

Severity strata for POEM, PO-SCORAD, and DLQI in US adults with atopic dermatitis



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ABSTRACT

Background: Patient-Oriented Eczema Measure (POEM) is the preferred patient-reported outcome (PRO) for assessing symptoms of atopic dermatitis (AD). Dermatology Life Quality Index (DLQI) is commonly used to assess the burden of skin disease. Previous severity strata were developed for POEM and DLQI in clinical cohorts, which may be biased toward more severe disease. Severity strata were not previously examined in population-based cohorts. Patient-Oriented Scoring AD (PO-SCORAD) is another commonly used PRO for assessing AD symptoms; however, severity strata are not established.

Objective: We sought to confirm previously developed strata for POEM and DLQI, and to develop strata for the PO-SCORAD in a population-based cohort of adults with AD.

Methods: A cross-sectional, population-based study of 8,217 adults was performed using a structured questionnaire. A diagnosis of AD was determined using modified UK Diagnostic Criteria for AD (n = 602). AD severity was assessed using self-reported global AD severity (anchoring question), POEM, PO-SCORAD, and DLQI. Strata were selected using an anchoring approach based on patient-reported disease severity.

Results: We confirmed the existing strata for DLQI (mild = 0-5, moderate = 6-10, severe = 11-30) (kappa = 0.446). However, the preferred strata for POEM was mild = 0-7, moderate = 8-19, and severe = 20-28 (kappa = 0.409) and PO-SCORAD was mild = 1-27, moderate = 28-56, severe = 57-104 (kappa = 0.444).

Conclusion: Existing strata for DLQI performed well in a population-based cohort of adult AD. The optimal severity strata for the POEM in our AD population varies slightly from those previously published for AD. This may suggest that different strata may be optimal in different study settings and cohorts. Finally, we proposed new strata for PO-SCORAD in adult AD.

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Introduction

Atopic dermatitis (AD) is a heterogeneous skin disorder that can have a profound patient burden, particularly in more severe disease. Atopic dermatitis is universally associated with skin lesions and pruritus, and it also can be associated with sleep disturbance,^{1,2} anxiety and depression,³ and impaired quality of life (QoL).^{4–9} Each of these domains can be assessed by using validated patient-reported outcomes (PRO) measures. For example, Patient-Oriented Eczema Measure (POEM) assesses the frequency of 7 AD signs and symptoms in the past week, including skin manifestations, itch, and sleep disturbance.¹⁰ Patient-Oriented Scoring AD (PO-SCORAD) assesses the extent and severity of AD lesions and the severity of itch and sleep disturbance.¹¹ Dermatology Life Quality Index (DLQI) assesses the burden of skin disease in adults.¹² No single PRO fully describes all aspects of AD.

Patient-Oriented Eczema Measure and DLQI have a fairly simple scoring system, whereas calculation of the PO-SCORAD is more complex. Nevertheless, all 3 of these PRO scores can be challenging to interpret. Severity strata or bands were previously developed for POEM and DLQI to improve interpretability and determination of clinical meaningfulness.^{10,13–15} Previous severity strata for POEM and DLQI were developed in clinical cohorts, which may be biased toward more severe disease. Severity strata were not previously examined in population-based cohorts. Different strata may be optimal in different study settings and cohorts; that is, previously developed strata are not optimal in population-based cohorts. This is important for the interpretation of AD severity and QOL impact in population-based epidemiology studies. In addition, no severity strata exist for PO-SCORAD. We sought to confirm whether previously reported strata for POEM and DLQI are applicable to a population-based cohort of adults with AD. We also sought to develop interpretable severity strata for PO-SCORAD.

Methods

Data Source

Data were obtained from the Atopic Dermatitis in America survey, whose population was sampled from the long-standing GfK Knowledge Panel. The GfK Knowledge Panel is a large probability-based web panel in the United States and contains between 40,000 and 50,000 adult panel members at any given time. The GfK web panel is initially constructed from a national address-based sample of households in the United States who are recruited to join in and who receive small incentives for participating in web surveys on a regular basis. This approach uses a single sampling frame via the Delivery Sequence File of the US Postal Service to provide a statistically valid representation of the US population as well as many difficult-to-survey populations. Adults from sampled households are invited to join the Knowledge Panel through a series of mailings, including an initial invitation letter, a reminder postcard, and a subsequent follow-up letter. Invited households can join by mail, telephone, or internet. After initially accepting the invitation to join the panel, participants are asked to complete a short demographic survey. The GfK web panel also provides internet access to households without existing internet access. This web-based panel has been used in other large, dermatologic epidemiological studies and has been shown to be representative of the US population.^{16–18} The survey questionnaire and protocol were approved by the ICF Institutional Review Board.

Study Design

This AD in America study was a cross-sectional study involving a 2-stage sampling process. Stage 1 was designed to determine the prevalence of AD in US adults. In this stage, an initial cross-sectional sample of 2,137 adults from the existing GfK Knowledge web panel was invited to participate in the survey. The focus of the survey was not disclosed in the invitation to members of the web panel, to avoid biasing participation based on respondent interest or disinterest in the subject. A total of 1,278 adults completed the survey (response rate = 59.80%). Although this sample provided a precise estimate of the prevalence of AD among the adult population, it did not yield a large enough sample of AD patients to investigate differences between various levels of disease severity. In stage 2, an additional sample of 8,217 adults from the GfK knowledge panel completed screening to identify and interview an additional group of adults with AD. The final cohort consisted of 602 adults who met an adapted UK working party (UKWP) definition of AD (eFig 1). Survey weights were created that adjusted for sex, age, race/ethnicity, education level, census region, household income, home ownership, and metropolitan residence, as well as potential differential nonresponse. These weights allow for generalizing results to the US population.

Assessment of Atopic Dermatitis

An adaptation of the UKWP criteria was selected by the AD in America advisory committee as the screening tool for patient eligibility.¹⁹ This included all aspects of the UKWP criteria (having an itchy skin condition during the past 12 months and 3 or more of the following: [1] history of skin crease involvement; [2] a personal history of asthma or hay fever; [3] a history of general dry skin during the past year; [4] visible flexural eczema; or [5] onset before the age of 2 years), except that assessment of visible flexural eczema by a clinician was not performed.

Self-assessments of AD severity and burden included the self-reported global AD severity question “Would you describe your atopic dermatitis or eczema as mild, moderate, or severe?”²⁰ as well as PROs related to AD, including PO-SCORAD index (range, 0–103),¹¹ POEM (7 questions; range, 0–28),¹⁰ and DLQI (10 questions; range, 0–30).¹²

Statistical Analyses

All data analyses and statistical processes were performed using SAS version 9.4 (SAS Institute, Cary, North Carolina). Spearman rank correlation was performed to compare self-reported global AD severity with POEM, PO-SCORAD, and DLQI scores. Correlations were compared by using a *z* test of the Fisher *z* transformation.

An anchor-based approach was used as recently described.²¹ Briefly, the thresholds for severity strata were determined by comparing the POEM, PO-SCORAD, and DLQI with self-reported global AD severity, as a 3-point severity anchor (1 = mild, 2 = moderate, and 3 = severe disease). First, the frequencies, mean, median, and mode of self-reported global AD severity were determined for each integer value of the POEM, PO-SCORAD, and DLQI. Then, different values for POEM, PO-SCORAD, and DLQI that were associated with a 1-grade increase in mean, median, or mode self-reported AD severity (eg, from 1 to 2, or 2 to 3) were considered possible threshold values for severity strata. For example, if median or mean scores of 2 (moderate) first occurred at a POEM score of 8, then 8 would be considered as a potential lower threshold for moderate POEM scores. Potential strata for POEM, PO-SCORAD, and DLQI were then constructed using

combinations of these different threshold values for moderate and severe disease. Weighted kappa coefficients were then determined for concordance between the potential bandings and self-reported global AD severity. The kappa statistic measures the degree of agreement between the compared assessments previously discussed than expected by chance alone and ranges from 0 (no better than chance) to 1 (perfect agreement). We also tested any bandings previously reported for the POEM, PO-SCORAD, and DLQI. Novel bands that were found to be optimal based on highest weighted kappa coefficient were compared with previously reported bands using a 2-sample z test. Finally, we tested the concordance of the final proposed severity strata for POEM, PO-SCORAD, and DLQI with each other.

Subgroup analyses were performed to determine how many patients had self-reported severity scores outside the final severity strata for each measure. Complete case analysis was performed; subjects with missing values were excluded. Missing or invalid responses occurred in less than 1% of subjects for any of the assessments.

Results

Patient Characteristics

Overall, the prevalence (95% confidence interval [CI]) of AD was 7.3% (5.9%–8.8%). Six hundred two subjects met the criteria for AD and were included in the final cohort. Subjects were 53.6% female and 71.9% white, with a mean \pm standard deviation (SD) age of 52.0 ± 16.3 years. Of those reporting global AD severity, 289 (58.4%) reported having mild, 172 (34.8%) moderate, and 34 (6.9%) severe AD (Table 1). The mean \pm SD PO-SCORAD was 25.8 ± 16.2 , POEM was 7.1 ± 6.4 , and DLQI was 4.2 ± 5.8 .

The POEM, DLQI, and PO-SCORAD scales were all significantly correlated with each other (Spearman rho 0.61–0.69; $P < .0001$). Self-reported AD severity (the anchor) correlated with DLQI (Spearman correlation; rho = 0.55), PO-SCORAD (rho = 0.54), and POEM (rho = 0.49) ($P < .0001$ for all). No significant differences were found in correlations of self-reported global AD severity with POEM, DLQI, and PO-SCORAD ($P \geq .14$).

Strata

The distribution, mean, median, and mode of self-reported AD severity for each POEM, PO-SCORAD, and DLQI score are presented in eTables 1 through 3.

To illustrate the anchor-based approach, selection of potential thresholds for POEM based on self-reported moderate and severe AD will be elaborated. A median and mode severity score of 2 (moderate) first occurred at a POEM score of 8, with a mean severity score of 1.7. However, POEM scores of 8 and 9 had median and mode severity scores of 1. Most POEM scores between 10 and 19 had median or mode severity scores of 2. Therefore, POEM scores of 8 and 11 were selected as a proposed threshold for moderate AD. A median and

Table 1
Subject Characteristics

Variable	Value
Age (mean \pm SD)	60.0 (15.9)
Female sex—n (%)	286 (57.8%)
Race/ethnicity—n (%)	
Caucasian/white	324 (65.5%)
African-American/black	64 (12.9%)
Hispanic	61 (12.3%)
Multiracial/other	46 (9.3%)
Self-reported AD severity	
Mild	289 (59.4%)
Moderate	172 (34.8%)
Severe	34 (6.9%)

Abbreviations: AD, atopic dermatitis; SD, standard deviation.

Table 2
Concordance of Proposed Severity Strata With Self-Reported AD Severity

Self-reported AD severity	Moderate	Severe	κ coefficient of agreement
Possible POEM bandings			
0-7	8-19	20-28	0.409
0-10	11-19	20-28	0.376
0-7	8-25	26-28	0.386
0-10	11-25	26-28	0.359
0-7	8-16	17-28	0.385
Possible PO-SCORAD bandings			
0-22	23-50	51-104	0.384
0-27	28-50	51-104	0.439
0-22	23-56	57-104	0.389
0-27	28-56	57-104	0.444
0-24	25-50	51-104	0.401
0-28	29-48	49-104	0.425
Possible DLQI bandings			
0-4	5-14	15-30	0.434
0-4	5-22	23-30	0.436
0-5	6-10	11-30	0.446

Abbreviations: AD, atopic dermatitis; POEM, Patient-Oriented Eczema Measure; PO-SCORAD, Patient-Oriented Scoring Atopic Dermatitis; DLQI, Dermatology Life Quality Index.

mode severity score of 3 (severe) first occurred at a POEM score of 20, although consistent median or mode severity scores of 3 occurred at a POEM score of 26 or greater. Therefore, POEM scores of 20 and 26 were considered as threshold for severe AD. However, a POEM score of 18 was associated with median and mode severity scores of 2. A POEM of 19 was the next score to be associated with a median and mode severity of 3. Therefore, a POEM of 19 was also considered as a potential threshold for severe AD. This was similarly done for PO-SCORAD and DLQI.

Based on assessment of mean, median, and mode values, 4 different strata were tested for POEM (Table 2). For POEM, the band 0 to 7 = mild, 8 to 19 = moderate, and 20 to 28 = severe was deemed optimal based on the highest kappa coefficient (0.409) (Table 2). The kappa coefficient for this band significantly differed from the previously reported band 0 to 7 = mild, 8 to 16 = moderate, 17 to 28 = severe ($\kappa = 0.385$; $P < .0001$) (Table 2). A substantial number of subjects ($n = 33$, 53.2%) who would have been classified as having severe AD using the previously published bands for POEM, would have been reclassified as having moderate AD using the revised POEM bands.

Six different potential strata were tested for PO-SCORAD, as well as previously established strata for SCORAD (Table 2). The band 0 to 27 = mild, 28 to 56 = moderate, and 57 to 104 = severe had the highest kappa coefficient (0.444). The kappa coefficient for this band significantly differed from the conventionally used band 0 to 24 = mild, 25 to 50 = moderate, 51 or higher = severe²² ($\kappa = 0.401$; $P < .0001$). Thirty-five (16.8%) and 19 (41.3%) subjects who would have been classified as having moderate or severe AD using the conventional bands for SCORAD would have been reclassified as having mild or moderate AD using the observed PO-SCORAD bands, respectively.

Two different strata were tested for DLQI, as well as previously established strata (Table 2). The previously reported band¹⁴ of 0 to 5 = mild, 6 to 10 = moderate, and 11 to 30 = severe was deemed optimal based on the highest kappa coefficient (0.446).

Fair to moderate concordance was seen between the proposed severity bands for POEM, PO-SCORAD, and DLQI (weighted κ range, 0.36–0.49; Fig 1).

Robustness of Strata

Seven patients (1.4%) had a self-reported AD severity score more than 1 point outside of that predicted by the final POEM strata. Seventy-five (15.1%) patients had a severity score 1 point higher and 89

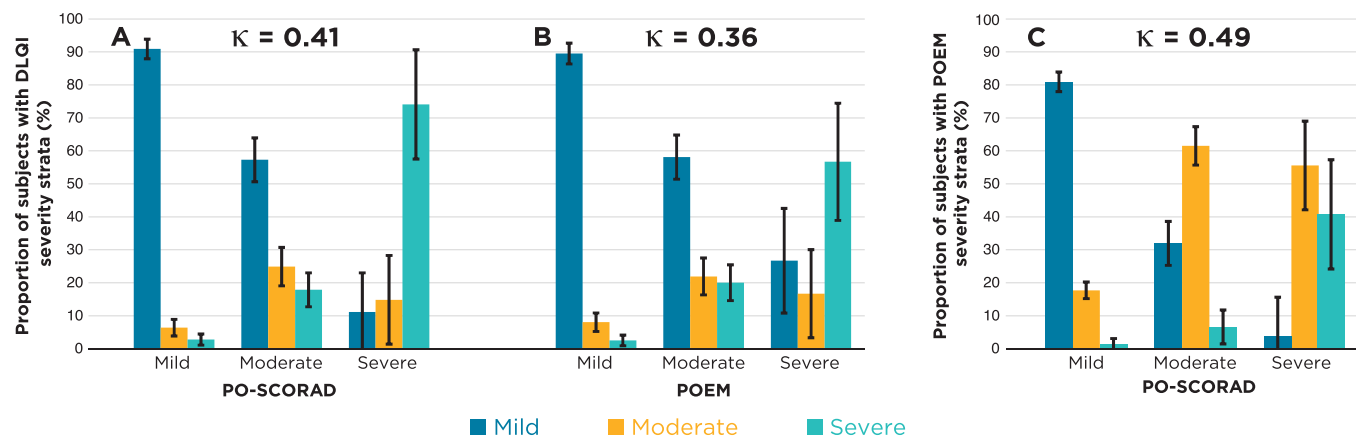


Figure 1. Relationship between severity strata for POEM, PO-SCORAD, and DLQI. Proportion (95% CI) of subjects with mild, moderate, or severe DLQI scores among those who also have mild, moderate, or severe (A) PO-SCORAD or (B) POEM scores, and (C) proportion (95% CI) of subjects with mild, moderate, or severe POEM scores among those who also have mild, moderate, or severe PO-SCORAD scores as judged by respective severity strata. Weighted kappas are presented. Abbreviations: POEM, Patient-Oriented Eczema Measure; PO-SCORAD, Patient-Oriented Scoring Atopic Dermatitis; DLQI, Dermatology Life Quality Index; CI, confidence interval.

(18.0%) had 1 point lower than the final POEM strata predicted. Seven patients (1.4%) had a self-reported AD severity score more than 1 point outside of that predicted by the final PO-SCORAD strata. Seventy-two (14.5%) patients had a severity score 1 point higher and 81 (16.3%) had 1 point lower than the final PO-SCORAD strata predicted. Twenty patients (4.0%) had a self-reported AD severity score more than 1 point outside of that predicted by the final DLQI strata. Eighty-six (17.4%) patients had a severity score 1 point higher and 52 (10.6%) had 1 point lower than the final DLQI strata predicted.

Discussion

The current study determined potential severity strata for DLQI in adults with AD, which was consistent with previously reported strata.¹⁴ However, the optimal severity strata for POEM in this population-based cohort differed from previously reported strata that were developed in clinical cohorts.¹⁰ This may suggest that different strata are optimal in different study settings and cohorts. In addition, we developed novel severity strata for the PO-SCORAD, which differed from SCORAD strata used by convention. We studied the interpretability of these PRO because of their commonality and potential utility in AD. These results are clinically relevant, because a substantial proportion of patients would have different severity classifications using the observed optimal strata for POEM and SCORAD compared with previously reported strata. This is important for interpretation of these PRO assessments in clinical practice.

The similar correlation of patient-reported AD severity with PO-SCORAD and POEM is intriguing. Patient-Oriented Eczema Measure has been well validated and shown to demonstrate construct validity, convergent validity, divergent validity, internal consistency, sensitivity to change, and test-retest reliability.^{23,24} Patient-Oriented Eczema Measure was chosen by the Harmonizing Outcome Measures in Eczema (HOME) group at the 4th international consensus meeting as the preferred core instrument to assess patient-reported symptoms in future AD trials.^{25,26} The results of the current study confirm that POEM correlates well with overall disease severity. However, they also suggest that PO-SCORAD correlates well with AD severity. Patient-Oriented Eczema Measure assesses the frequency of patient-reported signs and symptoms, whereas PO-SCORAD assesses the extent and severity of patient-reported signs and intensity of itch and sleep. Severity and intensity of signs and symptoms may be an equally important construct to assess AD severity from a patient perspective.

The concordance of POEM, PO-SCORAD, and DLQI with each other and with self-reported AD severity were all modest. This underscores

that each of these PROs assesses different constructs or aspects of AD. Thus, no single instrument alone appears to fully capture the multidimensional aspects of AD. Selection of an instrument in clinical practice or trials will depend on feasibility and specific domains sought to be probed.

This study has several strengths, including large sample size and a representative US population-based sample. However, this study has some limitations, including the lack of physician confirmation of diagnosis and objective assessment of severity. In addition, future studies are needed to confirm that the POEM and PO-SCORAD strata are optimal in the clinical and epidemiological settings.

In conclusion, the current study confirmed that previously determined severity strata for DLQI are optimal in adults with AD. We also found that novel strata for POEM were optimal in this population-based setting. Moreover, we developed novel strata for PO-SCORAD. We recommend that these strata be used to improve interpretation of these scores in clinical practice or research studies of adult AD.

Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.anai.2018.07.004>.

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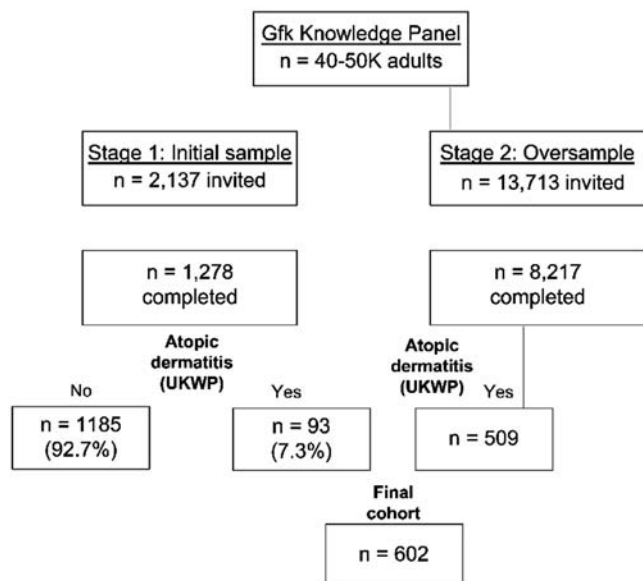


Figure 1. Atopic dermatitis study design.

Table 1
Distribution of Self-Reported AD Severity Across Different POEM Scores

POEM score	n	Self-reported severity			Mean	Median	Mode
		Mild	Moderate	Severe			
0	42	37	5	0	1.1	1	1
1	26	25	1	0	1.0	1	1
2	30	23	6	1	1.3	1	1
3	37	31	6	0	1.2	1	1
4	47	37	9	1	1.2	1	1
5	31	20	11	0	1.4	1	1
6	28	21	6	1	1.3	1	1
7	27	14	13	0	1.5	1	1
8	37	14	21	2	1.7	2	2
9	21	13	8	0	1.4	1	1
10	21	11	6	4	1.7	1	1
11	14	3	10	1	1.9	2	2
12	19	9	8	2	1.6	2	1
13	18	8	9	1	1.6	2	2
14	13	7	4	2	1.6	1	1
15	12	1	10	1	2.0	2	2
16	10	4	5	1	1.7	2	2
17	11	2	8	1	1.9	2	2
18	11	2	7	2	2.0	2	2
19	11	3	7	1	1.8	2	2
20	5	1	1	3	2.4	3	3
21	6	1	4	1	2.0	2	2
22	2	1	0	1	2.0	2	.
23	2	0	1	1	2.5	2.5	.
24	5	1	4	0	1.8	2	2
25	3	0	2	1	2.3	2	2
26	1	0	0	1	3.0	3	3
27	1	0	0	1	3.0	3	3
28	4	0	0	4	3.0	3	3
A							

Abbreviations: AD, atopic dermatitis; POEM, Patient-Oriented Eczema Measure.

eTable 2
Distribution of Self-Reported AD Severity Across Different PO-SCORAD Scores

PO-SCORAD score	N	Self-reported severity			Mean	Median	Mode
		Mild	Moderate	Severe			
0	6	6	0	0	1.0	1	1
1	6	6	0	0	1.0	1	1
2	2	2	0	0	1.0	1	1
3	1	1	0	0	1.0	1	1
4	3	3	0	0	1.0	1	1
5	5	5	0	0	1.0	1	1
6	7	7	0	0	1.0	1	1
7	10	9	1	0	1.1	1	1
8	11	10	0	1	1.2	1	1
9	8	7	1	0	1.1	1	1
10	11	10	1	0	1.1	1	1
11	8	7	1	0	1.1	1	1
12	9	8	1	0	1.1	1	1
13	11	7	4	0	1.4	1	1
14	17	13	4	0	1.2	1	1
15	15	12	3	0	1.2	1	1
16	9	7	2	0	1.2	1	1
17	11	11	0	0	1.0	1	1
18	7	5	2	0	1.3	1	1
19	12	10	2	0	1.2	1	1
20	14	9	5	0	1.4	1	1
21	11	7	3	1	1.5	1	1
22	15	8	6	1	1.5	1	1
23	17	8	8	1	1.6	2	1
24	14	12	2	0	1.1	1	1
25	8	6	2	0	1.3	1	1
26	14	11	3	0	1.2	1	1
27	13	8	5	0	1.4	1	1
28	14	6	8	0	1.6	2	2
29	13	6	7	0	1.5	2	2
30	10	4	6	0	1.6	2	2
31	9	5	3	1	1.6	1	1
32	21	16	5	0	1.2	1	1
33	9	4	4	1	1.7	2	1
34	8	5	3	0	1.4	1	1
35	11	4	7	0	1.6	2	2
36	5	1	4	0	1.8	2	2
37	5	2	3	0	1.6	2	2
38	3	0	2	1	2.3	2	2
39	5	2	2	1	1.8	2	1
40	9	6	3	0	1.3	1	1
41	5	1	2	2	2.2	2	2
42	4	1	3	0	1.8	2	2
43	3	1	1	1	2.0	2	.
44	8	1	7	0	1.9	2	2
45	6	0	5	1	2.2	2	2
46	5	1	3	1	2.0	2	2
47	7	2	4	1	1.9	2	2
48	7	1	5	1	2.0	2	2
49	4	0	4	0	2.0	2	2
50	3	0	2	1	2.3	2	2
51	3	0	1	2	2.7	3	3
52	3	0	3	0	2.0	2	2
53	2	0	1	1	2.5	2.5	.
54	6	1	4	1	2.0	2	2
55	2	1	1	0	1.5	1.5	.
56	3	0	3	0	2.0	2	2
57	1	0	0	1	3.0	3	3
58	3	0	2	1	2.3	2	2
60	1	1	0	0	1.0	1	1
61	1	1	0	0	1.0	1	1
63	2	0	0	2	3.0	3	3
65	2	0	2	0	2.0	2	2
66	5	1	2	2	2.2	2	2
67	2	0	2	0	2.0	2	2
68	1	0	0	1	3.0	3	3
70	1	0	0	1	3.0	3	3
71	1	0	0	1	3.0	3	3
73	1	0	1	0	2.0	2	2
75	1	0	1	0	2.0	2	2
78	1	0	0	1	3.0	3	3
84	2	0	0	2	3.0	3	3
90	1	0	0	1	3.0	3	3
104	1	0	0	1	3.0	3	3

Abbreviations: AD, atopic dermatitis; PO-SCORAD, Patient-Oriented Scoring Atopic Dermatitis.

eTable 3
Distribution of Self-Reported AD Severity Across Different DLQI Scores

DLQI score	n	Self-reported severity			Mean	Median	Mode
		Mild	Moderate	Severe			
0	69	60	8	1	1.1	1	1
1	132	110	22	0	1.2	1	1
2	75	50	22	3	1.4	1	1
3	40	24	14	2	1.5	1	1
4	22	12	7	3	1.6	1	1
5	19	8	9	2	1.7	2	2
6	20	6	12	2	1.8	2	2
7	18	3	15	0	1.8	2	2
8	17	6	11	0	1.6	2	2
9	6	1	4	1	2.0	2	2
10	13	0	12	1	2.1	2	2
11	7	3	3	1	1.7	2	1
12	12	3	5	4	2.1	2	2
13	1	0	1	0	2.0	2	2
14	2	0	2	0	2.0	2	2
15	4	0	2	2	2.5	2.5	2
16	3	0	3	0	2.0	2	2
17	6	0	5	1	2.2	2	2
18	4	1	3	0	1.8	2	2
19	8	1	6	1	2.0	2	2
20	2	0	1	1	2.5	2.5	.
21	2	0	2	0	2.0	2	2
22	2	0	1	1	2.5	2.5	.
23	1	0	0	1	3.0	3	3
24	1	0	1	0	2.0	2	2
26	1	0	0	1	3.0	3	3
29	1	0	0	1	3.0	3	3
30	7	1	1	5	2.6	3	3

Abbreviations: AD, atopic dermatitis; DLQI, Dermatology Life Quality Index.