Dermatol Ther (Heidelb)
https://doi.org/10.1007/s13555-025-01426-x

ORIGINAL RESEARCH

Assessing Long-Term Pain Reduction with Secukinumab in Moderate to Severe Hidradenitis Suppurativa: A Post Hoc Analysis of the SUNSHINE and SUNRISE Phase 3 Trials

John R. Ingram · Jacek C. Szepietowski · Lukasz Matusiak · Georgios Kokolakis · Magdalena B. Wozniak · Christine-Elke Ortmann · Angela Llobet Martinez · Shoba Ravichandran · Nicolas Thomas · Ivette Alarcon · Christelle C. Pieterse · Maryam Shayesteh Alam · Dimitrios Ioannides · Alexa B. Kimball

Received: January 27, 2025 / Accepted: April 14, 2025

ABSTRACT

***Introduction*:** Hidradenitis suppurativa (HS) is a chronic, painful skin disease associated with a high disease burden. Disease-related pain is frequently reported as the most troublesome symptom of HS. The SUNSHINE and SUNRISE phase 3 trials previously reported that secukinumab improved control of pain in patients with moderate to severe HS. The objective of this analysis was to evaluate the impact of secukinumab on multiple aspects of pain in patients with HS from SUNSHINE and SUNRISE.

***Methods*:** Patients were randomised to receive secukinumab 300 mg every 2 (SECQ2W) or 4 weeks (SECQ4W), or placebo until week 16. At week 16, the placebo group switched to receive SECQ2W (placebo-SECQ2W) or SECQ4W (placebo-SECQ4W), whereas the secukinumab groups continued their treatment, until week 52. Pain was assessed using the Patient's Global Assessment of skin pain—at worst on a continuous numeric rating scale (NRS) through week 52. Quartiles were used to categorise pain severity groups based on baseline NRS scores (NRS ≤ 3.3; NRS > 3.3 to ≤ 5.4; NRS > 5.4 to ≤ 7.2; NRS > 7.2). Additional assessments included quality of life (QoL) and pain medication use.

***Results*:** At week 16, a greater mean (standard deviation) absolute change from baseline in

Prior Presentation: Some of the results were presented as a poster at the European Academy of Dermatology and Venereology (EADV) Annual Meeting, 11–14 October 2023, Berlin, Germany.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s13555-025-01426-x.

J. R. Ingram (✉)
Department of Dermatology & Academic Wound Healing, Division of Infection and Immunity, Cardiff University, Cardiff, UK
e-mail: ingramjr@cardiff.ac.uk

J. C. Szepietowski · L. Matusiak
Division of Dermatology, Venereology and Clinical Immunology, Faculty of Medicine, Wroclaw University of Science and Technology, Wroclaw, Poland

J. C. Szepietowski · L. Matusiak
Department of Dermato-Venereology, 4th Military Hospital, Wroclaw, Poland

G. Kokolakis
Psoriasis Research and Treatment Center, Clinic of Dermatology, Venereology, and Allergology, Charité-Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität Zu Berlin, Berlin, Germany

M. B. Wozniak
Novartis Ireland Limited, Dublin, Ireland

C.-E. Ortmann · A. L. Martinez · N. Thomas · I. Alarcon
Novartis Pharma AG, Basel, Switzerland

Published online: 15 May 2025

skin pain was observed for patients treated with secukinumab [SECQ2W (−1.35 (2.16)); SECQ4W (−1.05 (2.02))] versus placebo [−0.47 (2.07)]. In the SECQ2W and SECQ4W groups, in patients with NRS > 7.2 at baseline, 20.0% and 12.7% had NRS ≤ 3.3 at week 16, respectively. This improvement in pain was maintained through week 52. Moreover, patients in the NRS ≤ 3.3 category generally experienced better QoL. The proportion of patients reporting pain medication use was generally reduced at weeks 16 and 52 versus baseline in the secukinumab groups.

Conclusion: This analysis highlights the sustained benefits of secukinumab in reducing pain in patients with moderate to severe HS. These pain reductions were associated with QoL improvements.

Trial Registration: ClinicalTrials.gov identifier: NCT03713619 (SUNSHINE) and NCT03713632 (SUNRISE).

Keywords: Acne inversa; Biologics; Hidradenitis suppurativa; HS; NRS; Pain control; Pain medication; Pain; Patient-reported outcomes; Secukinumab

Key Summary Points

Why carry out this study?

Secukinumab has previously been demonstrated to improve control of pain in patients with moderate to severe hidradenitis suppurativa based on the numeric rating scale 30 response.

The impact of secukinumab on additional features of pain in patients with moderate to severe hidradenitis suppurativa is unknown.

What was learned from the study?

Patients randomised to secukinumab experienced improvements in pain through week 52. In addition, improvements in pain were associated with improvements in quality of life, and the proportion of patients reporting pain medication use was also reduced.

Pain is one of the most troublesome symptoms of hidradenitis suppurativa; this study demonstrates the clinical utility of secukinumab in improving aspects of pain in this population, which were accompanied by improvements in quality of life.

INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic, painful, inflammatory skin disease associated with a high disease and comorbidity burden [1–3]. Despite a prevalence of approximately 0.4% [4], HS remains an under-recognised and undertreated disease [5–7] owing in part to a long delay in diagnosis and frequent misdiagnoses [5, 8, 9]. Symptoms of HS include inflammatory nodules, abscesses, malodorous tunnels, and scarring, making HS a painful, disfiguring disease that negatively impacts patients' quality of life (QoL) [1, 2, 10].

Disease-related pain is one of the most disabling and troublesome symptoms of HS [11, 12], which worsens with increased disease severity [13, 14] and strongly contributes to impaired QoL [10, 15, 16]. Pain has been reported to affect

S. Ravichandran
Novartis Pharmaceuticals Corporation, East Hanover, NJ, USA

C. C. Pieterse
Syneos Health, Amsterdam, The Netherlands

M. S. Alam
SimcoMed Health Ltd, 105-5 Quarry Ridge Road, Barrie, ON L4M 7G1, Canada

D. Ioannides
First Department of Dermatology and Venereology, School of Medicine, Aristotle University School of Medicine, Thessaloniki, Greece

A. B. Kimball
Harvard Medical School and Clinical Laboratory for Epidemiology and Applied Research in Skin (CLEARS), Department of Dermatology, Beth Israel Deaconess Medical Center, Boston, MA, USA

QoL in patients with HS by affecting sleep [17] and causing psychological distress including anxiety, depression and suicidality [10, 18–20]; patients with HS suffer from worse pain than those with other dermatologic conditions [10]. Moreover, pain may be a reason for absenteeism from work in the HS population, thus impacting patients' careers [19].

Limited therapies exist that can adequately control HS-related pain, and limited pain management guidelines for treating HS-related pain are available [10, 15, 21]. Often, multiple medications, including opioids, are used to manage pain but are not suitable for long-term use and may produce adverse effects [15, 21]. With the advent of biologic therapies for HS, patients have reported good control of pain [22–25] and are more satisfied with biologic compared to non-biologic treatments [26].

The SUNSHINE and SUNRISE trials, which assessed the efficacy and safety of secukinumab, have previously demonstrated sustained clinical efficacy of secukinumab in patients with moderate to severe HS, including control of pain as measured by numeric rating scale (NRS)30 [22], a valid and meaningful measure of skin pain response in HS [27]. However, the impact of secukinumab on more granular features of pain overall, and in specific subgroups of patients with HS based on baseline characteristics, has not been reported.

Here, a post hoc analysis of pooled data from SUNSHINE and SUNRISE was performed to evaluate the impact of secukinumab on multiple aspects of pain and in different subgroups of patients with HS.

METHODS

Study Design and Patients

SUNSHINE (NCT03713619) and SUNRISE (NCT03713632) were identically designed, global, multicentre, placebo-controlled, phase 3 trials conducted in 219 primary sites in 40 countries (the full list of participating countries is included in the primary manuscript [22] and available on ClinicalTrials.gov); a detailed study design and eligibility criteria have been reported elsewhere [22]. Briefly, in both trials, patients with moderate to severe HS were randomised 1:1:1 to receive secukinumab 300 mg subcutaneously every 2 (SECQ2W) or 4 weeks (SECQ4W), or placebo until week 16. At week 16, patients randomised to placebo were switched to receive SECQ2W (placebo-SECQ2W) or SECQ4W (placebo-SECQ4W) until week 52, whereas patients originally randomised to SECQ2W or SECQ4W continued this treatment until week 52 [22].

Objectives

The main objective of this analysis was to evaluate the change in skin pain in patients with moderate to severe HS during SUNSHINE and SUNRISE through week 52. Additional objectives included assessing the change in defined skin pain severity categories, change in QoL by skin pain severity categories, pain across baseline patient and disease characteristic subgroups, and the correlation between pain and efficacy outcomes.

Assessments

Skin Pain

Magnitude of skin pain due to HS was assessed using the Patient's Global Assessment of Skin Pain—at worst on a continuous NRS (0–10 scale; 0: no skin pain, 10: skin pain as bad as you can imagine) in the previous 24 h. Skin pain was assessed daily from baseline (average of the latest seven assessments before the date of the site visit when study treatment is administered) to week 16 as a weekly average of the daily skin pain assessments and thereafter was assessed weekly through week 52. For each post-baseline visit, only patients with data at both the baseline visit and the respective post-baseline visit were included.

Skin pain severity categories were used to subcategorise patients based on their pain level at

baseline. In the absence of validated categories for magnitude of skin pain in the HS population, quartiles based on pooled baseline pain scores from SUNSHINE and SUNRISE were used for categorisation: NRS ≤ 3.3; NRS > 3.3 to ≤ 5.4; NRS > 5.4 to ≤ 7.2; NRS > 7.2. Data are reported as a proportion of the overall population within each skin pain category and treatment arm. The change in skin pain severity categories from baseline to week 16 and week 52 was assessed using shift data and visualised using Sankey diagrams. All patients with an NRS assessment regardless of baseline score were included in these analyses.

Skin Pain Subgroup Analyses Mean skin pain at baseline, week 16, and week 52 was analysed across different baseline demographic and disease characteristics including sex (male, female), age (< 30, ≥ 30 to < 40, or ≥ 40 years), international HS severity score system (IHS4) categories (mild [≤ 3], moderate [4 to 10], or severe [≥ 11]) [28], prior biologic exposure (biologic-experienced, biologic-naïve), and disease duration (< 5, ≥ 5 to < 10, or ≥ 10 years since diagnosis).

Quality of Life

QoL was assessed in SUNSHINE and SUNRISE using the dermatology life quality index (DLQI) response (≥ 5-point decrease in DLQI total score versus baseline), and via the European QoL 5-dimension (EQ-5D) questionnaire. The proportion of patients achieving a DLQI response by skin pain severity category was assessed to investigate the relationship between self-reported QoL and pain at week 16 and week 52. For the EQ-5D, the visual analogue scale (VAS) score within each skin pain severity category was assessed at baseline, week 16, and week 52.

Correlation Analysis

The relationship between skin pain and measures of QoL, disease characteristics, and inflammatory marker outcomes was assessed.

Pain Medication

During SUNSHINE and SUNRISE, patients with uncontrolled pain due to HS were initially permitted to take analgesics including ibuprofen and acetaminophen up to the maximum dose as per the local label. If HS-related pain remained uncontrolled, patients could be prescribed tramadol (100 mg every 4 h; not exceeding 400 mg every 24 h). Pain medication use for HS was assessed as the proportion of patients who reported any use, and specific pain medication categories, by 28-day intervals relative to the first study treatment administration. Patients with multiple occurrences within the same category and interval were counted only once for that category and interval. Pain medication use was reported by the investigator in the electronic case report form and self-reported by patients using an eDiary and were reported through week 52.

Statistical Analyses

Statistical analyses were conducted based on pooled and observed data from SUNSHINE and SUNRISE from the full analysis set and the week 52 database lock (except for baseline characteristics which were based on the week 16 database lock). A mixed effects model for repeated measures (MMRM) was used to analyse the change from baseline in NRS scores, and reported estimated least squares mean (LSM) differences and 95% confidence intervals (CIs) for the comparisons of the two treatment groups with the placebo group. The model included study, treatment group, baseline NRS score, Hurley stage, use of stable dose of concomitant systemic antibiotics (yes vs no), geographical region (Europe; Asia–Pacific, Middle East and Africa combined with Japan; Latin America and Canada combined with the USA), baseline body weight (< 90 vs ≥ 90 kg) and interaction between treatment group and visit.

The differences in skin pain severity quartiles between secukinumab treatment groups (SECQ2W and SECQ4W) and placebo at week 16 were pairwise tested for significance using the two-sided chi-square test. *P* values presented in this post hoc analysis are nominal, and no multiplicity adjustments were made; therefore, results should be interpreted with caution. *P* values for the MMRM and chi-square were two sided, and $p < 0.05$ was considered significant. The correlation between

skin pain and measures of QoL (DLQI, EQ-5D), AN count, lesion count, inflammation (high-sensitivity C-reactive protein [hsCRP]), and disease severity (IHS4) was assessed from baseline through week 16 using Spearman's correlation coefficient. Cutoffs for interpretation of Spearman's correlation have been previously reported [29].

Ethical Approval

The study protocol and all amendments for the SUNSHINE and SUNRISE trials were reviewed by the independent ethics committee or institutional review board for each participating centre. The study was done according to The International Conference on Harmonisation Guidelines for Good Clinical Practice that have their origin in the Declaration of Helsinki. Written informed consent was obtained from each patient during the screening visit and before any study-specific procedure was done.

RESULTS

Patient Disposition and Baseline Characteristics

Overall, 1084 patients from SUNSHINE and SUNRISE were included in this analysis (SECQ2W [*N* = 361]; SECQ4W [*N* = 360]; placebo [*N* = 363]); a full description of patient disposition has been previously reported [22]. Baseline characteristics are detailed in Table 1. Overall, the mean (standard deviation [SD]) age was 36.2 (11.5) years; 56.3% were female and 78.0% were white. On the basis of the IHS4, no patients had mild HS, 19.4% (210/1084) had moderate HS, and 80.6% (874/1084) had severe HS. Overall, most patients had Hurley stage II (59.0%, 640/1084), a mean (SD) abscess and inflammatory nodule (AN) count of 13.0 (8.9), mean (SD) draining tunnel count of 2.6 (3.4) and mean (SD) NRS skin pain—at worst score of 5.2 (2.5).

Skin Pain at its Worst

At week 16, a greater mean (SD) absolute change from baseline in NRS skin pain—at worst was observed for patients treated with secukinumab [SECQ2W (– 1.35 (2.16)); SECQ4W (– 1.05 (2.02))] versus placebo (– 0.47 (2.07)], with reductions observed as early as week 4 (Fig. 1). Reductions in skin pain in the secukinumab groups at week 16 were sustained, with a trend for improvement, through week 52 [SECQ2W (– 1.76 (2.60)); SECQ4W (– 1.50 (2.74))]. Moreover, patients who switched from placebo to secukinumab at week 16 experienced reductions in skin pain through week 52 [placebo-SECQ2W (– 1.67 (2.83)); placebo-SECQ4W (– 1.61 (2.46))].

At week 16, the MMRM resulted in estimated treatment difference in LS means favouring both secukinumab treatment arms versus placebo (SECQ2W vs placebo: – 0.74 (95% CI – 1.06, – 0.42); $p < 0.0001$; SECQ4W vs placebo: – 0.56 (95% CI – 0.88, – 0.23); $p = 0.0008$.

Skin Pain at its Worst by Severity Categories

At baseline, approximately one-quarter of patients in each group reported NRS > 7.2 [SECQ2W (28.0%); SECQ4W (24.8%); placebo (21.0%)] (Table 2). At week 16, the distribution of the proportions across the skin pain severity categories was significantly different between the treatment arms, favouring secukinumab vs placebo (SECQ2W vs placebo: $p = 0.0162$; SECQ4W vs placebo: $p = 0.0280$; chi-square test). In particular, at week 16, the proportion of patients reporting NRS > 7.2 in the secukinumab groups [SECQ2W (15.4%); SECQ4W (13.7%)] was lower versus baseline. At week 52, the proportion of patients reporting NRS > 7.2 was further reduced in the secukinumab groups [SECQ2W (9.4%); SECQ4 W (12.1%)], with a similar reduction observed in placebo switcher groups [placebo-SECQ2W (9.3%); placebo-SECQ4W (10.9%)] (Table 2).

The shift in skin pain severity categories from baseline to week 16 and week 52 is shown in Fig. 2. In the SECQ2W group, of patients with NRS > 7.2 at baseline, 20.0% had NRS ≤ 3.3 at week 16 (Fig. 2a); 29.6% had NRS ≤ 3.3 at week 52 (Fig. 2c). In the SECQ4W group, of patients with NRS > 7.2 at baseline,

Table 1 Baseline demographic and disease characteristics based on pooled data from SUNSHINE and SUNRISE

Characteristic	SECQ2W (*N* = 361)	SECQ4W (*N* = 360)	Placebo (*N* = 363)	Overall (*N* = 1084)
Age, years, mean (SD)	37.2 (12.0)	35.6 (11.5)	35.9 (11.0)	36.2 (11.5)
Age group, years, *n* (%)				
< 30	110 (30.5)	129 (35.8)	108 (29.8)	347 (32.0)
30 to < 40	104 (28.8)	106 (29.4)	135 (37.2)	345 (31.8)
40 to < 65	141 (39.1)	120 (33.3)	117 (32.2)	378 (34.9)
≥ 65	6 (1.7)	5 (1.4)	3 (0.8)	14 (1.3)
Sex, female, *n* (%)	200 (55.4)	203 (56.4)	207 (57.0)	610 (56.3)
Race*, *n* (%)				
White	278 (77.0)	285 (79.2)	282 (77.7)	845 (78.0)
Black or African American	33 (9.1)	29 (8.1)	24 (6.6)	86 (7.9)
Asian	35 (9.7)	39 (10.8)	43 (11.8)	117 (10.8)
Other/multiple/not reported	15 (4.2)	7 (1.9)	14 (3.9)	36 (3.3)
Body mass index, kg/m^2, mean (SD)	32.3 (7.8) (*N* = 361)	32.4 (7.7) (*N* = 359)	31.7 (7.2) (*N* = 363)	32.1 (7.6) (*N* = 1083)
Smoking status, *n* (%)				
Never	111 (30.7)	121 (33.6)	102 (28.1)	334 (30.8)
Current smokers	192 (53.2)	186 (51.7)	207 (57.0)	585 (54.0)
Former smokers	58 (16.1)	53 (14.7)	54 (14.9)	165 (15.2)
Hurley stage, *n* (%)				
I	13 (3.6)	16 (4.4)	11 (3.0)	40 (3.7)
II	196 (54.3)	213 (59.2)	231 (63.6)	640 (59.0)
III	152 (42.1)	131 (36.4)	121 (33.3)	404 (37.3)
IHS4 category, *n* (%)				
Mild	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Moderate	62 (17.2)	70 (19.4)	78 (21.5)	210 (19.4)
Severe	299 (82.8)	290 (80.6)	285 (78.5)	874 (80.6)
Time since HS diagnosis, years, mean (SD)	7.2 (7.5) (*N* = 361)	7.4 (7.6) (*N* = 360)	7.2 (6.8) (*N* = 362)	7.3 (7.3) (*N* = 1083)
Time since HS symptom(s) onset, years, mean (SD)	13.3 (10.1)	13.4 (9.5)	12.8 (9.5)	13.2 (9.7)
AN count, mean (SD)	13.4 (9.8)	12.9 (8.6)	12.8 (8.3)	13.0 (8.9)
Draining tunnel count, mean (SD)	2.9 (3.5)	2.5 (3.5)	2.5 (3.2)	2.6 (3.4)

Table 1 continued

Characteristic	SECQ2W (*N* = 361)	SECQ4W (*N* = 360)	Placebo (*N* = 363)	Overall (*N* = 1084)
NRS skin pain—at worst, mean (SD)	5.3 (2.5) (*N* = 329)	5.1 (2.5) (*N* = 326)	5.2 (2.5) (*N* = 328)	5.2 (2.5) (*N* = 983)
DLQI score, mean (SD)	14.9 (6.9) (*N* = 325)	14.1 (6.7) (*N* = 319)	14.2 (7.0) (*N* = 338)	14.4 (6.9) (*N* = 982)
EQ-5D VAS score, mean (SD)	61.0 (21.2) (*N* = 325)	64.6 (18.7) (*N* = 319)	63.0 (20.5) (*N* = 336)	62.9 (20.2) (*N* = 980)
Prior surgery for HS, *n* (%)	149 (41.3)	143 (39.7)	150 (41.3)	442 (40.8)
Previous exposure to systemic biologics, *n* (%)	80 (22.2)	81 (22.5)	94 (25.9)	255 (23.5)
Previous exposure to systemic antibiotics, *n* (%)	297 (82.3)	301 (83.6)	301 (82.9)	899 (82.9)

Data are based on the week 16 database lock

AN abscess and inflammatory nodule, *DLQI* dermatology life quality index, *EQ-5D* European quality of life-5 dimension, *IHS4* international hidradenitis suppurativa severity score system, *HS* hidradenitis suppurativa, *N* number of patients in group, *n* number of patients with characteristic, *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SD* standard deviation, *SEC* secukinumab 300 mg, *VAS* visual analogue scale

*As this study utilises data from previously conducted trials, more specific demographical data was not available

12.7% had NRS ≤ 3.3 at week 16 (Fig. 2b); 29.8% had NRS ≤ 3.3 at week 52 (Fig. 2d). In the placebo group, of patients with NRS > 7.2 at baseline, 5.9% had an NRS ≤ 3.3 at week 16 (Fig. 2e).

Skin Pain at its Worst Based on Subgroups

Patients treated with secukinumab experienced greater numerical reductions in mean NRS skin pain—at worst versus placebo at week 16 across all demographic subgroups, including sex (men and women), age category (< 30, 30 to < 40, ≥ 40 years) (Fig. S1), and disease characteristic subgroups, namely IHS4 category (moderate and severe), prior biologic status (biologic-experienced and biologic-naïve), and disease duration (< 5 and 5 to < 10 years since diagnosis) (Fig. S2). Furthermore, there was a trend for further reductions at week 52 in the secukinumab groups, while the placebo switchers experienced reductions in skin pain following the switch (Figs. 3 and 4).

Skin Pain at its Worst and Quality of Life: DLQI Responders

At week 16, across all groups, the proportion of patients achieving a DLQI response was highest in the NRS ≤ 3.3 category [SECQ2W (51.4%), SECQ4W (59.8%), placebo (48.3%)] and lowest in the NRS > 7.2 category [SECQ2W (24.2%), SECQ4W (18.8%), placebo (15.9%)]. DLQI response was greater in patients treated with secukinumab than with placebo (Fig. 3a). These results were maintained with further improvement at week 52 in the secukinumab groups and generally improved in placebo switchers following the switch (Fig. 3b).

Skin Pain at its Worst and Quality of Life: EQ-5D VAS Score

At baseline, across all groups, patients in the NRS ≤ 3.3 category [SECQ2W (70.9); SECQ4W (70.5); placebo (75.0)] had the highest EQ-5D VAS scores, while those in the NRS > 7.2 category

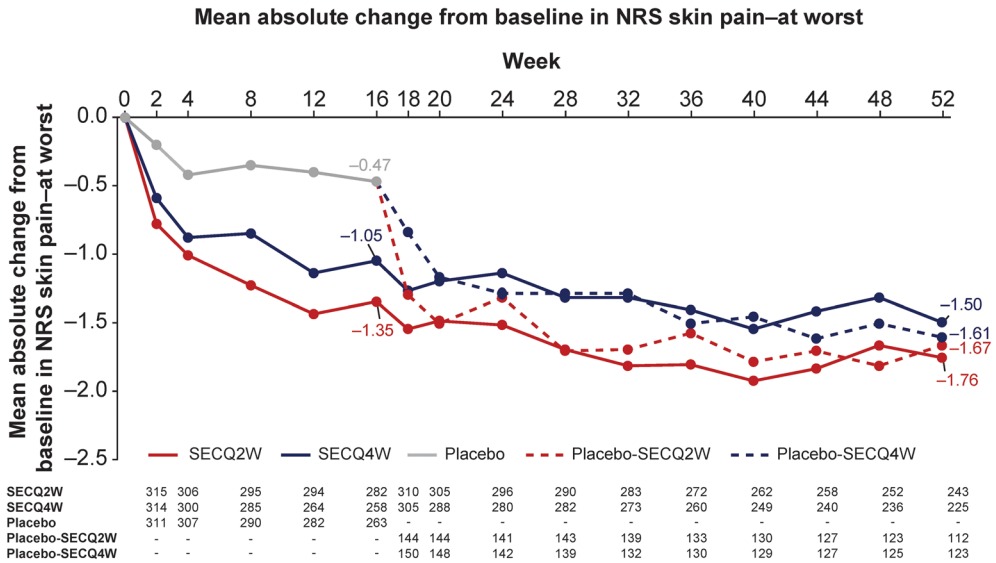


Fig. 1 Mean change from baseline in NRS skin pain—at worst from baseline through week 52 based on pooled data from SUNSHINE and SUNRISE. Line graph detailing the mean change from baseline in NRS skin pain—at worst in the SECQ2W, SECQ4W and placebo groups from baseline through week 52 based on pooled and observed data. Dashed lines represent patients switching from placebo to active treatment at week 16. The numbers below the figure represent the number of evaluable patients at each respective timepoint. Baseline is the average of the latest seven assessments before the date of the first administration of the study treatment. For each post-baseline visit, only patients with a value at both baseline and the respective post-baseline visit are included. *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg

[SECQ2W (51.4); SECQ4W (57.3); placebo (47.2)] had the lowest scores (Fig. 4). At week 16, across all groups, scores generally improved; patients in the NRS ≤ 3.3 category [SECQ2W (76.0); SECQ4W (74.2); placebo (78.2)] generally had higher EQ-5D VAS scores than the NRS > 7.2 category [SECQ2W (51.7); SECQ4W (47.6); placebo (50.0)]. Similar results, with further improvement, were generally observed at week 52 for the secukinumab groups.

Correlation Analysis Through Week 16

The correlation analysis of the relationship of NRS skin pain—at worst with various variables through week 16 is shown in Table 3. In all groups, pain was moderately correlated with DLQI total score [SECQ2W (r = 0.593); SECQ4W (r = 0.579); placebo (r = 0.624)] and the DLQI itchy, sore, painful or stinging skin question [SECQ2W (r = 0.538); SECQ4W (r = 0.551); placebo (r = 0.585)]. In contrast, in all groups, pain had a low correlation with hsCRP [SECQ2W (r = 0.239); SECQ4W (r = 0.186); placebo (r = 0.365)].

Frequency of Pain Medication Use

At baseline, 42.7% (SECQ2W), 36.7% (SECQ4W), and 38.6% (placebo) of patients reported using any pain medication (Fig. 5a); 3.6% (SECQ2W), 6.1% (SECQ4W), and 5.2% (placebo) of patients reported tramadol use (Fig. 5b).

At week 16, a larger reduction in the proportion of patients reporting pain medication use was observed in the secukinumab groups [SECQ2W (25.7%); SECQ4W, (19.9%)] versus placebo (28.9%) (Fig. 5a); similarly, a larger reduction in the proportion of patients reporting tramadol use was observed in the secukinumab groups [SECQ2W (1.4%); SECQ4W (2.0%)] versus placebo (4.9%) (Fig. 5b). At week 16, similar results were observed for opioids (excluding tramadol) (Fig. 5c), non-steroidal anti-inflammatory drugs (NSAIDs) (Fig. 5d), paracetamol/

Table 2 NRS skin pain—at worst severity categories at baseline, week 16 and week 52 based on pooled data from SUNSHINE and SUNRISE

Timepoint	NRS severity category, % (*n*/*N*)	SECQ2W (*N* = 361)	SECQ4W (*N* = 360)	Placebo (*N* = 363)	Placebo-SECQ2W (*N* = 180)	Placebo-SECQ4W (*N* = 183)
Baseline	NRS ≤ 3.3	23.7 (78/329)	28.5 (93/326)	25.6 (84/328)	–	–
	NRS > 3.3 to ≤ 5.4	27.7 (91/329)	23.0 (75/326)	22.3 (73/328)	–	–
	NRS > 5.4 to ≤ 7.2	20.7 (68/329)	23.6 (77/326)	31.1 (102/328)	–	–
	NRS > 7.2	28.0 (92/329)	24.8 (81/326)	21.0 (69/328)	–	–
Week 16	NRS ≤ 3.3	44.0 (129/293)	43.0 (119/277)	31.0 (85/274)	–	–
	NRS > 3.3 to ≤ 5.4	24.6 (72/293)	23.8 (66/277)	29.9 (82/274)	–	–
	NRS > 5.4 to ≤ 7.2	16.0 (47/293)	19.5 (54/277)	20.8 (57/274)	–	–
	NRS > 7.2	15.4 (45/293)	13.7 (38/277)	18.2 (50/274)	–	–
		$p = 0.0162$	$p = 0.0280$	–	–	–
Week 52	NRS ≤ 3.3	54.5 (139/255)	57.1 (137/240)	–	52.5 (62/118)	54.7 (75/137)
	NRS > 3.3 to ≤ 5.4	19.6 (50/255)	19.2 (46/240)	–	25.4 (30/118)	17.5 (24/137)
	NRS > 5.4 to ≤ 7.2	16.5 (42/255)	11.7 (28/240)	–	12.7 (15/118)	16.8 (23/137)
	NRS > 7.2	9.4 (24/255)	12.1 (29/240)	–	9.3 (11/118)	10.9 (15/137)

Severity categories are based on baseline NRS quartiles for all patients based on pooled data from SUNSHINE and SUNRISE. Baseline is the average of the latest seven assessments before the date of the first administration of the study treatment. *p* values correspond to the pairwise comparison of SECQ2W or SECQ4W versus placebo at week 16, based on chi-square test

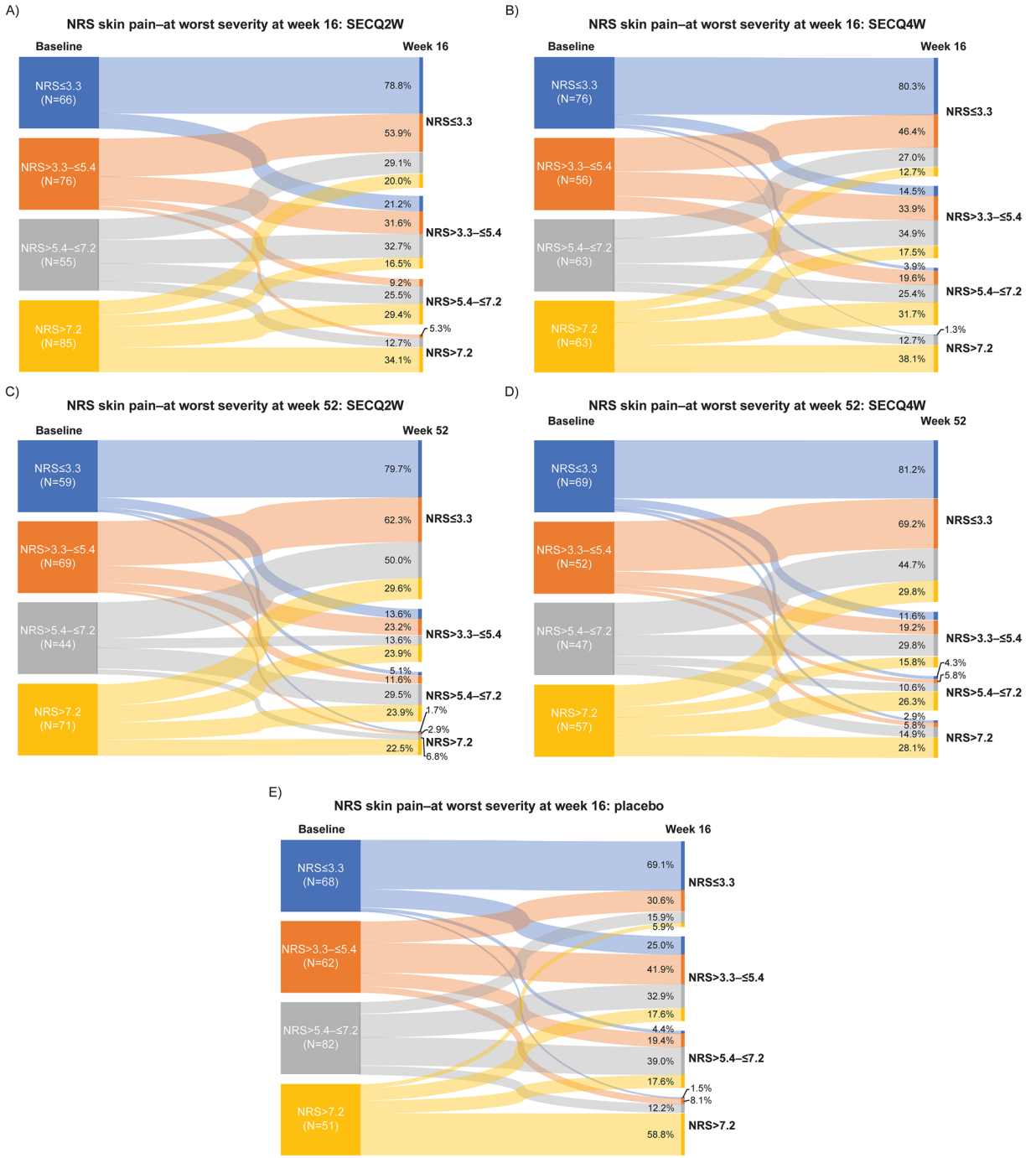
N number of patients in group, *n* number of patients with characteristic, *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg

acetaminophen (Fig. 5e), and other non-opioids (Fig. 5f). Similar results were generally observed at week 52 in the secukinumab and placebo switcher groups (Fig. 5).

DISCUSSION

Pain is a prominent symptom for patients living with HS and there is an unmet need for therapeutic interventions that improve disease-related pain [15, 16, 20]. The SUNSHINE and SUNRISE trials have previously reported the positive benefits of secukinumab in controlling disease-related pain in patients with moderate to severe HS as measured by NRS30 [22]. This analysis, based on pooled data from SUNSHINE and SUNRISE, further demonstrates the sustained benefits of secukinumab in alleviating pain associated with HS, and demonstrating that pain improvement is achieved irrespective of the different subgroups evaluated.

At baseline, overall mean skin pain at its worst ranged from 5.1 to 5.3 across treatment arms based on the NRS; approximately half of patients reported NRS >5.4, highlighting the significant



disease burden associated with pain in this population. Baseline reported pain at its worst in the current study is lower than that reported in the PIONEER trials (5.7 to 6.2) [23, 24], potentially due to slight variations in the eligibility criteria between the trials, but was within the range typically observed in patients with HS (3.6–7.7) [30]. Ensuring the inclusion of a representative HS population when assessing pain is important as HS-related pain is highlighted as an important outcome in the HISTORIC core outcomes set [31].

In this analysis, secukinumab demonstrated rapid improvement in skin pain, with improvements observed as early as week 4, which further

◂**Fig. 2** Change in NRS skin pain—at worst severity categories from baseline to week 16 and week 52 based on pooled data from SUNSHINE and SUNRISE. Sankey plots detailing change in NRS skin pain–at worst severity categories between baseline and week 16 in **a** the SECQ2W group and **b** the SECQ4W group; between baseline and week 52 in **c** the SECQ2W group and **d** the SECQ4W group; and between baseline and week 16 in **e** the placebo group. Severity categories are based on baseline NRS quartiles for all patients based on pooled data from SUNSHINE and SUNRISE. Baseline is the average of the latest seven assessments before the date of the first administration of the study treatment. Percentages are based on the number of patients with non-missing data at baseline and the post-baseline visit for each respective baseline category. *N* number of patients in group, *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg

improved through week 52. Moreover, placebo switchers experienced rapid reductions in skin pain, comparable to those observed in patients receiving continuous secukinumab, and these responses were sustained through week 52. These findings were also reflected in the shift data highlighting changes in skin pain categories; 20.0% and 12.7% of patients treated with SECQ2W and SECQ4W, respectively, improved from NRS >7.2 at baseline to NRS ≤3.3 at week 16, with further improvements at week 52. In the placebo group, only 5.9% of patients shifted from NRS >7.2 at baseline to NRS ≤3.3 at week 16. Furthermore, regardless of baseline characteristics, patients treated with secukinumab generally experienced greater reductions in skin pain versus placebo at week 16, which were sustained through week 52.

Given the significant burden that pain imposes on patients with HS, these findings indicate that secukinumab is associated with effective reduction in pain, a key symptom of active HS, as part of its overall benefit in reducing HS disease activity. The improvements in disease-related pain were associated with improvements in patient QoL, as well as pain correlating with measures of QoL through week 16, reinforcing the integral part pain plays in patient QoL in this population [10, 11, 15, 19]. An interesting finding was that hsCRP, IHS4 score, and lesion count did not strongly correlate with skin pain through week 16. This may be due to one lesion being inflamed and very painful, and the remaining lesions being stable or improved, highlighting the difficulty in capturing pain in this population and the need for a validated, disease-specific pain assessment in HS [32, 33].

Owing to the painful nature of HS, patients are typically managed with multiple analgesics including NSAIDs, paracetamol, and opioids [15, 21]; patients with HS have an increased risk of developing long-term opioid use [34, 35], highlighting the need for therapies that decrease pain and limit the need for opioids. In both secukinumab treatment groups, there was

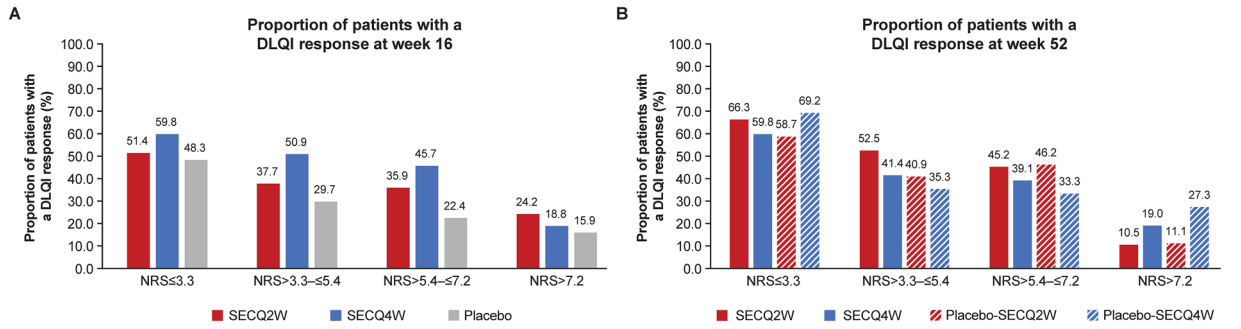


Fig. 3 Proportion of patients with a DLQI response at week 16 and week 52 by NRS skin pain–at worst severity categories based on pooled data from SUNSHINE and SUNRISE. Bar graphs detailing the proportion of patients with a DLQI response (≥ 5-point decrease versus baseline) at **a** week 16 and **b** week 52 by NRS skin pain–at worst severity category in the SECQ2W, SECQ4W and placebo groups. Severity categories are based on baseline NRS quartiles for all patients based on pooled data from SUNSHINE and SUNRISE. Only patients with DLQI total score ≥ 5 at baseline are included. *DLQI* dermatology life quality index, *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg

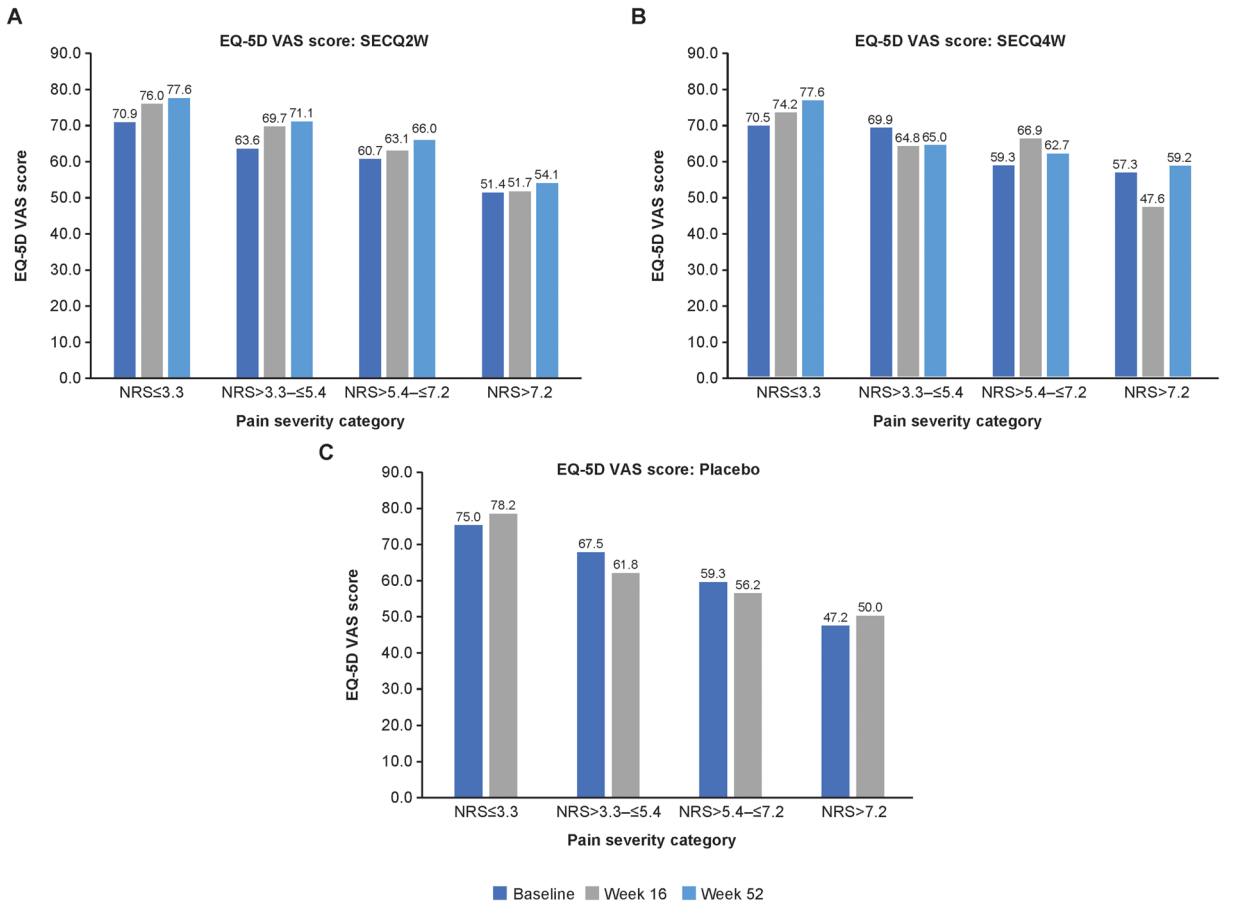


Fig. 4 EQ-5D VAS scores, based on baseline NRS skin pain—at worst severity categories, at baseline, week 16, and week 52 based on pooled data from SUNSHINE and SUNRISE. Bar graphs detailing EQ-5D VAS scores by baseline NRS skin pain–at worst severity categories at baseline, week 16 and week 52 in the **a** SECQ2W group; **b** SECQ4W group; and **c** placebo group. Severity categories are based on baseline NRS quartiles for all patients based on pooled data from SUNSHINE and SUNRISE. Note that higher EQ-5D VAS scores are more favourable. *EQ-5D* European quality of life-5 dimension, *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg, *VAS* visual analogue scale

a reduction in the proportion of patients with overall pain medication use, including tramadol, at week 16, which was generally sustained through week 52. While the reduction in pain medication use is encouraging, effective pain reduction may be greater than that captured in this study as both pain and pain medication use were reduced. Given that the half-life of pain medications is generally short, and that HS naturally has a fluctuating pattern, it is worth continuing to evaluate the design of pain endpoints in HS clinical trials to minimise patient discomfort during flares.

A full list of limitations of SUNSHINE and SUNRISE has been previously reported [22]. The data included in this analysis were exploratory; thus, no formal hypothesis testing was performed. Given that patients were not originally stratified according to baseline pain NRS levels, there were differences observed in the distribution of patients across skin pain severity categories between groups at baseline. The changes in

Table 3 Relationship between NRS skin pain—at worst and various quality of life, disease characteristic, and inflammatory marker outcomes through week 16 in the SECQ2W, SECQ4W and placebo groups based on pooled data from SUNSHINE and SUNRISE

Spearman's correlation coefficient	DLQI total score	DLQI itchy, sore, painful, or stinging skin	EQ-5D VAS score	EQ-5D pain/discomfort	AN count	Lesion count	hsCRP	IHS4 score
NRS skin pain—at worst (SECQ2W)	0.593	0.538	− 0.374	0.509	0.312	0.308	0.239	0.316
NRS skin pain—at worst (SECQ4W)	0.579	0.551	− 0.367	0.489	0.335	0.311	0.186	0.352
NRS skin pain—at worst (placebo)	0.624	0.585	− 0.489	0.512	0.349	0.314	0.365	0.354

Note that higher EQ-5D VAS scores are more favourable. Lesion count refers to all lesions while AN count refers to abscess and inflammatory nodule count only

AN abscess and inflammatory nodule, *DLQI* dermatology life quality index, *EQ-5D* European quality of life 5-dimension, *hsCRP* high-sensitivity C-reactive protein, *IHS4* international hidradenitis suppurativa severity score system, *NRS* numeric rating scale, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg, *VAS* visual analogue scale

skin pain observed in this analysis may stem from the use of concomitant medications and thus cannot be fully attributed to study treatment. Furthermore, the cutoffs used for assessing skin pain categories were based on baseline NRS quartiles in the absence of validated cutoffs for the HS population. Thus, cutoffs may vary across trials utilising this method. Pain outcomes are subjective by nature and often exhibit high variability, and completing patient-reported pain diaries can be burdensome for patients, highlighting the need for alternative measures of assessing pain. Finally, most patients enrolled in SUNSHINE and SUNRISE were self-reported to be White, with a relatively low proportion of Black patients included compared to the known demographics of HS worldwide [36]. While racial data obtained by self-report has limitations, the composition of the study population may limit the generalisability of the findings compared to the broader global population affected by HS.

CONCLUSION

This post hoc analysis of the SUNSHINE and SUNRISE phase 3 trials highlights the benefits of secukinumab in reducing skin pain in patients with moderate to severe HS, seen within a few weeks of treatment initiation, and sustained, with a trend for improvement, through week 52. Furthermore, pain relief was achieved irrespective of the subgroup, including baseline disease severity and previous exposure to other biologic treatments for HS. Importantly, improvements in disease-related pain were associated with improvements in QoL of patients, as well as a decrease in the proportion of patients taking pain medication.

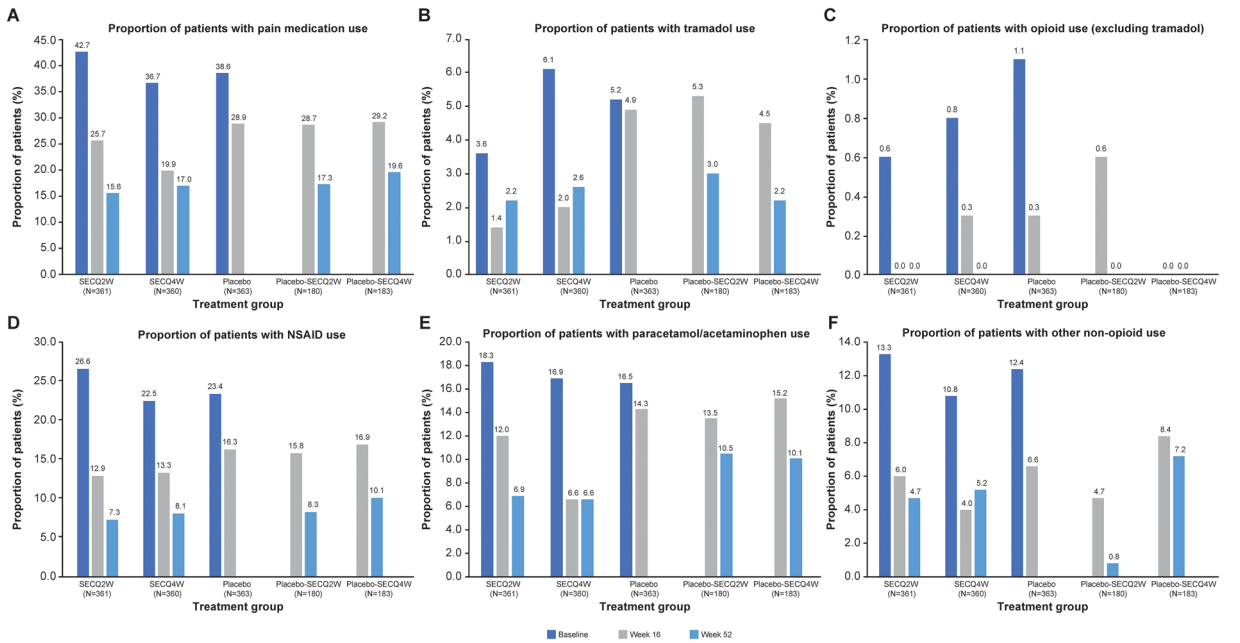


Fig. 5 Proportion of patients with pain medication use for HS at baseline, week 16, and week 52 based on pooled data from SUNSHINE and SUNRISE. Bar graphs detailing the proportion of patients with **a** overall pain medication use, **b** tramadol use, **c** opioid use (excluding tramadol), **d** NSAID use, **e** paracetamol/acetaminophen use, and **f** other non-opioid use at baseline, week 16 and week 52 in the SECQ2W, SECQ4W and placebo groups. The use of any pain medication was evaluated by 28-day intervals relative to first study treatment. A patient with multiple occurrences within the same category and interval was counted only once for that category and interval. Medication reported over more than one interval was counted in each interval during which the medication was reported. *N* number of patients in group, *NSAID* non-steroidal anti-inflammatory drug, *Q2W* every 2 weeks, *Q4W* every 4 weeks, *SEC* secukinumab 300 mg

ACKNOWLEDGEMENTS

The authors thank the participants of the study.

Medical Writing, Editorial and Other Assistance. The authors thank Philip O'Gorman, PhD, Trudy McGarry, PhD (Novartis Ireland Ltd, Dublin, Ireland) and Ramji Narayanan, M Pharm (Novartis UK Ltd, London, United Kingdom) for editorial and medical writing support, which was funded by Novartis Pharma AG, Basel, Switzerland, in accordance with the Good Publication Practice (GPP 2022) guidelines (https://www.ismpp.org/gpp-2022).

Author Contributions. Magdalena B. Wozniak and Alexa B. Kimball contributed to the design of the trials. Jacek C. Szepietowski, Lukasz Matusiak, Georgios Kokolakis, Maryam S. Alam, Dimitrios Ioannides and Alexa B. Kimball were principal investigators. Christine-Elke Ortmann and Christelle C. Pieterse performed data and statistical analysis. John R. Ingram, Jacek C. Szepietowski, Lukasz Matusiak, Georgios Kokolakis, Magdalena B. Wozniak, Christine-Elke Ortmann, Angela Llobet Martinez, Shoba Ravichandran, Nicolas Thomas, Ivette Alarcon, Christelle C. Pieterse, Maryam S. Alam, Dimitrios Ioannides, and Alexa B. Kimball provided substantial contributions to the interpretation of the data. John R. Ingram, Jacek C. Szepietowski, Lukasz Matusiak, Georgios Kokolakis, Magdalena B. Wozniak, Christine-Elke Ortmann, Angela Llobet Martinez, Shoba Ravichandran, Nicolas Thomas, Ivette Alarcon, Christelle C. Pieterse, Maryam S. Alam, Dimitrios Ioannides, and Alexa B. Kimball revised and reviewed the manuscript,

approved the final version of the manuscript for submission, and agreed to be accountable for the accuracy of the work.

Funding. This investigation and the journal's rapid service fees were sponsored by Novartis Pharma AG, Basel, Switzerland.

Data Availability. Novartis is committed to sharing, with qualified external researchers, access to patient-level data and supporting clinical documents from eligible trials. These requests are reviewed and approved by an independent review panel on the basis of scientific merit. All data provided are anonymised to respect the privacy of patients who have participated in the trials in line with applicable laws and regulations.

Declarations

Conflict of Interest. John R. Ingram is a consultant for AbbVie, Boehringer Ingelheim, ChemoCentryx, Citryll, Insmed, Kymera Therapeutics, Novartis, UCB Pharma, UNION therapeutics, and Viela Bio. He is immediate-past Editor-in-Chief of the *BJD* and receives an authorship honorarium for two UpToDate HS chapters. He is co-copyright holder of HiSQOL and Investigator and Patient Global Assessment instruments for HS. His department receives income from copyright of the Dermatology Life Quality Instrument (DLQI) and related instruments. Jacek C. Szepietowski has served as an advisor for AbbVie, LEO Pharma, Novartis, Pierre Fabre, Menlo Therapeutics, and Trevi; he has received speaker honoraria from AbbVie, Janssen-Cilag, LEO Pharma, Novartis, Sanofi-Genzyme, Sun Pharma and Eli Lilly, and he has received clinical trial funding from AbbVie, Almirall, Amgen, Galapagos, Holm, Incyte Corporation, InfraRX, Janssen-Cilag, Menlo Therapeutics, Merck, Novartis, Pfizer, Regeneron, Trevi and UCB. Lukasz Matusiak has been an advisory board/consultant for AbbVie, Leo Pharma, Novartis, Pierre Fabre; a speaker for AbbVie, Janssen, Leo-Pharma, Novartis, Pierre Fabre, Valeant; Involved in clinical trials with AbbVie, Almirall, Amgen, Bio-Thera, BMS, Celltrion, Galderma, Galapagos, Incyte, InfraRX, Janssen, Kiniksa, Medimmune, Menlo Therapeutics, Novartis, Pfizer, Regeneron, UCB, Teva and Trevi. JSK has been an advisory board/consultant for AbbVie, Bayer, ChemoCentryx, Incyte, Janssen, Novartis, Moonlake and UCB, and has received speaker fees from AbbVie, Janssen and UCB. Georgios Kokolakis reports consulting fees from Bayer; payment or honoraria from AbbVie, Abbott, Actelion Pharmaceuticals, Amgen, Basilea Pharmaceutica, Biogen IDEC, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Hexal, Janssen-Cilag, LEO Pharma, Eli Lilly, MSD, Mylan, Novartis, Parexel, Pfizer and UCB; support for attending meetings or travel from AbbVie, Abbott, Amgen, Basilea Pharmaceutica, Celgene, Janssen-Cilag, LEO Pharma, MSD, Novartis, Pfizer, Sanofi and UCB, and served on a Data Safety Monitoring Board or Advisory Board for AbbVie, Abbott, Amgen, Basilea, Bayer, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Janssen-Cilag, LEO Pharma, Eli Lilly, Novartis, Takeda and UCB. Magdalena B. Wozniak is an employee and stockholder at Novartis Ireland Limited, Dublin, Ireland. Christine-Elke Ortmann, Angela Llobet Martinez, Nicolas Thomas and Ivette Alarcon are employees of Novartis Pharma AG, Basel, Switzerland. Shoba Ravichandran was an employee of Novartis Pharmaceuticals, East Hanover, New Jersey, USA at the time of the study, and is now retired. Christelle C. Pieterse is an employee of Syneos Health fully contracted to Novartis. Maryam S. Alam has been the principal investigator for clinical trials funded by Novartis, Arcutis Biotherapeutics, Galderma Laboratories, Eli Lilly, AbbVie, Pfizer, Concert pharmaceutical, Dermira pharmaceutical, UCB, Incyte, Boehringer Ingelheim, Amgen, Evelo Sciences, Leo Pharma, Bristol-Myers- Squibb, Dice Therapeutics, Kiniska Pharmaceuticals, Zai Lab co., Sanofi and Bausch Health. MSA has been on the advisory board for the following companies Amgen, AbbVie, Sanofi, Novartis, Incyte, Boehringer Ingelheim, UCB, Arcutis, Bristol-Myers- Squibb and Bausch Health. Dimitrios Ioannides has collaborated in educational and scientific activities and has taken part in advisory services of AbbVie, Amgen, Eli Lilly, Genesis, Janssen, Novartis, Pfizer, Sanofi and UCB.

Alexa B. Kimball reports grants from AbbVie, Admirx, Anapyts Bio, Aristea, Bristol Myers Squibb, Eli Lilly, Incyte, Janssen, Moonlake, Novartis, Pfizer, Prometheus, Sanofi, Sonoma Bio and UCB, and fellowship funding from AbbVie and Janssen paid to her institution; royalties from BIDMC; honoraria or consulting fees from AbbVie, Alumis, Avalos, Bayer, Boehringer Ingelheim, Eli Lilly, Evoimmune, Innovaderm, Janssen, Novartis, Moonlake, Pfizer, Priovant, Sanofi, Sonoma Bio, Target RWE, UCB and Union Therapeutics; serving on advisory boards for Target RWE; serving as an advisory council member to the National Institute of Health Director; and serves on the board of directors of Almirall.

Ethical Approval. The study protocol and all amendments for the SUNSHINE and SUNRISE trials were reviewed by the independent ethics committee or institutional review board for each participating centre. The study was done according to The International Conference on Harmonisation Guidelines for Good Clinical Practice that have their origin in the Declaration of Helsinki. Written informed consent was obtained from each patient during the screening visit and before any study-specific procedure was done.

REFERENCES

1. Sabat R, Jemec GBE, Matusiak Ł, Kimball AB, Prens E, Wolk K. Hidradenitis suppurativa. Nat Rev Dis Primers. 2020;6(1):18.
2. Dufour DN, Emtestam L, Jemec GB. Hidradenitis suppurativa: a common and burdensome, yet under-recognised, inflammatory skin disease. Postgrad Med J. 2014;90(1062):216–21; quiz 220.
3. Ingram JR, Bettoli V, Espy JI, et al. Unmet clinical needs and burden of disease in hidradenitis suppurativa: real-world experience from EU5 and US. J Eur Acad Dermatol Venereol. 2022;36(9):1597–605.
4. Jfri A, Nassim D, O'Brien E, Gulliver W, Nikolakis G, Zouboulis CC. Prevalence of hidradenitis suppurativa: a systematic review and meta-regression analysis. JAMA Dermatol. 2021;157(8):924–31.
5. Kashetsky N, Mukovozov IM, Pereira J, Manion R, Carter S, Alhusayen R. Patient experiences with hidradenitis suppurativa: the hidradenitis patient experience survey. Clin Exp Dermatol. 2022;47(1):72–9.
6. Ring HC, Yao Y, Maul JT, et al. The road to biologics in patients with hidradenitis suppurativa: a nationwide drug utilization study. Br J Dermatol. 2022;187(4):523–30.
7. Kearney N, O'Donohoe S, Hughes R, Kirby B. Shorter time to initiation of biologic therapy in the setting of a hidradenitis suppurativa specialty clinic. Clin Exp Dermatol. 2023;48(10):1149–51.
8. Kokolakis G, Wolk K, Schneider-Burrus S, et al. Delayed diagnosis of hidradenitis suppurativa and its effect on patients and healthcare system. Dermatology. 2020;236(5):421–30.
9. Saunte DM, Boer J, Stratigos A, et al. Diagnostic delay in hidradenitis suppurativa is a global problem. Br J Dermatol. 2015;173(6):1546–9.
10. Patel ZS, Hoffman LK, Buse DC, et al. Pain, psychological comorbidities, disability, and impaired quality of life in hidradenitis suppurativa [corrected]. Curr Pain Headache Rep. 2017;21(12):49.
11. Matusiak Ł, Szczęch J, Kaaz K, Lelonek E, Szepietowski JC. Clinical characteristics of pruritus and pain in patients with hidradenitis suppurativa. Acta Derm Venereol. 2018;98(2):191–4.
12. Kirby JS, Martorell A, Sayed CJ, et al. Understanding the real-world patient journey and unmet needs of people with hidradenitis suppurativa through social media research. Br J Dermatol. 2023;189(2):228–30.

13. Krajewski PK, Matusiak Ł, von Stebut E, et al. Pain in hidradenitis suppurativa: a cross-sectional study of 1,795 patients. Acta Derm Venereol. 2021;101(1):adv00364.

14. Nielsen RM, Lindsø Andersen P, Sigsgaard V, Theut Riis P, Jemec GB. Pain perception in patients with hidradenitis suppurativa. Br J Dermatol. 2020;182(1):166–74.

15. Savage KT, Singh V, Patel ZS, et al. Pain management in hidradenitis suppurativa and a proposed treatment algorithm. J Am Acad Dermatol. 2021;85(1):187–99.

16. Smith HS, Chao JD, Teitelbaum J. Painful hidradenitis suppurativa. Clin J Pain. 2010;26(5):435–44.

17. Kaaz K, Szepietowski JC, Matusiak Ł. Influence of itch and pain on sleep quality in patients with hidradenitis suppurativa. Acta Derm Venereol. 2018;98(8):757–61.

18. Keary E, Hevey D, Tobin AM. A qualitative analysis of psychological distress in hidradenitis suppurativa. Br J Dermatol. 2020;182(2):342–7.

19. Matusiak Ł. Profound consequences of hidradenitis suppurativa: a review. Br J Dermatol. 2020;183(6):e171–7.

20. Orenstein LAV, Salame N, Siira MR, et al. Pain experiences among those living with hidradenitis suppurativa: a qualitative study. Br J Dermatol. 2023;188(1):41–51.

21. Puza CJ, Wolfe SA, Jaleel T. Pain management in patients with hidradenitis suppurativa requiring surgery. Dermatol Surg. 2019;45(10):1327–30.

22. Kimball AB, Jemec GBE, Alavi A, et al. Secukinumab in moderate-to-severe hidradenitis suppurativa (SUNSHINE and SUNRISE): week 16 and week 52 results of two identical, multicentre, randomised, placebo-controlled, double-blind phase 3 trials. Lancet. 2023;401(10378):747–61.

23. Kimball AB, Sundaram M, Shields AL, et al. Adalimumab alleviates skin pain in patients with moderate-to-severe hidradenitis suppurativa: secondary efficacy results from the PIONEER I and PIONEER II randomized controlled trials. J Am Acad Dermatol. 2018;79(6):1141–3.

24. Kimball AB, Okun MM, Williams DA, et al. Two phase 3 trials of adalimumab for hidradenitis suppurativa. N Engl J Med. 2016;375(5):422–34.

25. Kimball AB, Jemec GBE, Sayed CJ, et al. Efficacy and safety of bimekizumab in patients with moderate-to-severe hidradenitis suppurativa (BE HEARD I and BE HEARD II): two 48-week, randomised, double-blind, placebo-controlled, multicentre phase 3 trials. Lancet. 2024;403(10443):2504–19.

26. Midgette B, Strunk A, Akilov O, et al. Factors associated with treatment satisfaction in patients with hidradenitis suppurativa: results from the Global VOICE project. Br J Dermatol. 2022;187(6):927–35.

27. Wei X, Passera A, Muscianisi E, et al. Assessing the validity and clinical meaningfulness of skin pain response (NRS30) assessed using numerical rating scale in hidradenitis suppurativa: results from the SUNSHINE and SUNRISE trials. J Am Acad Dermatol. 2023;89(6):1285–7.

28. Zouboulis CC, Tzellos T, Kyrgidis A, et al. Development and validation of the International Hidradenitis Suppurativa Severity Score System (IHS4), a novel dynamic scoring system to assess HS severity. Br J Dermatol. 2017;177(5):1401–9.

29. Mukaka MM. Statistics corner: a guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012;24(3):69–71.

30. Kimball AB, Kirby J, Ingram JR, et al. Burden of hidradenitis suppurativa: a systematic literature review of patient reported outcomes. Dermatol Ther (Heidelb). 2024;14(1):83–98.

31. Thorlacius L, Ingram JR, Villumsen B, et al. A core domain set for hidradenitis suppurativa trial outcomes: an international Delphi process. Br J Dermatol. 2018;179(3):642–50.

32. Alhusayen R. The pain of hidradenitis suppurativa: 'we only see what we know.' Br J Dermatol. 2020;182(1):17–8.

33. Ingram JR, Hadjieconomou S, Piguet V. Development of core outcome sets in hidradenitis suppurativa: systematic review of outcome measure instruments to inform the process. Br J Dermatol. 2016;175(2):263–72.

34. Garg A, Papagermanos V, Midura M, Strunk A, Merson J. Opioid, alcohol, and cannabis misuse among patients with hidradenitis suppurativa: a population-based analysis in the United States. J Am Acad Dermatol. 2018;79(3):495-500.e1.

35. Reddy S, Orenstein LAV, Strunk A, Garg A. Incidence of long-term opioid use among opioid-naive patients with hidradenitis suppurativa in the United States. JAMA Dermatol. 2019;155(11):1284–90.

36. Lee DE, Clark AK, Shi VY. Hidradenitis suppurativa: disease burden and etiology in skin of color. Dermatology. 2017;233(6):456–61.