

# Novel Sentiment Positivity Index: Natural Language Processing of Online Patient Forums for Atopic Dermatitis

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## Background and Methods

- Atopic dermatitis (AD) affects ~10–13% of the U.S. population and significantly impairs quality of life through pruritus, pain, and sleep disruption. While the Dermatology Life Quality Index (DLQI) captures patient-reported outcomes, it is limited by structured design and short recall (1). In contrast, anonymous online forums (e.g., Reddit) enable rich, unfiltered patient narratives. Natural language processing (NLP) offers an opportunity to quantify these discussions, but treatment-specific sentiment analysis in AD remains understudied (2,3).
- The objective was to evaluate patient-perceived effectiveness of AD therapies by developing a Sentiment Positivity Index (SPI) derived from online forum discussions. Posts (n=322,460) from the r/eczema community (2017–2022) were extracted using Pushshift.io. After deduplication and filtering for single-medication mentions listed in Table 1, 28,159 posts were analyzed. Text was preprocessed and evaluated using DistilBERT (fine-tuned on Stanford Sentiment Treebank). Sentiment was classified as positive or negative (threshold  $\geq 0.50$ ). SPI was calculated as the proportion of positive posts per treatment, with 95% confidence intervals (Wilson method). Therapies with <10 posts were excluded.

## Results

- Among 322,460 Reddit posts, 28,159 discussed AD treatments, contributed by 12,439 unique authors. Treatment-related posts were longer (mean 92 words), with 38.5% truncated for analysis. The most discussed therapies were dupilumab (36.7%), topical tacrolimus (17.5%), and antihistamines (11.9%), while newer agents (e.g., topical/systemic tofacitinib) were rarely mentioned.
- Sentiment varied widely, with SPI ranging from 0.116 to 0.365 (mean 0.221). The highest positivity was observed with JAK inhibitors—upadacitinib (0.365), ruxolitinib (0.324), and baricitinib (0.290)—while lower-potency topical corticosteroids showed the lowest sentiment, including Class V (0.116) and Class VI (0.128) (Figure 1).
- Treatments with fewer posts, including JAK inhibitors and azathioprine, demonstrated wider confidence intervals, reflecting greater uncertainty in SPI estimates despite trends toward higher (JAK inhibitors) or lower (azathioprine) sentiment (Figure 1).

## Table and Figure

Treatment Category	Formulations (Search Terms)
Topical JAK Inhibitor	{'opzelura', 'ruxolitinib', 'tofacitinib cream', 'topical tofacitinib'}
Systemic JAK Inhibitor	{'xejanz', 'tofacitinib', 'CIBINQO', 'abrocitinib', 'RINVOQ', 'upadacitinib', 'olumiant', 'baricitinib'}
Monoclonal Antibody (systemic)	{'dupixent', 'Dupixent', 'dupilumab', 'adtraiza', 'tralokinumab', 'adbry'}
Topical Immunomodulator	{'protopic', 'tacrolimus ointment', 'elidel', 'pimecrolimus', 'crisaborole', 'eucrisa', 'VTAMA', 'benvilimod', 'tapinarof'}
Systemic Immunosuppressant	{'gengraf', 'sandimmune', 'neoral', 'cyclosporine', 'muran', 'azathioprine', 'mycophenolate mofetil', 'mycophenolate', 'cellcept', 'tacrolimus', 'prograf', 'reditrex', 'tasuvo', 'otrexup', 'methotrexate'}
Phototherapy	{'phototherapy', 'light therapy', 'photo therapy'}
Antihistamine (systemic)	{'quzzytir', 'levocetirizine', 'xyzal', 'cetirizine', 'allegra', 'loratidine', 'montelukast', 'diphenhydramine', 'singulair', 'alavert', 'nytol', 'dimedrol', 'lexofenadine', 'zyrtec', 'benadryl', 'claritin', 'daedalon'}
Class I Steroids (TCS)	{'ultravate', 'halobetasol propionate', 'diflorasone diacetate', 'diprolene', 'maxiflor', 'dermovate', 'augmented betamethasone dipropionate', 'flutone', 'embeline', 'psorcon', 'olux', 'cormax', 'clovevate', 'clobetasol propionate', 'florone', 'temovate', 'apexicon', 'clobex'}
Class II Steroids (TCS)	{'alphatrex', 'diprosone', 'cyclocort', 'tiamol', 'betamethasone dipropionate', 'lidex', 'dovobet', 'triderm', 'mometasone furoate', 'topocort', 'trisynt', 'halog', 'elecon', 'taro-desoximetasone', 'del-beta', 'topsyn', 'occlucort', 'lyderm', 'lcis', 'desoximetasone', 'triamcinolone acetonide', 'vanos', 'lidemol', 'halcinonide', 'amcinonide', 'cinolar', 'kenalog', 'desoxi', 'fluocinonide'}
Class III-IV Steroids (TCS)	{'derma-smoother', 'luxiq', 'betamethacot', 'qualisone', 'cloderm', 'synalar', 'cordran', 'fluticasone propionate', 'capex', 'cutivate', 'clocortolone pivalate', 'betamethasone valerate', 'valisone', 'drenison', 'beta-val', 'purantix', 'clider', 'derma smooth', 'fluocinolone acetonide', 'furandrenolide'}
Class V Steroids (TCS)	{'westcort', 'hydrocortisone valerate', 'pandel', 'dermatop', 'hydrocortisone butyrate', 'locoid', 'prednicarbate', 'hydrocortisone probutate'}
Class VI Steroids (TCS)	{'desonide', 'alclometasone dipropionate', 'aclovate', 'desonate', 'lokara', 'desowen'}
Class VII Steroids (TCS)	{'cortaid', 'dekpak 13 day taperpak', 'baycadron elixe', 'dexmethasone', 'cortizone-10', 'hydrocortisone acetate', 'nucort', 'decadron', 'hydrocortisone', 'ala-cort', 'dexpak', 'cortizone-5'}

Table 1. Treatments Categories and Corresponding Formulation Search Terms in Atopic Dermatitis Forum

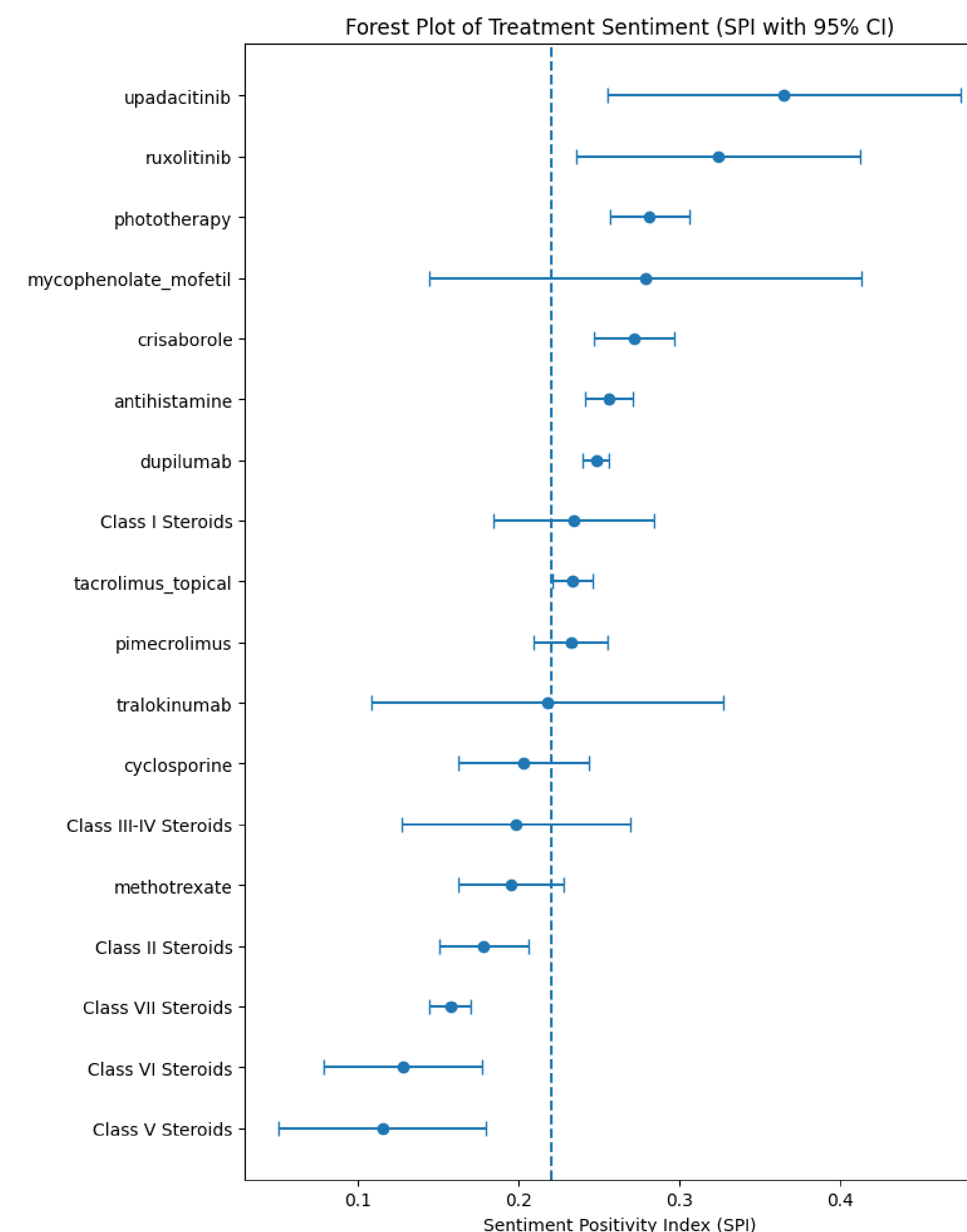


Figure 1. Forest plot of sentiment positivity index (SPI) by treatment. Points represent SPI with 95% confidence intervals; treatments are ordered from lowest to highest SPI. The dashed line indicates the overall mean SPI (~0.22).

## Discussion

- This study introduces the Sentiment Positivity Index (SPI) as a novel NLP-derived metric capturing patient perspectives from real-world, anonymous discussions. JAK inhibitors demonstrated the highest positivity, while lower-potency topical corticosteroids (TCS) showed the lowest, suggesting meaningful differences between perceived and traditional first-line therapies.
- Comparisons with established measures such as DLQI and TSQM reveal both alignment and divergence. High SPI for JAK inhibitors parallels strong DLQI improvements, whereas lower SPI for cyclosporine and methotrexate—despite favorable DLQI data—may reflect concerns about safety, tolerability, or patient burden not fully captured in clinical trials.
- Lower SPI for TCS may reflect real-world challenges including adherence burden, steroid phobia, and discussions of topical steroid withdrawal commonly seen in online forums, highlighting the influence of patient narratives on perceived treatment value.
- Strengths include large-scale, anonymous, free-text data capturing unfiltered patient experiences. Limitations include binary sentiment classification, potential NLP misclassification, selection bias toward negative experiences, and limited generalizability due to Reddit demographics and unequal treatment representation.

## Conclusion

- NLP-derived SPI provides a scalable, complementary approach to traditional QoL metrics by capturing real-world patient sentiment across therapies.
- Findings suggest a disconnect between clinical efficacy and patient perception for certain treatments, emphasizing the importance of incorporating patient-centered insights into decision-making.
- This framework can be expanded to other diseases and platforms to better understand treatment perceptions globally.
- Future work should focus on validation, improved sentiment modeling (including neutral/contextual analysis), and integration with clinical outcomes to enhance relevance and applicability.

## References

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