated and culturally adapted to Spanish ePROMs were administered at each timepoint: the 7-day PSSD and DLQI. The PSSD evaluated 5 symptoms and 6 signs on a 0–10 scale, producing summary scores ranging from 0 to 100, where lower scores indicate fewer symptoms. The DLQI assessed HRQoL across six domains (range: 0–30), with lower scores reflecting lower impact on daily life. Moreover, patient satisfaction was evaluated at month 6 via a 0–10 Likert scale.

Analysis of longitudinal changes in ePROMs

Longitudinal changes in ePROMs were evaluated using non-parametric statistical approaches due to the presence of missing

Table 1
Patient characteristics.

Variable	Category	*n* (%)
Sociodemographic and lifestyle variables		
Gender	Male	90 (47.37)
	Female	100 (52.63%)
Age group	21–45 years	75 (39.5%)
	46–65 years	96 (50.5%)
	66–75 years	14 (7.4%)
	76–100 years	3 (1.6%)
	Not reported	2 (1.1%)
BMI category	Underweight (<18.5)	3 (1.6%)
	Normal weight (≥18.5)	65 (34.2%)
	Overweight (25–29.9)	57 (30%)
	Obesity (≥30)	65 (34.2%)
Physical activity	Regular	51 (26.8%)
	Occasional	71 (37.4%)
	Never	30 (15.8%)
	Not reported	38 (20.0%)
Balanced diet	Occasional	63 (33.2%)
	Regular	80 (42.1%)
	Never	9 (4.7%)
	Not reported	38 (20.0%)
Patient association membership	Yes	5 (2.6%)
	No	184 (96.8%)
	Not reported	1 (0.5%)
Marital status	Single	61 (32.1%)
	Married/Cohabitating	102 (53.7%)
	Divorced	19 (10%)
	Widowed	5 (2.6%)
	Not reported	3 (1.6%)
Education level	<Primary Education	4 (2.1%)
	Primary Education	31 (16.3%)
	Secondary Education	51 (26.8%)
	Vocational Training	62 (32.6%)
	Bachelor's or Higher	39 (20.5%)
	Doctorate	3 (1.6%)
Employment status	Employed	120 (63.2%)
	Unemployed	33 (17.4%)
	Retired	18 (9.5%)
	Temporary Leave	10 (5.3%)
	Permanent Leave	2 (1.1%)
	Student	7 (3.7%)
Alcohol consumption	Never	53 (27.9%)
	Occasional	93 (48.9%)
	Weekends only	35 (18.4%)
	Daily	9 (4.7%)
Smoking status	Never	48 (25.3%)
	Former smoker	51 (26.8%)
	Current smoker	53 (27.9%)
	Not reported	38 (20.0%)
Caffeine consumption	Never	24 (12.6%)
	Occasional	52 (27.4%)
	Habitual	76 (40.0%)
	Not reported	38 (20.0%)
Patient group	Biologic Naïve	125 (65.8%)
	Biologic experienced	64 (33.7%)
	Not reported	1 (0.5%)
Treatment classification		
Biologic-naïve	Anti-TNF	112 (60.2%)
	Anti-IL-23	44 (23.7%)
	PDE-4 Inhibitors	9 (4.8%)
	Anti-IL-17	19 (10.2%)
	Anti-IL-12/23	2 (1.1%)
Biologic-experienced	Anti-TNF	58 (30.5%)
	Anti-IL-23	8 (4.2%)
	PDE-4 Inhibitors	6 (3.2%)
	Anti-IL-17	2 (1.1%)
Treatment discontinuation	Therapeutic failure	22 (47.8%)
	Adverse events	13 (28.3%)
	Patient decision	6 (13%)
	Other causes	4 (8.7%)
	Pregnancy	1 (2.2%)
Comorbidities		
Hypercholesterolemia		100 (52.9%)
Hypertension		32 (16.9%)
Diabetes mellitus		22 (11.6%)
Renal insufficiency		3 (1.6%)
Liver insufficiency		1 (0.5%)

n (%): absolute and relative frequencies. The total number of responses varies due to non-mandatory fields and missing data. "Not reported" indicates variables for which information was not available or could not be reliably categorized based on patient-provided data.

questionnaire responses and varying sample sizes across follow-up visits. Specifically, Kruskal–Wallis tests were applied to compare score distributions across follow-up time points and between subgroups at each visit, avoiding assumptions of complete repeated measures and within-subject correlation required by classical repeated-measures models. Where appropriate, post-hoc pairwise comparisons were performed using Dunn's test with adjustment for multiple comparisons. Variance homogeneity was assessed using Levene's test to guide the choice of statistical procedures.

Patients were stratified into three predefined therapeutic trajectory groups: Group 1 (biologic-naïve), comprising patients initiating their first biological treatment; Group 2, including those with up to two previous biologic drugs; and Group 3, consisting of patients with three or more prior biologic treatment lines. This classification was determined by the hospital pharmacist, recorded in the NAVETA platform, and used to explore differences in ePROM score distributions across follow-up visits.

The association between DLQI and PSSD-7 day scores was assessed using Pearson correlation coefficients across all available time points. To explore clinically meaningful outcomes, Chi-square tests were applied to evaluate differences in the proportion of patients achieving predefined thresholds of improvement (DLQI ≤1 and PSSD-7 days <20).

All statistical tests were two-sided, with a significance level set at $p < 0.05$. Statistical analyses were performed using Origin (version 2021, OriginLab Corporation, Northampton, MA, USA).

Results

Cohort description

A total of 210 patients with moderate-to-severe plaque psoriasis treated with biologic agents or small-molecule inhibitors were enrolled and monitored through the NAVETA platform for up to 12 months. Of these, 190 patients were included in the baseline descriptive analysis, which constitutes the basis for the sociodemographic and lifestyle characteristics presented in Table 1. Among them, 188 patients provided at least one validated questionnaire response—defined as questionnaires completed with sufficient data quality and internal consistency—and were therefore eligible for inclusion in the longitudinal analyses of ePROMs.

The baseline cohort showed a balanced gender distribution (52.6% female), was predominantly aged 46–65 years (50.5%), and presented a high prevalence of overweight or obesity (64.2%). Detailed sociodemographic and lifestyle characteristics are summarized in Table 1.

At baseline, 65.8% of participants were biologic-naïve, while 33.7% were biologic-experienced. Among biologic-naïve patients, anti-TNF agents were the most frequently initiated therapies (60.2%), followed by anti-IL-23 agents (23.7%), anti-IL-17 agents (10.2%), PDE-4 inhibitors (4.8%), and anti-IL-12/23 agents (1.1%). Among biologic-experienced patients, anti-TNF agents were the most common prior treatment (30.5%), followed by anti-IL-23 agents (4.2%), PDE-4 inhibitors (3.2%), and anti-IL-17 agents (1.1%).

Treatment persistence—defined as the duration from treatment initiation to the last dose before discontinuation—was 87%. Among patients who discontinued treatment, the most frequent reason was therapeutic failure (47.8%), followed by adverse events (28.3%), patient

decision (13.0%), other causes (8.7%), and pregnancy (2.2%). Hypercholesterolemia (52.9%), hypertension (16.9%), and diabetes mellitus (11.6%) were the most prevalent comorbidities, reflecting a substantial metabolic burden in this population.

Finally, during the study period, 132 chat-based interactions were recorded, involving 86 patients (40% of the cohort). The adherence rate to questionnaire completion was 71%, defined as the proportion of completed questionnaires relative to the total number of questionnaires sent during follow-up, and the overall satisfaction score was 9 out of 10.

Evolution of HRQoL

For the overall PSSD-7 day score (Fig. 1a, Table 2), a steady decrease in mean scores was observed across successive follow-up visits, from baseline to month 12. Differences between follow-up time points were statistically significant (Kruskal–Wallis test, $p < 0.001$), and post-hoc Dunn tests confirmed significantly lower scores at all subsequent visits compared with baseline (all $p < 0.001$). Comparable patterns were observed for both the signs and symptoms subscales, which showed marked reductions from baseline to month 12 (both $p < 0.001$).

When stratified by gender (Fig. 1b, Table 2), women consistently reported higher PSSD-7 day scores than men at all assessed time points. Statistically significant differences were observed at baseline and at months 3 and 6, whereas differences at month 1 and month 12 did not reach statistical significance. This pattern was also reflected in the signs and symptoms subscales, with women reporting higher scores at most follow-up visits.

Finally, PSSD-7 day scores were analyzed according to previous treatment status (Fig. 1c, Table 2). At baseline, biologic-naïve patients showed lower overall scores compared with patients previously treated with biologics. This between-group difference was maintained at month 3 and remained evident at month 12, with biologic-naïve patients consistently reporting lower scores.

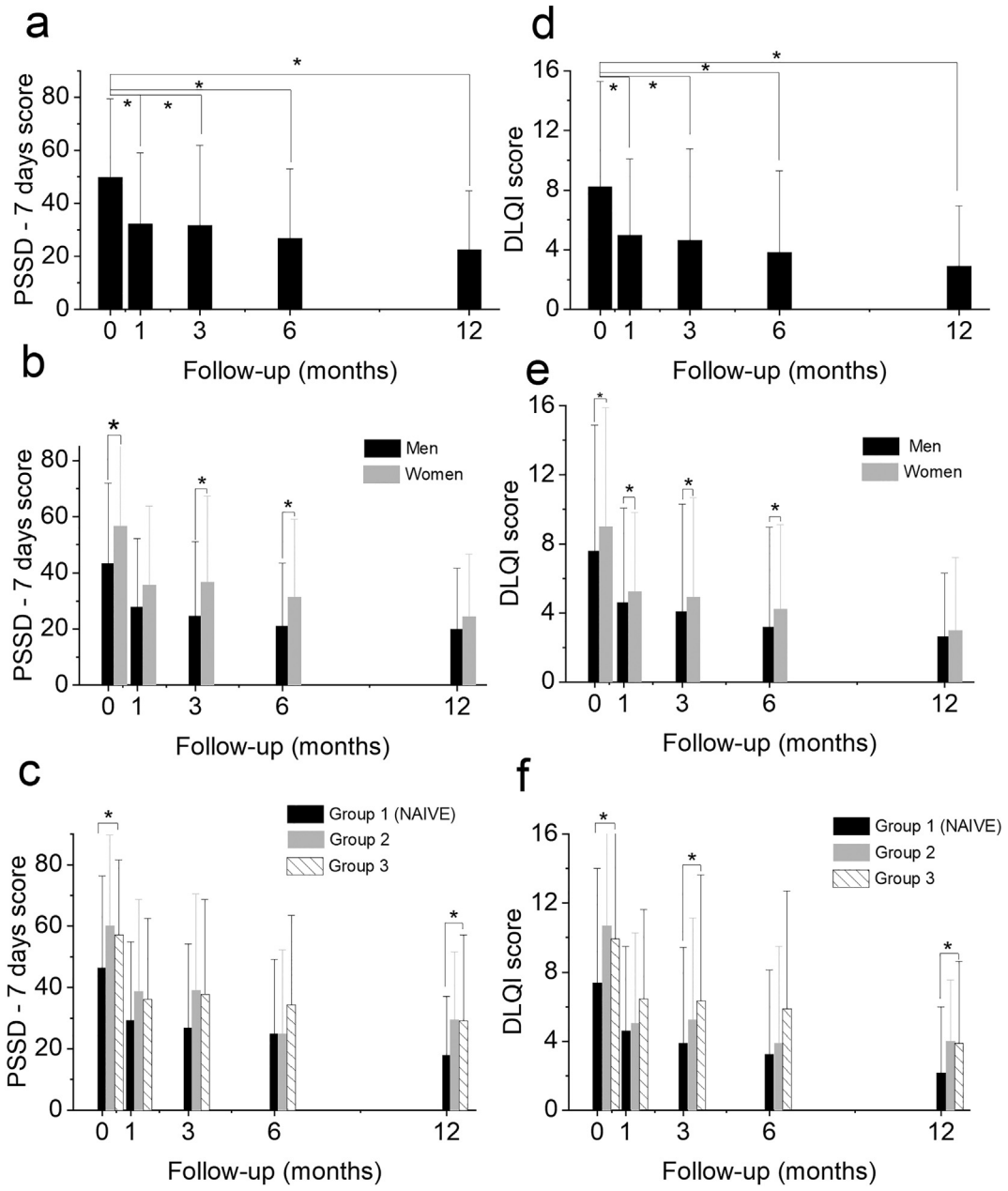

Figure 1. ***Evolution of PSSD-7 days and DLQI scores over 12 months of follow-up.*** Bar plots show the progression of patient-reported outcomes (a,d: overall), stratified by gender (b, e: men vs. women), and by treatment history (c, f: Group 1: biologic-naïve; Group 2: 2 previous biologics; Group 3: ≥3 previous biologics).

Table 2
PSSD-7 day scores across follow-up visits, overall and stratified by gender and previous treatment status.

A. Overall population				
PROM	**Follow-up (month)**	**Mean ± SD**	***n***	***p*-value**
PSSD-7 days (Overall score)	0	49.7 ± 29.7	182	<0.001
	1	32.3 ± 26.7	197	<0.001
	3	31.8 ± 30.0	198	<0.001
	6	26.8 ± 26.3	191	<0.001
	12	22.5 ± 22.2	168	<0.001
B. Overall PSSD-7 day score by gender				
	Follow-up (month)	**Gender**	**Mean ± SD**	***n***	***p*-value**
PSSD-7 days (Overall score)	0	Men	43.3 ± 28.7	81	0.004
	0	Women	56.6 ± 29.2	93	0.004
	1	Men	27.8 ± 24.4	86	0.063
	1	Women	35.6 ± 28.2	101	0.063
	3	Men	24.7 ± 26.5	87	0.002
	3	Women	36.7 ± 30.7	105	0.002
	6	Men	21.0 ± 22.5	94	0.004
	6	Women	31.4 ± 27.7	91	0.004
	12	Men	20.1 ± 21.6	77	0.070
	12	Women	24.4 ± 22.3	86	0.070
C. Overall PSSD-7 days score by previous treatment group				
	Follow-up (month)	**Previous treatment group**	**Mean ± SD**	***n***	***p*-value**
PSSD-7 days (Overall score)	0	Biologic-naïve	46.5 ± 29.8	122	0.036
	0	Group 2	60.0 ± 29.7	32	0.036
	0	Group 3	57.1 ± 24.4	21	0.036
	1	Biologic-naïve	29.2 ± 25.7	128	0.107
	1	Group 2	38.8 ± 29.9	35	0.107
	1	Group 3	36.2 ± 26.3	25	0.107
	3	Biologic-naïve	26.8 ± 27.4	127	0.030
	3	Group 2	39.1 ± 31.3	35	0.030
	3	Group 3	37.8 ± 30.8	28	0.030
	6	Biologic-naïve	24.9 ± 24.2	123	0.248
	6	Group 2	24.8 ± 27.4	38	0.248
	6	Group 3	34.3 ± 29.2	24	0.248
	12	Biologic-naïve	17.9 ± 19.2	101	0.007
	12	Group 2	29.5 ± 22.2	38	0.007
	12	Group 3	29.1 ± 28.1	24	0.007

Note: *p*-values correspond to Kruskal–Wallis tests comparing score distributions across groups at each follow-up visit. Sample sizes vary across visits due to missing questionnaire responses.

A comparable pattern was observed for DLQI scores (Fig. 1d–f, Table 3), with mean values decreasing across successive follow-up visits from baseline to month 12. Differences between follow-up time points were statistically significant (Kruskal–Wallis test, $p < 0.001$), and post-hoc Dunn tests confirmed significantly lower scores at all subsequent visits compared with baseline.

When stratified by gender (Fig. 1e, Table 3), women reported higher DLQI scores than men at baseline and at months 1, 3, and 6, whereas no statistically significant difference was observed at month 12. This pattern indicates persistent gender-related differences during early and mid-follow-up, which attenuated over time.

Analysis by previous treatment status (Fig. 1f, Table 3) showed lower DLQI scores in biologic-naïve patients at baseline, with between-group differences re-emerging at month 12. No statistically significant differences were observed between treatment groups at intermediate follow-up visits.

Achievement of clinical targets in HRQoL: DLQI ≤1 and PSSD-7 Days <20 by treatment history and gender

The proportion of patients achieving optimal HRQoL, defined as DLQI ≤1, increased steadily over the 12-month follow-up, with a marked rise from baseline to month 12 (Table 4). This improvement was more pronounced among biologic-naïve patients, who consistently showed higher rates of target attainment than biologic-experienced patients, with significant between-group differences observed at month 12.

Gender-stratified analyses indicated higher DLQI ≤1 achievement rates among men during the intermediate follow-up visits, whereas no significant differences were observed at baseline or at month 12.

A comparable pattern was observed for the PSSD-7 days <20 threshold. The proportion of patients reaching this target increased progressively throughout follow-up, with biologic-naïve patients again showing more favorable outcomes, particularly at months 3 and 12. Gender differences favored men at baseline and at month 6, while no statistically significant differences were detected at the end of follow-up.

Overall, these findings indicate a sustained increase in the proportion of patients achieving clinically relevant HRQoL targets over time, with differential patterns according to treatment history and sex, as summarized in Table 4.

Discussion

In the TELEPROMpsoriasis study, HRQoL was monitored over 12 months using the ePROMs DLQI and PSSD-7 days in patients with moderate-to-severe psoriasis treated with biologic or small-molecule therapies via a telepharmacy program.

Both measures showed significant improvement over time, indicating meaningful gains in symptom control and psychosocial well-being. The proportion of patients achieving clinically relevant thresholds (DLQI ≤1 and PSSD-7 days <20) increased progressively throughout follow-up, indicating a marked improvement from baseline to month 12. These improvements underscore the effectiveness of advanced

Table 3
DLQI scores across follow-up visits, overall and stratified by gender and previous treatment status.

A. Overall population				
PROM	**Follow-up (month)**	**Mean ± SD**	***n***	***p*-value**
DLQI (Overall score)	0	8.21 ± 7.07	180	<0.001
	1	4.98 ± 5.10	199	<0.001
	3	4.62 ± 6.15	199	<0.001
	6	3.82 ± 5.48	196	<0.001
	12	2.89 ± 4.03	171	<0.001
B. DLQI score by gender				
PROM	**Follow-up (month)**	**Gender**	**Mean ± SD**	***n***	***p*-value**
DLQI (Overall score)	0	Men	7.58 ± 7.31	80	0.035
	0	Women	9.00 ± 6.90	95	0.035
	1	Men	4.59 ± 5.48	90	0.032
	1	Women	5.24 ± 4.57	100	0.032
	3	Men	4.07 ± 6.24	88	0.021
	3	Women	4.91 ± 5.77	104	0.021
	6	Men	3.18 ± 5.80	92	0.005
	6	Women	4.22 ± 4.88	97	0.005
	12	Men	2.62 ± 3.70	78	0.373
	12	Women	2.99 ± 4.22	87	0.373
C. DLQI score by previous treatment group				
PROM	**Follow-up (month)**	**Previous treatment group**	**Mean ± SD**	***n***	***p*-value**
DLQI (Overall score)	0	Biologic-naïve	7.37 ± 6.63	120	0.012
	0	Group 2	10.67 ± 8.27	33	0.012
	0	Group 3	9.91 ± 6.89	23	0.012
	1	Biologic-naïve	4.60 ± 4.89	129	0.147
	1	Group 2	5.03 ± 5.24	37	0.147
	1	Group 3	6.44 ± 5.20	25	0.147
	3	Biologic-naïve	3.87 ± 5.56	128	0.089
	3	Group 2	5.23 ± 5.93	35	0.089
	3	Group 3	6.32 ± 7.32	28	0.089
	6	Biologic-naïve	3.24 ± 4.88	125	0.217
	6	Group 2	3.88 ± 5.63	40	0.217
	6	Group 3	5.88 ± 6.82	24	0.217
	12	Biologic-naïve	2.16 ± 3.81	104	0.003
	12	Group 2	4.00 ± 3.54	37	0.003
	12	Group 3	3.88 ± 4.74	24	0.003

systemic therapies—including anti-TNF, IL-17 and IL-23 inhibitors—in reducing disease burden and enhancing HRQoL, in line with previous reports.[5,22,23]

Gender-based differences were also evident. Women consistently reported worse HRQoL scores and were less likely to achieve clinical targets, particularly during the first six months of follow-up. This trend, observed in previous literature, may reflect heightened psychosocial sensitivity or differences in treatment perception among women with psoriasis, even at comparable levels of disease severity.[24] These findings emphasize the need for gender-sensitive approaches in clinical practice and HRQoL monitoring.

When stratified by treatment history, biologic-naïve patients consistently showed better outcomes than biologic-experienced patients, particularly at the later stages of follow-up. By the end of the study, a markedly higher proportion of biologic-naïve patients achieved optimal HRQoL thresholds, suggesting that earlier initiation of advanced therapies may yield greater benefits. A descriptive comparison across pharmacological classes (Anti-TNF, Anti-IL-17, Anti-IL-23) did not reveal statistically significant differences in HRQoL evolution, indicating that improvements were comparable among patients treated with different biologic mechanisms in routine clinical practice. Treatment persistence remained high across all subgroups, and discontinuations due to

Table 4
Achievement of clinical HRQoL targets (DLQI ≤1 and PSSD-7 days <20) over 12 months, by treatment group and gender.

Time (months)	Overall *n*/*N* (%)	Naïve *n*/*N* (%)	Group 2 *n*/*N* (%)	Group 3 *n*/*N* (%)	*p*-value	Women *n*/*N* (%)	Men *n*/*N* (%)	*p* (χ^2)
DLQI ≤1								
0	20/180 (11.1)	14/120 (12.0)	3/33 (9.3)	2/23 (10.5)	0.81	10/95 (10.7)	9/80 (11.6)	0.88
1	58/199 (28.9)	42/129 (32.7)	8/37 (20.5)	6/25 (25.0)	0.16	23/100 (22.5)	32/90 (35.8)	0.010
3	73/199 (36.8)	53/128 (41.2)	10/35 (28.9)	9/28 (31.3)	0.14	31/104 (29.8)	39/88 (44.7)	0.0045
6	97/196 (49.5)	69/125 (54.9)	16/40 (40.1)	11/24 (43.7)	0.08	38/97 (39.2)	57/92 (62.0)	0.0028
12	90/171 (52.6)	63/104 (60.6)	13/37 (35.1)	11/24 (45.8)	0.022	42/87 (48.3)	46/78 (59.0)	0.229
PSSD-7 days < 20								
0	37/182 (20.3)	26/122 (21.5)	6/32 (18.3)	4/21 (19.0)	0.67	16/93 (17.0)	20/81 (24.6)	0.0297
1	62/197 (31.7)	44/128 (34.0)	9/35 (25.8)	7/25 (28.6)	0.28	28/101 (27.9)	31/86 (36.3)	0.081
3	84/198 (42.2)	63/127 (49.2)	11/35 (32.1)	10/28 (36.4)	0.0094	39/105 (37.5)	41/87 (46.9)	0.073
6	99/191 (51.8)	69/123 (56.0)	18/38 (46.7)	11/24 (47.9)	0.12	40/91 (44.0)	60/94 (63.8)	0.0103
12	99/168 (58.9)	67/101 (66.3)	16/38 (42.1)	14/24 (58.3)	0.034	46/86 (53.5)	50/77 (64.9)	0.185

Note: Values are expressed as *n*/*N* (%), representing the proportion of patients achieving predefined clinical HRQoL targets at each follow-up visit. Treatment-group comparisons were assessed using the Kruskal–Wallis test, while gender comparisons were performed using the Chi-square test. *N* corresponds to the number of patients with valid questionnaire data for each visit and subgroup; denominators therefore vary across time points due to missing responses.

adverse events were infrequent, aligning with the favorable safety profiles described in clinical trials and real-world studies.[25]

Moreover, a strong and consistent correlation between DLQI and PSSD-7 days was observed at all timepoints, remaining high throughout follow-up. This reinforces the concurrent validity of both tools and illustrates how symptom improvement and perceived well-being evolve in parallel.

These results should be interpreted in light of the analytical approach used. Due to missing questionnaire responses and varying sample sizes across follow-up visits, analyses were based on non-parametric comparisons of score distributions at each follow-up time point rather than within-subject longitudinal models. Accordingly, the observed reductions in DLQI and PSSD-7 day scores reflect consistent differences across successive follow-up visits and between groups, but do not formally quantify individual-level change over time.

The integration of telemonitoring platforms such as NAVETA into chronic disease management offers a scalable and patient-centered strategy to enhance engagement, optimize resource use, and ensure continuity of care.[21] The participation levels and satisfaction observed in this study support the feasibility and acceptability of telepharmacy-based follow-up in dermatological settings. These findings align with previous evidence indicating that digital tools can facilitate communication between patients and healthcare professionals, promote adherence, and sustain patient involvement over time.

By facilitating remote ePROMs collection, NAVETA enables timely therapeutic feedback, supports shared decision-making, and improves the overall experience with pharmaceutical care. These findings are consistent with growing evidence supporting digital health tools to enhance treatment adherence, monitor HRQoL, and tailor care in immune-mediated inflammatory diseases.[26,27]

These findings collectively suggest that the systematic use of ePROMs through telepharmacy platforms provides a comprehensive picture of patient progress, extending beyond traditional clinical metrics. Improvements in both HRQoL and symptom scores reflect not only therapeutic efficacy but also enhanced patient engagement and self-awareness regarding disease management. The consistency observed between DLQI and PSSD-7 trends supports the reliability of combining general and symptom-specific PROMs to capture multidimensional changes in well-being.

Furthermore, the results highlight the relevance of integrating patient-reported data into routine clinical workflows. Telemonitoring tools such as NAVETA can help identify early non-responders, support timely clinical decisions, and maintain patient motivation over time. This approach aligns with the current paradigm of personalized and value-based healthcare, where patient experience and quality of life are recognized as essential treatment outcomes in chronic inflammatory diseases.

This study is not without limitations. The absence of a control group without telepharmacy follow-up precludes direct comparison of outcomes. Selection bias is possible, as participants required basic digital literacy, excluding patients without access to or familiarity with digital tools. Additionally, attrition over time may have introduced follow-up bias.[26,27] Another limitation is that the analysis did not differentiate between patients who discontinued previous biologic therapies due to loss of efficacy or adverse events, nor whether treatment switches involved a change in the pharmacological mechanism of action. These factors could influence HRQoL trajectories and should be explored in future studies.

In conclusion, the TELEPROMpsoriasis study demonstrates that telepharmacy-supported monitoring using validated ePROMs (DLQI and PSSD-7 days) effectively captures the longitudinal evolution of HRQoL and cutaneous symptoms in patients with moderate-to-severe psoriasis treated with biologic or small-molecule therapies. The progressive improvement observed in both measures confirms the capacity of digital follow-up to reflect meaningful clinical benefit.

The analysis of predefined HRQoL thresholds (DLQI ≤1 and PSSD-7 days <20) showed that a substantial proportion of patients reached optimal outcomes over time, supporting the clinical relevance of these targets in real-world settings. Differences according to treatment history and gender indicate that prior biologic exposure and sex-related factors influence perceived well-being, underscoring the importance of individualized patient monitoring.

A strong correlation between DLQI and PSSD-7 days further validates their combined use for remote assessment, confirming that improvements in symptom severity translate consistently into better quality of life. Overall, these findings reinforce the value of PROM-based, patient-centered care and highlight the potential of telepharmacy platforms such as NAVETA to enhance digital equity, adherence, and continuity of care in chronic dermatological conditions.

Author note

All authors are members of the Working Group of the Spanish Society of Hospital Pharmacy (GTEII-SEFH), except for Jaime Notario Rosa, María Eugenia Escrivá Sancho, and Salvador Herrera-Pérez.

CRediT authorship contribution statement

Gabriel Mercadal-Orfila: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Piedad López Sánchez:** Writing – review & editing, Investigation. **Nuria Padullés-Zamora:** Writing – review & editing, Investigation. **Aránzazu Pou Alonso:** Writing – review & editing, Investigation. **Olatz Ibarra-Barrueta:** Writing – review & editing, Investigation. **Emilio Monte-Boquet:** Writing – review & editing, Investigation. **Joaquín Borrás Blasco:** Writing – review & editing, Investigation. **Patricia Sanmartin-Fenollera:** Writing – review & editing, Investigation. **Cristina Capilla Montes:** Writing – review & editing, Investigation. **María Angeles Bernabéu Martínez:** Writing – review & editing, Investigation, Conceptualization. **Jaime Notario Rosa:** Investigation. **María Eugenia Escrivá Sancho:** Investigation. **Salvador Herrera-Pérez:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Ethics approval

This study is part of a wider project with approval by the Research Ethics Committee of the Balearic Islands (IB 4542/21 EOm).

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Conflicts of interest

The authors declare no conflict of interest.

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