Clinical experience and psychometric properties of the Cardiff Acne Disability Index (CADI)*

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Summary

The Cardiff Acne Disability Index (CADI) is a questionnaire designed to measure the quality of life of teenagers and young adults with acne. It has been used clinically and within therapeutic research globally. This review aims to appraise all published data regarding the clinical and research experience of the CADI, its psychometric properties and validation, from its publication in 1992 until September 2020, in a single reference source. A literature search was conducted using MEDLINE via Ovid, PubMed, EBSCOhost, Web of Science and Scopus. All full articles in the English language were included. A total of 96 clinical studies were identified and analysed. The CADI has been used in 44 different countries, including four multinational studies, and has validated translations in 25 languages. Overall, 29 therapeutic interventions have used the CADI, demonstrating its responsiveness to change. The reliability of the CADI has been assessed in 14 studies through test–retest and internal consistency studies. In total, 57 studies have demonstrated aspects of its validity through correlation to other measures, and five studies have investigated the dimensionality of the CADI. There is evidence of high internal consistency, test–retest reliability, responsiveness to change and significant correlation with other objective measures. The minimal clinically important difference and validated score meaning bands have not yet been reported. This information is needed to improve the interpretability of CADI scores for clinical use and in research. The authors of the CADI have also rephrased Question 2 of the measure to ensure inclusivity.

What is already known about this topic?

- Acne significantly impacts quality of life in patients.
- There are several skin-specific and acne-specific instruments used in day-to-day practice and research.
- The validation and other measurement properties of the Cardiff Acne Disability Index (CADI) have not been easily accessible.

What does this study add?

- The CADI has been extensively used and is a reliable and valid tool.
- There is a need to develop validated CADI score bands and calculate the minimal clinically important difference.
- The CADI authors have rephrased Question 2 to ensure that the wording is inclusive.
- There is inconsistent reporting of CADI data and a need for guidelines when reporting and publishing quality-of-life data.
**Introduction**

Acne, with an estimated global prevalence of 9.38%, is an inflammatory condition primarily affecting the face and upper back.¹ Patients are generally treated in primary care; however, those with severe disease or whose lives are adversely affected are often referred to secondary care where they frequently receive isotretinoin. Acne is most common during adolescence with an estimated prevalence of 35% to almost 100% at any one point.¹

Adolescence is a particularly challenging period owing to the significant biopsychosocial changes associated with individuals undergoing puberty, establishing relationships, developing persona and exploring their self-image within the adult world. There is a great need for clinicians to fully understand the extent of a patient’s quality-of-life (QoL) impairment in order to inform treatment decisions. The Acne Disability Index (ADI),² from which the Cardiff Acne Disability Index (CADI) was developed, was the first to measure acne-specific QoL. As the ADI has never been used, to our knowledge, this review focuses on the CADI.

The CADI has been used worldwide in many settings. However, valuable information regarding its clinical use and psychometric properties is scattered across publications and there has been no previous attempt to collate and appraise this published data. It may be useful for researchers and clinicians who wish to assess the QoL impact of acne to have ready access to a one-stop source of all the known literature. This review aims to collate and consolidate the data, from the inception of the CADI in 1992³ to 2020, as a one-stop reference source. This review also aims to highlight both strengths and weaknesses of the CADI, providing a transparent reference source while also pointing to areas requiring further validation and identifying potential limitations of the CADI.

**The Cardiff Acne Disability Index**

The CADI,² developed in 1992 by Motley and Finlay, is a short questionnaire for use in teenagers and young adults with acne. The CADI consists of five items with each question answered on a 4-point Likert scale, scored from 0 to 3, resulting in a score range of 0 to 15. A higher score represents greater QoL impairment. Questions are based on the impact experienced over the previous month. Questions 1 and 2 assess the psychological and social consequences, Question 3 focuses on truncal acne, Question 4 addresses the patient’s psychological state and Question 5 asks for the patient’s assessment of their acne severity. The questions were created after identifying areas of greatest concern for patients with acne.²

**Methods**

**Search strategy**

A literature search was conducted from May to September 2020 using MEDLINE via Ovid, PubMed, EBSCOhost, Web of Science and Scopus to identify all studies that used the CADI from 1992 until September 2020. The search terms used in each database were ‘Cardiff Acne Disability Index’ or ‘CADI’ and ‘acne’. Furthermore, all citations on Google Scholar of the original 1992 publication were reviewed to identify other studies and ensure none had been missed. Although this is not a systematic review, PRISMA guidelines were used in part to improve the robustness of this study. The inclusion criteria were full-text articles that were written in English. Publications only available as abstracts were excluded; however, citations were checked for further relevant studies. All articles that fulfilled the inclusion criteria were reviewed to identify clinical and psychometric aspects of the CADI. Y.T.A. screened the records and extracted the data. However, any ambiguity was discussed and resolved between all other coauthors. Data were recorded on Excel® (Microsoft, Redmond, WA, USA) for categorization and information analysis. The research process is shown in Figure S1 (see Supporting Information).

**Data extraction**

The psychometric data extracted included the following: dimensionality and factor structure, test–retest reliability, internal consistency reliability, validation against other measures, sensitivity to change, specificity compared with nonacne populations, translations, cross-cultural adaptations and any statistical test used. Furthermore, we extracted data on the interpretability and clinical meaningfulness of the CADI.

The clinical information extracted included the following: the primary aim of the study, study design and setting, country, language, therapeutic intervention, patient ages, sample size, mean/median CADI scores for both the patients and controls at baseline and postintervention, and any statistical test used. The translation certificates of the CADI on the Cardiff University Dermatology Quality of Life website were also analysed.⁴ All data were cross-checked with the original articles to ensure accuracy.

**Results**

A total of 96 publications fulfilled the inclusion criteria. However, three of these studies used the CADI without reporting data.⁵–⁷ Studies using the CADI were published in >65 journals, most frequently in the Journal of the European Academy of Dermatology and Venereology (eight articles) and in Dermatology (six articles).

**Psychometric data**

**Dimensionality and factor structure**

A measure is unidimensional if there is one latent variable between the separate items.⁸ Five studies⁹–¹³ analysed the dimensionality of the CADI through factor analysis. Four of these reported the CADI to have two factors⁹–¹¹,¹³ (two of which identified the same two factors)⁹,¹³ and one study
reported the CADI to have one factor (Table S1; see Supporting Information). The two studies reported that the first dimension comprised three items addressing emotional well-being and the second dimension comprised the two items addressing the social impact of acne.

Test–retest and internal consistency reliability

Test–retest reliability ensures that a scale has a low random measurement error. If the acne severity has not changed over time, CADI scores should not change. The test–retest reliability of the CADI was assessed in six studies. Two studies reported Spearman’s rank correlation (rs = 0.9816 and rs = 0.80);14 two studies reported Pearson’s correlation (r = 0.4818 and r = 0.90). Four studies showed intraclass correlation coefficients (ICCs) ranging from 0.78 to 0.97, demonstrating high test–retest reliability (Table 1). As the level of measurement of such data is ordinal, it would be more appropriate to use Spearman’s rank correlation coefficient (rs) rather than Pearson’s correlation. It would also be more appropriate to use ICC to test the level of agreement between test 1 (T1) and test 2 (T2), weighing the difference between T1 and T2 for each patient.

Overall, 12 studies reported internal consistency of the CADI using Cronbach’s α. Values ranged from α = 0.704 to α = 0.9016 indicating good internal consistency. The item total score correlation was reported in five studies with a Spearman’s rank correlation ranging from rs = 0.6013 to rs = 0.812, demonstrating strong correlation between CADI items (Table 1). Four of 14 studies reporting either test–retest or internal consistency reliability used a parametric test, assuming normal data distribution.

Validation against other measures

A total of 57 studies in 26 countries described CADI usage in parallel with other closely related measures, allowing assessment of construct validity of convergent type. Few studies also described using more distantly related measures, allowing divergent validity to be assessed (Table S2; see Supporting Information). The most frequently reported comparator instruments were the Dermatology Life Quality Index (DLQI) (convergent validity, 12 studies), the Global Acne Grading System (GAGS) (convergent validity, 12 studies) and the Children’s Dermatology Life Quality Index (CDLQI) (convergent validity, five studies). The DLQI is the most commonly used dermatology-specific QoL measure that has been extensively validated. In total, 12 studies examined the correlation between CADI and DLQI scores; most demonstrated a good positive correlation with Spearman’s rank correlation ranging from rs = 0.5817 to rs = 0.8810 (Table S2; see Supporting Information). Overall, 11 of 57 studies reported using parametric tests when comparing the CADI with other measures, inappropriately assuming normality.

Many studies correlated the CADI with the clinicians’ evaluation of acne severity using a range of clinical grading systems, with the majority showing significant correlation (Table S2; see Supporting Information).

Sensitivity to change

A total of 29 publications have demonstrated the sensitivity of the CADI to change following intervention (Tables 2, 3 and 4). These studies were carried out in 22 counties, including four multinational trials, the largest of which was conducted across 15 countries. Patient numbers ranged from 10 to 3746. The reported mean decrease in CADI scores following a variety of interventions ranged from 1.5 to 7.4. All studies demonstrated an improvement in CADI scores following intervention. One study did not report CADI data. Despite many studies reporting statistically significant improvement in CADI scores, it is not possible to directly interpret these score changes based on their clinical significance as the minimal clinically important difference (MCID) for CADI is not yet known.

Specificity compared with nonacne populations

A prospective UK study reported the mean CADI score to be significantly higher in patients with acne (mean 6.31) compared with healthy volunteers (1.98), confirming high specificity for acne.

However, a retrospective Shanghai study by Wang et al demonstrated a mean CADI score of 7.85 in patients with acne (n = 1037) vs. 5.37 in healthy volunteers (n = 1046). However, the method of acne assessment was not specified. A study by Mojica et al in the Philippines conducted in pupils in high school (aged 11 to 18 years), found that pupils with acne scored around one point higher than those without acne.

Interpretability and clinical meaningfulness of the scores

The MCID of a measure is the smallest change in outcome that would be considered beneficial by the patient. Knowledge of the MCID may help clinicians interpret scores when making clinical decisions. The MCID for CADI has not yet been calculated and there is no validated score banding system to provide further meaningful to the scores. However, in 25 studies, unvalidated score descriptor bands were used to interpret data (Table S3; see Supporting Information). These unvalidated descriptors were first introduced in 2009 and since then they have been used in many studies.

Descriptive and clinical studies

Translations, cross-cultural adaptations and use in other countries

Often a literal translation of a measure does not account for linguistic, cultural and health behaviour differences. Cross-cultural adaptation aims to bridge this gap through adopting rigorous methodology to ensure that a measure...
| Reference          | Year   | Setting          | Country | Sample size | Test–retest | Internal consistency | Comment                                      |
|--------------------|--------|------------------|---------|-------------|-------------|----------------------|-----------------------------------------------|
| Aghaei et al.      | 2006   | Hospital         | Iran    | 100         | Not conducted| Cronbach’s alpha: \( \alpha = 0.79 \) | Good internal consistency                      |
|                    |        | outpatients      |         |             |             | Pearson’s correlation coefficient: \( r = 0.68 \) |                                |
|                    |        |                  |         |             |             | Spearman’s rank correlation coefficient (item total score correlation): \( r_s \), range = 0.62–0.73; \( P < 0.01 \) |                                |
|                    |        |                  |         |             |             | Good internal consistency |                                |
|                   |        |                  |         |             |             |                      |                                |
| Chandani et al.   | 2018   | OPD clinic       | India   | 90          | Not conducted| Cronbach’s alpha: \( \alpha = 0.70 \) | Good internal consistency                      |
|                   |        |                  |         |             |             |                      |                                |
| Dreno et al.      | 2004   | Hospital         | France  | 16 (test–retest) | Mean CADI difference between T1 and T2 = 1.1; \( P = 0.20 \) | Cronbach’s alpha: \( \alpha = 0.87 \) | High test–retest reliability and internal consistency |
|                   |        | outpatients      |         |             |             |                      |                                |
|                   |        |                  |         |             |             | ICC = 0.87            |                                |
| Grando et al.     | 2016   | Hospital         | Brazil  | 100         | (internal   | Cronbach’s alpha: \( \alpha = 0.73 \) | Good internal consistency                      |
|                   |        |                  |         |             | Good internal consistency |                                |
|                   |        |                  |         |             |             | ICC = 0.89            |                                |
|                   |        |                  |         |             |             |                      |                                |
|                   |        |                  |         |             |             |                      |                                |
|                   |        |                  |         |             |             |                      |                                |
| Jankovic et al.   | 2012   | High school      | Serbia  | 465         | Not conducted| Cronbach’s alpha: \( \alpha = 0.79 \) | Good internal consistency                      |
|                   |        |                  |         |             |             | Item-total correlation coefficient (item total score correlation): \( r \) range = 0.502–0.76; \( P < 0.01 \) |                                |
|                   |        |                  |         |             |             |                      |                                |
| Krich et al.      | 2014   | Hospital         | Morocco | 120         | ICC = 0.97 (95% CI 0.95–0.98) | Cronbach’s alpha: \( \alpha = 0.75 \) | Good internal consistency                      |
|                   |        | clinic           |         | 60 (test–retest) |             |                      |                                |
| Kyeong-Han et al. | 2017   | Community        | Korea   | 254         | Not conducted| Cronbach’s alpha: \( \alpha = 0.83 \) | Good internal consistency                      |
|                   |        |                  |         |             |             | Item-total correlation coefficient (item total score correlation): \( r \) mean = 0.74; range = 0.53–0.81 |                                |
| Law et al.        | 2009   | Two high schools | China   | 85          | Spearman’s rank correlation coefficient: \( r_s = 0.80; P < 0.01 \) | Cronbach’s alpha: \( \alpha = 0.76 \) | Good internal consistency                      |
|                   |        |                  |         |             | ICC = 0.78; \( P < 0.01 \) |                      |                                |
| Motley and Finlay | 1992   | Hospital         | UK      | 49          | Not conducted| Correlation between individual CADI items: Spearman’s rank correlation coefficient | All significantly associated with each other except for Questions 1 and 5 |
|                   |        | clinic           |         |             |             |                      |                                |

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retains its conceptual, experiential and semantic meaning in a different language, culture and country.\textsuperscript{36,38} Figure 1 summarizes the internationally recommended translation and cross-cultural adaptation process.\textsuperscript{38} This includes independent forward and back translation, reconciliation and cognitive debriefing, which involves ensuring face validity.

The CADI has undergone linguistic validation in 25 languages (Table S4; see Supporting Information). Nine studies reported cross-cultural adaptation and subsequent validation in Cantonese, Filipino, French, Hindi, Korean, Moroccan Arabic, Persian, Portuguese and Serbian (Table S5; see Supporting Information). A study that reported cross-cultural adaptation and subsequent validation in Ukrainian was otherwise excluded from this review as it was not in English.\textsuperscript{39} The CADI has been used in 44 countries (Table S6; see Supporting Information) and in four multinational studies (one phase IV,\textsuperscript{30} one epidemiological,\textsuperscript{40} one observational\textsuperscript{28} and one randomized therapeutic phase III study)\textsuperscript{41} (Supplementary Table 7; see Supporting Information). These took place in 15 countries across six continents.

**Topical drug interventions**

The CADI has been used in 13 studies\textsuperscript{30,31,41–51} describing pharmacological topical interventions (Table 2). The studies investigated the use of topical nadifloxacin and benzoyl peroxide, clindamycin and benzoyl peroxide, combined retinoldehyde and glycolic acid cream, adapalene and benzoyl peroxide, erythromycin and zinc acetate and several dermocosmetic products. The pretreatment and post-treatment CADI scores were reported in 10 studies.\textsuperscript{30,31,42,43,45–47,49–51} One study\textsuperscript{48} reported the percentage improvement and two studies gave a descriptive account of QoL improvement.\textsuperscript{31,44} All 14 studies depicted improvement in CADI scores following intervention; however statistical significance was not always reported.

**Systemic drug interventions**

The CADI has been used in seven studies\textsuperscript{5,7,52–58} that involved systemic pharmacological interventions (Table 3). The systemic interventions included the following: isotretinoin, azithromycin, tetracycline, metformin and ‘Perfact’ face tablets. The CADI scores were reported before and after treatment showing statistically significant improvement in five studies. One study\textsuperscript{54} gave a descriptive account of improvement and another study\textsuperscript{5} did not report CADI data.

**Other therapeutic interventions**

Three studies\textsuperscript{57–59} reported the outcome of nonpharmacological interventions with an educational focus (Table 4). One study compared the use of daily text-message reminders and patient information leaflets alongside the application of benzoyl peroxide, in comparison with standard patient instructions.\textsuperscript{57} Another study focused on the outcome of text-message reminders for adherence to treatment.\textsuperscript{58} Both studies reported significant improvement in CADI scores following intervention, with the greatest improvement in the text-message group. Additionally, one study reported the impact of patient education alongside the use of a mobile application on the enhancement of treatment outcome.\textsuperscript{59}

Four studies\textsuperscript{60–63} reported using phototherapy in treating acne. Two studies reported CADI scores showing a significant improvement following intervention and two gave descriptive accounts of improvement in CADI score; however, P-values were not always reported. One study\textsuperscript{32} describing the use of bone marrow stem cells to treat atrophic acne scars showed a
### Table 2: Responsiveness of the Cardiff Acne Disability Index (CADI) to topical interventions

| Reference            | Year | Sample Size | Therapeutic intervention                          | Treatment Length | Mean CADI before | Mean CADI after | Comments                                      |
|----------------------|------|-------------|--------------------------------------------------|------------------|------------------|----------------|-----------------------------------------------|
| Bettoli et al.       | 2019 | 3746        | Cosmetic emulsion                               | 2–3 months treatment | 5–0, SD ± 3–0 (range = 0–15) | 2–7, SD ± 2–4 (range 0–13) | P < 0–01; Significant improvement in mean CADI scores |
| Choudhury et al.     | 2011 | 79          | Nadifloxacin, Clindamycin                        | 8 weeks          | 8–21, SD ± 2–42 7–7, SD ± 2–33 | 4–24, SD ± 2–36 5–41, SD ± 2–67 | Group difference: P = 0–35; Change from baseline: P < 0–01 | Significant improvement in mean CADI scores of nadifloxacin |
| Dreno et al.         | 2007 | 128         | Combined 0–1% retinaldehyde/ 6% glycolic acid cream | 78 days          | Retinaldehyde + glycolic acid D0: NR | Day 78: retinaldehyde: 3–26, SD ± 3–07; P < 0–01 | Vehicle cream D0: NR | Significant improvement in mean CADI scores |
| Gollnick et al.      | 2015 | 5131        | Adapalene 0–1% and benzoyl peroxide 2–5% topical gel | 9 months         | 5–9, SD ± 3–0 3 months: 3–8, SD ± 2–7 9 months: 2–4, SD ± 2–7, P < 0–01 | Group difference: P < 0–01 | Significant improvement in mean CADI scores |
| Gosh and Das         | 2018 | 37          | Group A: nadifloxacin and benzoyl peroxide       | 12 weeks         | Baseline group A: 6–64, SD ± 0–4 Group A: week 12 = 0–88, SD ± 0–1, P < 0–01 | Baseline Group B: 5–76, SD ± 0–4 Group B: week 12 = 0–23, SD ± 0–1, P < 0–01 | P < 0–14; Significant improvement in mean CADI scores of Group B |
| Italian Acne Board  | 2011 | 72          | Topical cream containing Efectiose, retinaldehyde and glycolic acid | 12 weeks | 4–97 2–38 52% decrease | CADI score ‘improved’ P < 0–01 | Significant improvement in mean CADI scores |
| Kyrgidis et al.      | 2019 | 49          | Cosmetic product                                | 112 days         | NR                | CADI score ‘improved’ P < 0–01 | Significant improvement in mean CADI scores |
| Mohammadi et al.     | 2019 | 110         | Niosomal benzoyl peroxide and clindamycin lotion | 12 weeks         | Cases: 11–89, SD ± 1–77 Controls: 11–38, SD ± 1–63 | Cases: 8–60, SD ± 2–52 Controls: 10–06, SD ± 2–04 P < 0–01 | Significant improvement in mean CADI scores of niosomal benzoyl peroxide and clindamycin lotion combination more effective |
| Mohammadi et al.     | 2017 | 70          | Group A: niosomal 4% erythromycin suspension Group B: erythromycin 4% and zinc acetate 1–2% | 12 weeks         | Group A: 8–5, SD ± 3–69 Group A: 3–64, SD ± 2–80, P = 0–02 | Group B: 10–5, SD ± 3–08 Group B: 2–87, SD ± 1–99, P = 0–04 | Significant improvement in mean CADI scores in favour of erythromycin and zinc acetate |
| Pantoja-Villa et al. | 2019 | 50          | Benzoyl peroxide and adapalene                   | NR               | NR                | NR QoL: 72% good, 24% regular, 4% poor | Improvement in CADI scores following treatment |

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statistically significant improvement in CADI scores 6 months post-treatment. One study reported a significant reduction in CADI scores following treatment but did not report which therapeutic intervention was used.18

Epidemiological surveys and other uses

A multinational epidemiological study conducted in 2962 patients with mild-to-moderate acne in France, Italy, Portugal and Switzerland reported a mean CADI score of 5.0 ± 3.0 with a range of 0–15.40 The CADI has also been used in several studies assessing the impact of acne on QoL in nonclinical settings. Overall, 17 studies11,17,22,23,64–76 were conducted in schools, with reported mean CADI scores ranging from 2.9117 to 5.865 in high schools and a mean of 1.974 in primary school children and 1.2173 in preadolescents. Seven studies21,77–82 were conducted in universities reporting a mean CADI score ranging from 1.4777 to 3.7.82 A study by Chernyshov et al.83 reported a mean CADI score of 6.91 in hospital and 3.81 in the community for individuals with a confirmed acne diagnosis.

All studies used CADI in patients with acne, except for a report of its use in Birt–Hogg–Dubé syndrome,84 where the questionnaire was modified by changing the term ‘acne’ to ‘fibrofolliculomas’.

Wording of Question 2

During the process of reviewing the complete CADI literature it became apparent that the original wording of question two is no longer appropriate in the 2020s. This review publication provides the opportunity to announce a change in the wording of one CADI question. The original wording of Question 2, addressing relationships ‘with the opposite sex’, does not take different sexual orientations into account. We confirm that the authors of the CADI (R.J.M. and A.Y.F.) have taken different sexual orientations into account. We confirm that the authors of the CADI (R.J.M. and A.Y.F.) have rephrased Question 2 to ensure that the CADI is inclusive and suitable for all patients. The phrase ‘relationships with members of the opposite sex’ has been changed to ‘intimate personal relationships’. Therefore, the revised wording of Question 2 is ‘Do you think that having acne during the last month interfered with your daily social life, social events or...’
Table 3 Responsiveness of the Cardiff Acne Disability Index (CADI) to systemic interventions

| Reference          | Year | Sample size | Therapeutic intervention | Treatment length | Mean CADI before | CADI Mean CADI after | Comments |
|--------------------|------|-------------|---------------------------|------------------|------------------|----------------------|----------|
| Ergun et al. [52]  | 2012 | 63          | Isotretinoin              | NR               | 6.10             | 1 month: 4.10, end of treatment: 1.70 | Significant improvement in mean CADI scores |
| Metekoglu et al.   | 2019 | 72          | Isotretinoin              | NR               | 6.10             | 1.39, SD ± 1.60; P < 0.01 | Significant improvement in mean CADI scores |
| Motley and Finlay  | 1992 | 20          | Isotretinoin              | 2–13 months (median 6 months) | Median CADI: 8 | After: 2 | Isotretinoin more effective in reducing mean CADI score |
| Pezza and Carlonago | 2017 | 100         | Group A: inositol, Group B: placebo | 6 months | NR | NR | |
| Rehman et al. [54] | 2020 | 26          | Group 1: azithromycin 500 mg 3 consecutive days every 10 days, Group 2: azithromycin 500 mg 4 consecutive days every month | 3 months | NR | NR | Reported statistically significant improvement in CADI overall |
| Robinson et al. [55] | 2019 | 84          | Group 1: metformin + tetracycline + benzoyl peroxide, Group 2: tetracycline + benzoyl peroxide | 12 weeks | Group 1: 9.1, SD ± 3.13, Group 2: 8.8, SD ± 2.78 | Mean reduction: 4.82, SD ± 3.39 | Significant reduction in CADI from baseline following both interventions |
| Yadav et al. [56]  | 2011 | 141         | Group I: oral tablets (Perfact Tablet), Group II: dermatological gel (Perfact gel), Group III: oral tablets containing dermatological gel | 4 weeks | Group I: 8.45, SD ± 0.48, Group II: 8.45, SD ± 0.46, Group III: 8.56, SD ± 0.47 | Group I: 4.97, SD ± 0.49; P < 0.05, Group II: 4.82, SD ± 0.24; P < 0.01, Group III: 4.78, SD ± 0.48; P < 0.05 | CADI significantly improved with all three treatments |

NR, not reported. Where reported, 95% confidence interval and P-values have been displayed.
### Table 4  Responsiveness of the Cardiff Acne Disability Index (CADI) to other therapeutic interventions

| Reference | Year  | Sample size | Therapeutic intervention | Treatment length | Mean CADI before | Mean CADI after | Comments |
|-----------|-------|-------------|--------------------------|------------------|------------------|----------------|----------|
| Antoniou et al.  | 2016 | 89          | Group A: LED and photoconverter chromophores + skin cleanser and noncomedogenic cream  
Group B: skin cleanser and noncomedogenic cream | 6 weeks NR | NR | Group A: 40% CADI score improvement between weeks 6 and 12  
Group B: CADI score increase between weeks 6 and 12 | Chromophore-assisted blue light phototherapy was more effective at improving CADI scores |
| Banakat et al.  | 2017 | 24          | IPL treatment           | 6 weeks 11.21 ± 1.56 | P < 0.01 | Significant improvement in mean CADI scores |
| Donnarumma et al.  | 2019 | 126         | Topical adapalene 0.3%/benzoyl peroxide 2.5%  
Group 1: trained on the gel application by an explicative leaflet  
Group 2: leaflet + daily SMS  
Group 3: standard instructions | 12 weeks Median CADI scores: Group 1: 8 (IQR = 7–11)  
Group 2: 8 (IQR = 6–11)  
Group 3: 9 (IQR = 6–12) | Median CADI scores: Group 1: 5 (IQR = 4–9)  
Group 2: 5 (IQR = 2–7)  
Group 3: 6 (IQR = 4–9)  
P = 0.01 | Use of leaflet and SMS alongside gel application training is most effective at improving QoL |
| Fabbrocini et al.  | 2014 | 160         | Nonpharmacological: SMS reminders for treatment adherence | 12 weeks SMS group = 86, SD ± 1.3  
Control group = 78, SD ± 1.2 | SMS group: 2.0, SD ± 0.8;  
P < 0.01  
Control: 5.1, SD ± 0.8;  
P < 0.01 | Greater mean CADI score improvement in SMS group |
| Ianosi et al.  | 2013 | 123         | Group A: IPL wavelength 500–1200 nm and vacuum  
Group V: IPL with dual wavelength 400–700 nm and 870–1200 nm, no vacuum  
Group 0 (control): topical treatment | 5 weeks NR | NR | Group A more satisfied with treatment compared with Group V;  
P = 0.00  
Groups A and V significantly more satisfied compared with Group 0 (control);  
P < 0.01 |
| Ibrahim et al.  | 2015 | 14          | Single session of autologous bone marrow stem cell therapy | 6 months 12, SD ± 3.1 | 4.6, SD ± 2.9;  
P < 0.01 | Significant improvement in mean CADI scores |
| Liu et al.  | 2020 | 30          | Patient education and mobile application | 4 weeks 7.45, SD ± 3.21 | 4.15, SD ± 2.39;  
P < 0.01 | Significant improvement in mean CADI scores |
| Mofiah et al.  | 2016 | 35          | Topical liposomal methylene blue hydrogel followed by IPL on one half of back vs. IPL alone on the other half | 3 weeks 11.28 ± 3.07 | 1 month: 5.88 ± 2.84;  
P < 0.01  
3 months: 6.42 ± 3.66;  
P < 0.01 | Significant improvement in mean CADI scores |
| Tan et al.  | 2012 | 19          | NR | 60–90 days NR | Mean CADI score reduction = 1.9;  
P = 0.01 | Significant improvement in mean CADI scores |

IPL, intense pulsed light; IQR, interquartile range; LED, light-emitting diode; NR, not reported; QoL, quality of life; SMS, short message service. Where reported, 95% confidence intervals and P-values have been displayed.
intimate personal relationships? However, this change requires confirmation by a content validity study.

Discussion

Understanding the impact of disease allows a more holistic and patient-centred approach to healthcare. The concept of measuring the effect of skin disease on a patient’s QoL is becoming increasingly accepted and integrated within routine clinical practice and research.85,86

This review has demonstrated the extensive use of the CADI, described as the easiest QoL scale to use in routine dermatology practice.87 Additionally, a recent systematic review identified the CADI to be among the top five most commonly used instruments for measuring the impacts of acne.88 However, frequency of use is not a guide to the quality of a measure. Several studies reported choosing the CADI because of its short completion time of around 1 min in English4 and 1.5 minutes in Filipino.34 However, the practicalities of a measure must be balanced against its validity. We have collated the psychometric properties of the CADI, demonstrating aspects of its reliability and validity. It is responsive to change and can discriminate between treatments of different effectiveness (Tables 2–4). Although acne severity does not always correlate with QoL impairment,4 the majority of studies reported a correlation between CADI and clinicians’ acne grading, as an objective measure. Four studies reported the CADI to be bidimensional with the exception of a study by Kyeong-Han et al. that reported unidimensionality.12 This may be due to the researchers examining the Korean translated version of the CADI in addition to the different study population. Furthermore, no studies performed confirmatory factor analysis.

There are a variety of QoL questionnaires used in acne. These include generic measures, such as the 36-Item Short Form Survey or EQ-5D and dermatology-specific measures, such as DLQI, CDLQI, Skindex or Teenagers’ Quality of Life (T-QoL), a questionnaire designed for teenagers with any skin disease.89 In addition to the CADI, there are other acne-specific QoL measures, including Assessment of the Psychological and Social Effects of Acne (APSEA), Acne-specific Quality of life questionnaire (Acne-QoL), Acne-Q4, Acne Quality of Life Scale (AQOL), Acne Quality of Life Index (Acne-QOLI) and Acne Symptom and Impact Scale (ASIS).90 The validation of these measures has been summarized.90

Despite the extensive validation of the CADI, certain psychometric properties require further investigation. The use of arbitrary unvalidated score bands by investigators highlights the need for developing validated score meaning bands. The anchor-based approach91 might be the most suitable for the CADI as it is a short, simple questionnaire.92 There is also no MCID reported for the CADI, and users of the CADI should be aware of this when interpreting score change in order to inform routine clinical decision making and when carrying out research.93

Several studies have attempted to correlate CADI data with a range of demographic items such as sex, education level and socioeconomic class. Correlation results were varied and inconclusive overall. The majority of participants in these studies were female. This may be due to the clinic-based setting of most studies, and the possibility that women may be more likely to seek treatment for their acne than men. Although the CADI was designed for use in adolescents and young adults with acne, this review identified that the CADI has also been used in older age groups, both in routine practice and for therapeutic research.

There are 25 validated translations of the CADI; however, the majority of translations, although created using a standard process of forward and backward translations, have not undergone full cross-cultural adaptation. Ideally this should be conducted for all translations.16,38 Several authors chose the CADI because there was a validated version in their language. The use of trained translators and pretesting on bilingual lay people is recommended by guidelines to ensure optimal comprehension,16 and this was mostly adhered to. Studies often

![Figure 1 Recommended translation and cultural adaptation process.](image)
compared CADI scores between different cultures; however, as for all QoL measures, despite cross-cultural adaptation, similar CADI scores in different countries should not be assumed to be directly comparable as perceptions of health and QoL are culturally influenced.17

Patients should ideally complete QoL questionnaires alone, as having the clinician present may influence responses. However, in one study, the CADI was read aloud to patients who were illiterate17 and in another study, the CADI questionnaire was administered over the phone.94 As virtual appointments become integrated into outpatient dermatology care, it may become routine practice for QoL questionnaires to be completed via apps or over the phone. The use of the DLQI on an app has been validated against the paper version,95 providing encouragement that other QoL questionnaires delivered in this way may also be valid; however, this remains to be established for the CADI. For future research, it would be prudent to develop an electronic version of the CADI and test it for psychometric equivalency to that of the paper version.

The European Academy of Dermatology and Venereology Quality of Life Task Force has published recommendations for the use of QoL measures generally, and specifically in acne.90 Inconsistencies within QoL reporting have been previously identified.96 This has also occurred in the reporting of CADI data; inappropriate unvalidated scoring has been introduced and frequently used. Baseline and end-of-treatment data values were sometimes missing and P-values not always reported. SDs and confidence intervals were frequently omitted. The CADI is an ordinal scale, but parametric tests were sometimes applied, inappropriately assuming normality. In a few reports it was not clear which statistical test was used. Two studies used an incorrect score range12,53 and another reported data outside the possible range.21 We have previously highlighted this lack of quality assurance in the use and reporting of QoL studies97–100 and recommend the implementation of formal guidelines and tighter requirements for publishing QoL data.96

The main limitation of this review is that only English-language reports were included; however, several studies using the CADI in other languages were identified. We were not able to obtain the articles describing three studies that used the CADI. Articles frequently had inadequate QoL reporting, which affected the ability to interpret data. Although extensive searching was conducted to identify all articles, it is possible that some may have been missed.

Conclusions

We have presented the extensive use and psychometric properties of the CADI, to act as a reference for potential users. The CADI is a short, practical and effective measure to assess acne-related QoL impairment. Question 2 of the CADI has been rephrased to ensure that it is an appropriate measure for all patients. Further investigation with regards to score meaning and the MCID is needed to assist the interpretation of CADI scores. Finally, validation of CADI delivery by app or over the phone should be carried out.

References

1 Heng AHS, Chew FT. Systematic review of the epidemiology of acne vulgaris. Sci Rep 2020; 10:5754.
2 Motley RJ, Finlay AY. How much disability is caused by acne? Clin Exp Dermatol 1989; 14:194–8.
3 Motley RJ, Finlay AY. Practical use of a disability index in the routine management of acne. Clin Exp Dermatol 1992; 17:1–3.
4 Cardiff University Department of Dermatology and Wound Healing. The Cardiff Acne Disability Index (CADI). Available at: https://www.cardiff.ac.uk/medicine/resources/quality-of-life-questionnaires/cardiff-acne-disability-index (last accessed 21 September 2020).
5 de Lucas R, Moreno-Arias G, Perez-Lopez M et al. Adherence to drug treatments and adjutant barrier repair therapies are key factors for clinical improvement in mild to moderate acne: the ACTUO observational prospective multicenter cohort trial in 643 patients. BMC Dermatol 2015; 15:17.
6 Misery L, Wolkenstein P, Amici J et al. Consequences of acne on stress, fatigue, sleep disorders and sexual activity: a population-based study. Acta Derm Venereol 2015; 95:485–8.
7 Pezza M, Carломagno V. Insomnio in women suffering from acne and PCOS: a randomized study. Glob Dermatol 2017; 4:1–4.
8 Hattie J. Methodology review: assessing unidimensionality of tests and items. Appl Psych Meas 1985; 9:139–64.
9 Grando LR, Horn R, Cunha VT, Cestari TF. Translation, cultural adaptation and validation for Brazilian Portuguese of the Cardiff Acne Disability Index instrument. An Bras Dermatol 2016; 91:180–6.
10 Gupta A, Sharma YK, Dash K, Verma S. Cultural adaptation of the Cardiff Acne Disability Index to a Hindi speaking population: a pilot study. Indian J Dermatol 2015; 60:419.
11 Jankovic S, Vukicevic J, Djordjevic S et al. The Cardiff Acne Disability Index (CADI): linguistic and cultural validation in Serbian. Qual Life Res 2013; 22:161–6.
12 Kyeong-Han K, Sang-Chul L, Young-Bae P, Young-Jae P. Cardiff acne disability index: cross-cultural translation in Korean and its cultural and linguistic validation in Serbian. Qual Life Res 2013; 22:161–6.
13 Aghaei S, Mazharinia N, Jafari P, Abbasfard Z. The Persian version of the Cardiff Acne Disability Index: cross-cultural translation in Persian and its cultural and linguistic validation in Persian. Qual Life Res 2013; 22:161–6.
14 Basra MK, Fenech R, Gatt RM, Finlay AY. The Dermatology Life Quality Index 1994–2004: a comprehensive review of validation data and clinical results. Br J Dermatol 2008; 159:997–1035.
15 Doward LC, Meads DM, Thorsten H. Requirements for quality of life instruments in clinical research. Value Health 2004; 7 (Suppl 1):S13–16.
16 Salek MS, Khan GK, Finlay AY. Questionnaire techniques in assessing acne handicap: reliability and validity study. Qual Life Res 1996; 5:131–8.
17 Law MP, Chuh AA, Lee A. Validation of a Chinese version of the Cardiff Acne Disability Index. Hong Kong Med J 2009; 15:12–7.
18 Tan J, O’Toole A, Zhang X et al. Cultural and linguistic validation of acne-QoL in French. J Eur Acad Dermatol Venereol 2012; 26:1310–4.
19 Dreno B, Finlay AY, Nocera T et al. The Cardiff Acne Disability Index: cultural and linguistic validation in French. Dermatology 2004; 208:104–8.

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Clinical experience and psychometric properties of CADI, Y.T. Abdelrazik et al.

20 Krich S, Meziane M, El-Fakir S et al. Validation of The Cardiff Acne Disability Index questionnaire in patients with acne in Morocco. Int J Clin Dev Res 2014; 2:9–13.

21 Chandani KU, Raval RC, Rana DA, Malhotra SD. Study of drug use pattern & analysis of quality of life in patients of acne attending the dermatology OPD In a tertiary care hospital: study of drug use pattern & analysis of quality of life in patients of acne attending the dermatology OPD. Nat J Int Med 2018; 9: 108–16.

22 Jankovic S, Vukicevic J, Djordjevic S et al. Quality of life among schoolchildren with acne: results of a cross-sectional study. Indian J Dermatol Venereol Leprol 2012; 78:454–8.

23 Perić J, Maksimović N, Janković J et al. Prevalence and quality of life in high school pupils with acne in Serbia. Vojonsut Pregl 2013; 70:935–9.

24 Mojca WP, Lanconio LLDL, Doftas BL, Genuino RF. Validation of a Filipino Version of the Cardiff Acne Disability Index. Acta Medica Philippina 2017; 51: 105–10.

25 Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI): a simple practical measure for routine clinical use. Clin Exp Dermatol 1994; 19: 210–6.

26 Doshi A, Zaheer A, Stiller MJ. A comparison of current acne grading systems and proposal of a novel system. Int J Dermatol 1997; 36:416–8.

27 Lewis-Jones MS, Finlay AY. The Children’s Dermatology Life Quality Index (CDLQI): initial validation and practical use. Br J Dermatol 1995; 132: 942–9.

28 Dréno B, Thiboutot D, Layton AM et al. Large-scale international study enhances understanding of an emerging acne population: adult females. J Eur Acad Dermatol Venereol 2015; 29: 1096–106.

29 Knight JM. Combined 400–600nm and 800–1200nm intense pulsed phototherapy of facial acne vulgaris. J Drugs Dermatol 2019; 18: 1116–22.

30 Bettoli V, Coutanceau C, Georgescu V. A real-life, international, observational study demonstrating the efficacy of a cosmetic emulsion in the supportive care of mild-to-moderate facial acne. Clin Cosmet Investig Dermatol 2019; 12:759–69.

31 Poláková K, Faugier A, Sayag M, Jourdan E. A dermocosmetic containing bakuchiol, Ginkgo biloba extract and mannosil improves the efficacy of adapalene in patients with acne vulgaris: result from a controlled randomized trial. Clin Cosmet Investig Dermatol 2015; 8:187–91.

32 Ibrahim ZA, Eltawatzy RA, Ghaly NR et al. Autologous bone marrow stem cells in atrophic acne scars: a pilot study. J Dermatolog Treat 2015; 26:260–5.

33 Wang P, Wang H, Ding H et al. Risk factors, psychological impacts and current treatments of acne in Shanghai area of China. J Dermatolog Treat 2016; 27:146–7.

34 Jaeschke R, Singer J, Guyatt GH. Measurement of health status. Ascertaining the minimal clinically important difference. Control Clin Trials 1989; 10:407–15.

35 Norman GR, Sloan JA, Wyrwich KW. Interpretation of changes in health-related quality of life: the remarkable universality of half a standard deviation. Med Care 2003; 41:582–92.

36 Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. J Clin Epidemiol 1993; 46:1417–32.

37 Kleinman A, Eisenberg L, Good B. Culture, illness, and care: clinical lessons from anthropologic and cross-cultural research. Ann Intern Med 1978; 88:251–8.

38 Wild D, Grove A, Martin M et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR task force for translation and cultural adaptation. Value in Health 2005; 8:94–104.

39 Chernyshov PV. [Creation and validation of the Ukrainian version of the Cardiff Acne Disability Index]. L'k Sprav 2012; 5:139–43 (in Ukrainian).

40 Dréno B, Jean-Decoster C, Georgescu V. Profile of patients with mild-to-moderate acne in Europe: a survey. Eur J Dermatol 2016; 26:177–84.

41 Dreno B, Katsambas A, Pelfini C et al. Combined 0.1% retinaldehyde/6% glycolic acid cream in prophylaxis and treatment of acne scarring. Dermatology 2007; 214:260–7.

42 Choudhury S, Chatterjee S, Sarkar DK, Dutta RN. Efficacy and safety of topical nadifloxacin and benzoyl peroxide versus clindamycin and benzoyl peroxide in acne vulgaris: a randomized controlled trial. Indian J Pharmacol 2011; 43:628–31.

43 Gollnick HPM, Friedrich M, Peschen M et al. Effect of adapalene 0.1%/benzoyl peroxide 2.5% topical gel on quality of life and treatment adherence during long-term application in patients with predominantly moderate acne with or without concomitant medication – additional results from the non-interventional cohort study ELANG. J Eur Acad Dermatol Venereol 2015; 29:23–9.

44 Kyrgidis A, Becker M, Zampeli V et al. Multimodal clinical imaging assessment of the outcome in mild-to-moderate acne: a prospective study. Dematol 2019; 35:471–7.

45 Mohammadi S, Farajzadeh S, Pardakhiti A et al. A survey to compare the efficacy of niosomal erythromycin alone versus combination of erythromycin and zinc acetate in the treatment of acne vulgaris. J Iran Uni Med Sci 2017; 24:420–30.

46 Pantoya-Villa F, Medina-Castillo E, Aviles-Sanchez E. Depression and quality of life in patients with acne at the beginning and at the end of the treatment. Dermatol Res Med 2019; 63:123–43.

47 Tabasum HA, Tanzeel A, Anjum F, Rehman H. The effect of Unani antiacne formulation (Zimade Mulaha) on acne vulgaris: a single-blind, randomized, controlled clinical trial. J Pakistan Assoc Dermatol 2014; 24:319–26.

48 Scher din U, Presto S, Rippke F et al. In vivo assessment of the efficacy of an innovative face care system in subjects with mild acne vulgaris. Int J Cosmet Sci 2004; 26:221–9.

49 Mohammadi S, Pardakhiti A, Khalili M et al. Niosomal benzoyl peroxide and clindamycin lotion versus niosomal clindamycin lotion in treatment of acne vulgaris: a randomized clinical trial. Adv Pharm Bull 2019; 9:578–83.

50 Italian Acne Board. Efficacious: result from an Italian Acne Board (IAB) clinical trial. Eur J Acne Bd Dis 2011; 2:38–9.

51 Ghosh A, Das K. Efficacy and safety of nadifloxacin and benzoyl peroxide versus adapalene and benzoyl peroxide in acne vulgaris: a randomized open-label phase IV clinical trial. J Pharmacol Pharmacother 2018; 9:27–31.

52 Ergun T, Seckin D, Ozaydın N et al. Isotretinoin has no negative effect on attention, executive function and mood. J Eur Acad Dermatol Venereol 2012; 36:431–9.

53 Metekoglu S, Oral E, Ucar C, Akalin M. Does isotretinoin cause depression and anxiety in acne patients? Dermatol Ther 2019; 32: e12795.

54 Rehman N, Ch’ng CC, Sundram TKM, et al. Efficacy and safety of azithromycin in moderate acne vulgaris. Malays J Med Health Sci 2016; 19:69–74.

55 Robinson S, Kwan Z, Tang MM. Metformin as an adjunct therapy for the treatment of moderate to severe acne vulgaris: a randomized open-labeled study. Dermatol Ther 2019; 32:e12953.

56 Yadav N, Singh A, Chatterjee A, Belemkar S. Evaluation of efficacy and safety of Perfect face gel and Perfect face tablets in management of acne. J Clin Exp Dermatol Res 2011; 2:118.
724 Clinical experience and psychometric properties of CADI, Y.T. Abdelrazik et al.

96 Finlay AY. Quality of life in dermatology: after 125 years, time for more rigorous reporting. Br J Dermatol 2014; 170-4–6.
97 Ali FM, Cueva AC, Vyas J et al. A systematic review of the use of quality-of-life instruments in randomized controlled trials for psoriasis. Br J Dermatol 2017; 176:577–93.
98 Dodington SR, Basra MK, Finlay AY, Salek MS. The Dermatitis Family Impact Questionnaire: a review of its measurement properties and clinical application. Br J Dermatol 2013; 169:31–46.
99 Basra MKA, Gada V, Ungar B et al. Infants’ Dermatitis Quality of Life Index: a decade of experience of validation and clinical application. Br J Dermatol 2013; 169:760–8.
100 Salek MS, Jung S, Brincat-Ruffini LA et al. Clinical experience and psychometric properties of the Children’s Dermatology Life Quality Index (CQLQ), 1995–2012. Br J Dermatol 2013; 169:734–59.
101 Ahmed AA, Nayaf MS, Ahmed HS. Psychosocial impact of acne vulgaris among adolescent Iraqi patients. Sys Rev Pharm 2020; 11:800–3.
102 Alotaibi H, Alalwan AA, Alanazi EA, Alenezi GM. Quality of life in acne patients in King Khalid University Hospital, Riyadh, Saudi Arabia. Ind Am J Pharm Sci 2019; 6:2724–30.
103 Arabshahi A, Bagheri Z, Esmaili M, Mohebi S. Assessment of quality of life in patients with acne vulgaris and its consequent disabilities in Qom, 2018. Arch Hgy Sci 2020, 9:27–36.
104 Augustin M, Reich C, Schaefer I et al. Development and validation of a new instrument for the assessment of patient-defined benefit in the treatment of acne. J Disch Dermatol Ge 2008; 6:113–20.
105 Awad SM, Morsy H, Sayed AA et al. Oxidative stress and psychiatric morbidity in patients with facial acne. J Comet Dermatol 2018; 17:203–8.
106 Batra A, Matreja P, Singh A et al. To study the impact of acne vulgaris on the quality of life of patients. U Toronto Med J 2014; 92:33–6.
107 Durai PCT, Nair DG. Acne vulgaris and quality of life among young adults in South India. Indian J Dermatol 2015; 60:33–40.
108 França K, Keri J. Psychosocial impact of acne and postinflammatory hyperpigmentation. An Bras Dermatol 2017; 92:505–9.
109 Gupta A, Sharma YK, Dash KN et al. Quality of life in acne vulgaris: relationship to clinical severity and demographic data. Indian J Dermatol Venrol Leprol 2016; 82:292–7.
110 Hosthota A, Bondade S, Basavaraja V. Impact of acne vulgaris on quality of life and self-esteem. Cuts 2016; 98:121–4.
111 How KN, Shamsudin N. The psychological impact and functional disability of patients with acne vulgaris in Hospital Serdang, Malaysia: a cross sectional analysis. Malaysian J Med Health Sci 2019; 15:56–61.
112 Ismail KH, Mohammed-Ali KB. Quality of life in patients with acne in Erbil city. Health Qual Life Outcomes 2012; 10:60.
113 Kokandi A. Evaluation of acne quality of life and clinical severity in acne female adults. Dermatol Res Pract 2010; 2010:410809.
114 Kumar S, Singh RP, Kaur S, Mahajan BB. Psychosocial impact of acne on quality of life in North India: a hospital-based cross-sectional study. J Pakistan Assoc Dermatol 2016; 26:35–9.
115 Liu YS, Sun CK, Li TS, Liu CJ. The development and validation of an acne self-regulation inventory. J Dermatol Sci 2016; 84:203–9.
116 Parajuli N, Kayastha B. Quality of life in patients with acne: a questionnaire study. Nepal J Dermatol, Venereol & Leprol 2018; 16:45–8.
117 Pradhan M, Jha C, Rai D. The impact of acne on the quality of life of the patients attending dermatology outpatient department at Nobel Medical College Teaching Hospital. J Nobel Med Coll 2018; 7:45–59.
118 Safizadeh H, Shamsi-Meymandy S, Naeimi A. Quality of life in Iranian patients with acne. Dermatol Res Pract 2012; 2012:571516.
119 Saka B, Akakpo AS, Télessou GN et al. Acne in Lomé, Togo: clinical aspects and quality of life of patients. BMC Dermatol 2018; 18:7.
120 Shahzad N, Nasir J, Ikram U et al. Frequency and psychosocial impact of acne on university and college students. J Coll Physicians Surg Pak 2011; 21:442–3.
121 Yap FB. Cardiff Acne Disability Index in Sarawak, Malaysia. Ann Dermatol 2012; 24:158–61.
122 Zaraa I, Belglith I, Ben Alaya N et al. Severity of acne and its impact on quality of life. Skinmed 2013; 11:148–53.
123 Xiao Y, Chen L, Jing D et al. Willingness-to-pay and benefit-cost analysis of chemical peels for acne treatment in China. Patient Prefer Adherence 2019; 13:363–70.
124 Samanthula H, Kodali M. Acne and quality of life – a study from a tertiary care centre in South India. IJOSR J Dent Med Sci 2013; 6:59–62.
125 Shamsh N, Niaz F, Zeeshan S et al. Cardiff Acne Disability Index base quality of life in acne patients, risk factors and associations. J Iaupat Uni Med Health Sci 2018; 17:29–33.
126 Ayedun S, Onayemi O, Olaseode OA et al. Clinical characteristics of acne vulgaris and its effect on patients quality of life. Teul J Publ Health 2019; 7:862–9.
127 Dreno B, Bordet C, Seise S et al. Acne relapses: impact on quality of life and productivity. J Eur Acad Dermatol Venervol 2019; 33:937–43.
128 Tabasum H, Ahmad T, Anjum F, Rehman H. The effect of Unani antiacne formulation (Zinmade Mulhasa) on acne vulgaris: a single-blind, randomized, controlled clinical trial. J Pakistan Assoc Dermatol 2014; 24:319–26.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher’s website:

Figure S1 Summary of the steps undertaken in the research process.

Table S1 Dimensionality and factor structure of the Cardiff Acne Disability Index.

Table S2 Correlation of the Cardiff Acne Disability Index with other measures.

Table S3 Unvalidated descriptor bands of the Cardiff Acne Disability Index.

Table S4 Validated language translations of the Cardiff Acne Disability Index.

Table S5 Published studies reporting cross-cultural adaptation of the Cardiff Acne Disability Index.

Table S6 Countries where the Cardiff Acne Disability Index has been used.

Table S7 Multinational studies using the Cardiff Acne Disability Index.