

Evaluation of Cost-Effectiveness and Patient Satisfaction of Topical, Topical Plus Systemic, and Topical Plus Laser Treatment in Patients with Acne Vulgaris

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Received: May 25, 2025

Received in Revised: June 21, 2025

Accepted: July 20, 2025

Abstract

Acne vulgaris is a common skin problem in adolescents and young adults, reducing quality of life and causing psychological distress. Topical, systemic, and laser therapies are widely used, but comparative evidence in Southeast Asia is limited. Studies indicate that combination therapy (topical + systemic or topical + laser) is generally more effective than monotherapy. Laser plus topical therapy reduces inflammatory lesions more than topical therapy alone, though cost-effectiveness is rarely assessed. A meta-analysis (Yeung et al., 2021) supports the superiority of combination therapy, while NICE (2021) found topical + systemic more cost-effective in the UK. This study evaluated cost-effectiveness and patient satisfaction of topical, topical + systemic, and topical + laser treatment in acne vulgaris. A prospective cohort study at Erha Clinic (April 2024–March 2025) involved 90 participants divided into three equal groups (n = 30). Quality of life, satisfaction, and cost-effectiveness were measured using CADI, VAS, and total costs at baseline, 2, 4, 8, and 12 weeks, analysed with IBM SPSS 22. Lesion reduction was greatest with topical + laser (21.17 → 0.10; USD 369.09), followed by topical + systemic (15.50 → 0.17; USD 298.71) and topical (15.17 → 0.40; USD 198.71). Topical + laser achieved the fastest IGA score reduction (CER USD 97.90). For CADI, topical therapy was most cost-effective (USD 3.52), followed by topical + systemic (USD 4.74) and topical + laser (USD 11.89). In satisfaction, topical was also most economical (USD 6.93). All therapies effectively reduced acne severity; topical + laser gave the best clinical results but at the highest cost, while topical alone was most cost-efficient.

Keywords: Acne Vulgaris, Cost-Effectiveness, Quality of Life, Patient Satisfaction, CADI, VAS, Acne Treatment and Dermatology Clinics

Introduction

Acne is one of the most common chronic inflammatory skin diseases involving pilosebaceous unit, characterised by the formation of comedones, papules, pustules, nodules and even cyst (Sifatullah & Zulkarnain, 2021; Yunus, 2025). It mainly affects region where sebaceous glands are abundant such as face, chest, and upper back. The underlying pathology that leads to the acne includes increased sebum production, abnormal hyperkeratinisation of the pilosebaceous

follicles leading to obstruction of the lumen, increased growth of propionibacterium acne due to high sebum concentration in the pilosebaceous unit and finally followed by inflammation.

Globally, the estimated prevalence of acne vulgaris for all age is up to 9.38% (Heng & Chew, 2020; Heng et al., 2022). However, the precise prevalence based on the available data varies depends on the population studied and methodology used, with a range of 26.8% to almost 100% especially among adolescents coincides with the onset of puberty where the sebaceous gland activity is the most active (Pappu, 2013).

According to Gollnick et al. (2008) Although acne is commonly seen as benign disease, it should not be underestimated, as literature have shown that it could lead to critical consequences. Studies found that patients with acne especially those with moderate and severe grade, or those developed acne scar suffered serious psychosocial morbidity like embarrassment, low self-esteem, frustration, depression, and even suicidal ideation (Sood et al., 2020; Zhou et al., 2023). Besides, patients with acne scar also have poorer quality of life comparable to more severe skin disease (Dreno et al., 2021).

Acne could also significantly disturbs friendship, academic achievement, and even sexual relationship of the sufferers (Murray & Rhodes, 2005). Thus, efforts must be made to treat patient with acne promptly and utilising the most appropriate treatment regime. The goals are to achieve resolution of lesions, alleviating the psychological morbidity of the sufferers, as well as preventing the development of permanent acne scar.

Currently, there are few treatment modalities available to treat acne. These includes topical medications, systemic medications, physical therapies as well as cosmoceutical products (Souto et al., 2020). The choice of treatment should be based on the grading and severity of acne, as well as the current psychological status of the patient. Examples of the topical medications include benzoyl peroxide (BPO), retinoid like tretinoin and adapalene, antibiotics like clindamycin, azelaic acid, and salicylic acid.

These medications can be used in the form of monotherapy or in fixed combination to enhance the efficacy (Sharma et al., 2009). For systemic medications, the examples include oral antibiotics like doxycycline and azithromycin, isotretinoin, and hormonal medication like combined oral contraceptive, spironolactone, and metformin especially for female with signs of hyperandrogenism.

Physical therapies are mainly used as adjunctive therapy on top of the topical plus systemic medications above, which include intralesional corticosteroid injection for nodules and cyst, comedone extraction, chemical peels and the energy-based devices. Energy based devices can be categorised further into light therapies (photodynamic therapy, intense pulse light, blue light, red light), laser therapies (erbium glass laser, neodymium-doped yttrium aluminium garnet (Nd:YAG), pulsed dye laser, and non-ablative fractional laser), as well as radiofrequency emitting device.

In existing guidelines, topical medications are advocated as the first line treatment for mild to moderate acne. In mild acne with predominantly inflammatory lesions, topical BPO is recommended, while topical retinoid is recommended when non-inflammatory lesion is predominant. If there is minimal improvement after 3 months of treatment with monotherapy agent, or in moderate acne, combination of any two topical agents is recommended.

Following that, if there is still marginal clinical improvement after another three months with the above treatment regime, or in severe acne or the patient is suffering from serious

psychological morbidities, combination of two topical agents plus oral antibiotic is recommended.

Alternatively, isotretinoin, the most potent medication for acne, can be used to treat patient with severe acne especially those with nodulocystic acne or who is resistant for topical plus oral medications. Despite the increasing popularity of physical treatment, at the present moment, these modalities only serve as an adjunctive therapy without replacing the conventional pharmacological oral and topical therapies, as there is limited evidence supporting the use of these treatment as the main treatment modalities.

Recently published systematic review and network meta-analysis based on 179 randomised controlled trials evaluating the efficacy of topical, oral, and physical treatments for acne vulgaris had revealed efficacy of several treatment types on the acne lesion reduction. For mild to moderate acne, the most effective option for topical medications was combined retinoid/BPO reducing acne lesions up to 26.2% from baseline compared to placebo, for physical treatment was chemical peels using salicylic acid or mandelic acid reducing 39.7% of lesions, and for photochemical therapy was combined blue/red light reducing 35.4% of lesions.

Whereas, for moderate to severe acne, most effective option for topical medication was combined retinoid with lincosamide (44.4% reduction), for systemic medication was oral isotretinoin with total cumulative dose of ≥ 120 mg/kg per single course and the most potent (58.1% reduction), for physical therapy was the photodynamic therapy (40.5% reduction), and for combined medication was the retinoid/BPO plus oral tetracycline (43.5% reduction).

The same author in the subsequent publication focusing on cost-efficacy concluded that for mild to moderate acne, the most cost-effective acne treatments were combined fixed dose topical medications such as BPO with adapalene (£195) and tretinoin with clindamycin (£189), and photochemical therapy in the form of combined blue and red light with a higher cost of £546 but offer strong clinical benefits. For moderate to severe acne, topical tretinoin with clindamycin (£224.46), oral lymecycline combined with BPO/adapalene (£287.80), and oral isotretinoin were the most cost-effective treatment.

Oral isotretinoin cost differed between gender, as the treatment cost for female was higher as compared to male due to gender specific requirement (£902 and £582). The author also emphasized that physical therapies like chemical peels and photodynamic therapy were less cost effective compared to the treatment mentioned above considering the high cost but only offers modest improvement in alleviating the acne lesions. Besides, another investigator also supports the use of oral isotretinoin and combination of fixed dose adapalene/BPO plus the oral doxycycline (A-BPO/D) as these treatments capable in reducing 80-90% and 72% acne lesions, which is affordable and costed about \$72.1 and \$47.41 respectively.

Thus, these evidence supports the recommendation of several clinical guideline where topical and systemic medications should be the preferred first line agent for treating mild to moderate acne and moderate to severe acne, while the physical therapy only serves as adjunctive treatment on top of the conventional pharmacological treatment, considering the cost and also the clinical efficacy towards the improvement of acne (Mavranetzouli et al., 2022).

Nevertheless, few studies had verified the effectiveness of laser treatment particularly Nd: YAG laser in treating acne vulgaris. Puaratanaarunkon & Asawanonda (2022) said that, for instance had assessed efficacy of this laser among 61 patients with acne vulgaris where they underwent three session of laser treatment with 2-week interval, combined with topical emollient and sunscreen. 80.3% of the participants showed very good response resulting in 80% reduction of the acne lesions, and only 13.1% of them showed poor response.

In addition, most mild to moderate acne patients only required three treatment sessions, indicating highly effective treatment, although patients with severe acne required more session (Newton et al, 1997). Similarly, another author also had determined the efficacy of this laser and discovered that 99% of the participants had achieved clear or almost clear IGA score, with a mean of five laser sessions. However, these studies did not explore the cost of treatment as well as it's cost-effficacy.

Current available evidence supports combination of topical agents and combination therapy using fixed-dose topical medication and oral agents as the most cost effective in treating mild to severe acne. However, the data depicted in the meta-analysis was based on different studies where the methodology, patients' demography, and treatment outcomes were different and direct comparison cannot be made. Besides, direct comparison of topical, topical plus systemic medication, and topical plus laser treatment especially in real-world setting and private clinics in southeast asia is lacking. A study directly compares these three treatment types could evaluate these therapies under similar condition, using similar grading scale, follow-up period, and patient population. Thus, this study aims to evaluate and compare the cost-effectiveness and patient satisfaction of topical alone, topical plus systemic, and topical plus laser treatment for treating acne vulgaris.

Methods

Study Design and Subjects

This study was conducted in four dermatological aesthetic clinics in Indonesia. Each clinic was assigned to one of the treatment regimes tested in this study to minimise contamination. As these clinics were private clinics, the patients chose their preferred treatment after being thoroughly examined and briefed about the treatment options by their treating doctor. No randomisation was performed throughout the study. Instead, this study utilised a prospective cohort study design whereby the treatment regime chosen by the patient and the outcome were assessed at each of the specific study periods. All acne vulgaris patients who came to clinics for treatment were screened for inclusion and exclusion criteria. They were invited to participate in the study if they met the inclusion criteria, did not have the exclusion criteria, and could follow the treatment and research protocol. The inclusion criteria were male and female patients aged 16 years and above suffering from mild to severe acne vulgaris and able to follow the treatment and research protocol. Patients with exclusion criteria, such as pregnant and breastfeeding women, received previous acne treatment within 3 months, received oral isotretinoin within the last 1 year, received antibiotic treatment in the last month, have received laser treatment for acne, have a history of photosensitivity, tendency to develop keloid or hypertrophic scars, and history of liver problem were excluded from this study. The data collection was conducted from April 2024 until May 2025, where 30 patients were recruited for each treatment arm. Consecutive convenience sampling was utilised in this study for patient recruitment. All subjects who met the inclusion criteria and did not have exclusion criteria were recruited until the required number of subjects was met. After thorough history taking and physical examination, the patients were briefed about the treatment options, and subsequently chose their treatment regimen. All subjects in this study continued their treatment regimen from the beginning until the end.

Measurement Tools

Several measurement tools were used in this study, including the Cardiff Acne Disability Index (CADI) to assess quality of life, the Visual Analogue Scale (VAS) to measure patient satisfaction, and a cost-effectiveness analysis to assess the efficiency of expenditures on clinical

outcomes. Treatment effectiveness was evaluated based on the reduction in lesion count and IGA score. At the same time, cost-effectiveness was calculated by comparing total treatment costs to changes in clinical scores and improved quality of life (CADI).

Cost-Effectiveness

Cost-effectiveness analysis (CEA) compares the costs against the health outcomes of an intervention, without converting the results into monetary values (Bertram et al., 2021). Cost-effectiveness is determined by comparing the total cost of care to the change in the clinical effectiveness score. Here is the structure of the cost-effectiveness analysis from the patient perspective:

Medical Costs (Borne by the Patient)

These costs include physician consultations, topical medications, systemic treatments, and procedures such as laser therapy. Patient-centred cost-effectiveness analyses exclude non-medical costs (such as transportation or lost productivity). Acne treatment costs vary between topical, topical + systemic, and topical + laser therapies due to differences in treatment components, monitoring intensity, and technology. Topical therapy is typically the least expensive because it involves only consultation and topical treatment, while combination topical + systemic therapy is more expensive because it includes additional oral medication, more intensive consultations, and often laboratory testing. Topical + laser therapy has the highest costs because it involves high-tech procedures, the use of specialised equipment, and the ongoing need for topical treatment and regular checkups. In these studies, calculated costs generally include consultations, treatments, and medical costs (borne by the patient).

Table 1. Medical Costs

No	Characteristic	Topical	Systemic + Topical	Laser + Topical
		USD	USD	USD
1	Cost at baseline			
	Doctor Consultation Fee	14.06	14.06	14.06
	Total	14.06	14.06	14.06
2	Cost at 2 –weeks			
	Doctor Consultation Fee	14.06	14.06	14.06
	Cost Treatment	32.10	57.10	163.45
	Total	46.16	71.16	177.51
3	Cost at 4 – weeks			
	Doctor Consultation Fee	14.06	14.06	14.06
	Cost Treatment	32.10	57.10	163.45
	Total	46.16	71.16	177.51
4	Cost at 8- weeks			
	Doctor Consultation Fee	14.06	14.06	0
	Cost Treatment	32.10	57.10	0
	Total	46.16	71.16	0
5	Cost at 12–weeks			
	Doctor Consultation Fee	14.06	14.06	0
	Cost Treatment	32.10	57.10	0
	Total	46.16	71.16	0
	Total Cost Treatment	198.71	298.71	369.09

Measure of Effectiveness

Effectiveness measures are clinical parameters that reflect the success of a treatment. In this study effectiveness was assessed using several indicators, including: (1) Lesion Count, which

refers to the objective reduction in the number of acne lesions; (2) Investigator Global Assessment (IGA), is a clinical grading tool that evaluates the overall severity of acne based on standardized criteria. The IGA uses a scale from 0 to 5, where lower scores indicate better outcomes and greater clinical improvement; (3) Additionally, effectiveness were measured using CADI and VAS to correlate it with quality of life and patient satisfaction.

ICER (Incremental Cost-Effectiveness Ratio)

It indicates the incremental cost required to gain one additional unit of effectiveness when switching from a standard treatment to a new intervention, such as a topical and laser combination. The intervention is considered cost-effective if the ICER is below the willingness-to-pay threshold.

Visual Analogue Scale (VAS)

A Visual Analogue Scale (VAS) was used to measure patient satisfaction with acne treatment at each clinic visit. The scale is a 10 cm (100 mm) horizontal line, with one end indicating total dissatisfaction and the other indicating maximum satisfaction. In this study, the VAS was used to assess patients' perceptions of the results of their acne treatment.

Cardiff Acne Disability Index (CADI)

The CADI assesses the improvement in patients' quality of life over the study period by evaluating the functional and emotional impact of acne on daily life, including social interactions, work, and self-esteem. The Cardiff Acne Disability Index (CADI) is a validated questionnaire developed specifically to measure the impact of acne on quality of life in adolescents and young adults. The questionnaire consists of five questions addressing patients' experiences over the past month, including: (1) Feelings of embarrassment or low self-esteem due to acne; (2) Impact on social interactions; (3) Interference with daily activities or leisure time; (4) Emotional distress related to acne; (5) Patient's subjective assessment of acne severity. Each question is scored from 0 to 3, resulting in a total score ranging from 0 (no impact) to 15 (maximum impact). Higher CADI scores indicate a greater negative impact of acne on the patient's quality of life. The CADI is widely used in dermatological research due to its brevity, specificity for acne, ease of administration, and strong validation across diverse populations.

Data Analysis

This study used IBM SPSS version 22 for data analysis. The first step is to describe the research variables using descriptive statistics, such as mean, standard deviation, and minimum and maximum values. Furthermore, a normality test is carried out to determine whether the statistical model's confounding or residual variables are normally distributed. The criterion for normal distribution is a significance value greater than 0.05. The homogeneity test uses the Levene test to assess whether two or more populations have the same variance. If the significance value of the test is more significant > 0.05 , the data is considered to have the same variance. If less < 0.05 , the data is considered to have unequal variance.

Next, the homogeneity test will assess whether two (or more) populations are homogeneous (the same). It can be performed if the data have the same variance. The variance of the data will be tested using the Levene test. If the significance value (sig) > 0.05 , the data is considered to have the same variance. If the sig value < 0.05 , the data is considered unequal variance. Hypothesis testing will be performed using ANOVA to analyse and compare the average variables produced. This analysis will help determine if the differences between groups are significant, providing insight into the effectiveness of laser and non-laser treatments in treating acne vulgaris.

The data in this study analysed the cost-effectiveness and patient satisfaction of various acne vulgaris treatment modalities in dermatology clinics using descriptive and inferential approaches. Treatment cost data were analysed by calculating the average, range, incremental cost-effectiveness, and CADI before and after therapy using the ANOVA. At the same time, patient satisfaction scores for Topical, Systemic + Topical, and Laser + Topical treatments were analysed using the Friedman Test. The results are presented in tabular and graphical form to illustrate the distribution of costs, effectiveness, satisfaction levels, and the significant relationships between variables, providing deeper clinical and economic insights.

Results and Discussion

Sociodemographic Profile

Table 2. Socio-Demographic Characteristic

Characteristic	Topical		Systemic		Laser		p-value
	n	%	n	%	n	%	
Age							
16 – 28	20	66.7	20	66.7	20	66.7	0.876
29 – 38	8	26.7	6	20.0	6	20.0	
39 – 48	2	6.7	4	13.3	4	13.3	
Total	30	100.0	30	100.0	30	100.0	
Gender							
Male	0	0.0	10	33.3	3	10.0	0.001
Female	30	100.0	20	66.7	27	90.0	
Total	30	100.0	30	100.0	30	100.0	
Education							
High School (SMA)	1	3.3	5	16.7	7	23.3	0.003
Diploma (D3)	3	10.0	9	30.0	12	40.0	
Bachelor's degree)	26	86.7	16	53.3	11	36.7	
Master (S2)	0	0.0	0	0.0	0	0.0	
PhD (S3)	0	0.0	0	0.0	0	0.0	
Total	30	100.0	30	100.0	30	100.0	
Occupation							
Government	0	0.0	8	26.7	7	23.3	0.007
Student	1	3.3	5	56.7	19	63.3	
Self-employed	29	96.7	17	16.7	4	13.3	
Pensioner	0	0.0	0	0.0	0	0.0	
Not working	0	0.0	0	0.0	0	0.0	
Total	30	100.0	30	100.0	30	100.0	
Salary							
<123.68 USD	1	3.3	1	3.3	0	0.0	0.000
>123.68 USD <309.21 USD	15	50.0	5	16.7	27	90.0	
>309.21	14	46.7	24	80.0	3	10.0	
Total	30	100.0	30	100.0	30	100.0	
Relationship							
Married	14	46.7	15	50.0	11	36.7	0.557
Not married	16	53.3	15	50.0	19	63.3	
Total	30	100.0	30	100.0	30	100.0	

Patients aged 16–28 comprised the majority across all treatment groups, comprising 66.7% of participants in the topical, topical plus systemic, and topical plus laser categories. In comparison, individuals aged 29–38 and 39–48 years showed a gradual increase in preference for more advanced therapies, particularly topical combined with systemic or laser treatments. Despite this trend, the age distribution between the systemic and laser groups was identical, reflecting a consistent pattern with no significant variation. Statistical analysis confirmed that the difference in age distribution was insignificant ($p = 0.876$), indicating that age was not a significant factor influencing treatment selection. In contrast, gender distribution differed significantly between the groups. All participants in the topical alone group were female (100%), while the topical plus systemic group consisted of 33.3% male patients and 66.7% female patients. The topical plus laser group included 10% male and 90% female participants. This variation based on gender was statistically significant, with a p-value of 0.001, indicating a strong correlation between gender and treatment preference. This finding suggests that female patients are more likely to choose topical therapies, especially those involving laser treatments, than male patients.

Quality of Life Score (CADI)

The results show that at baseline, topical plus systemic group had the highest baseline CADI (15.00), while the topical monotherapy group was the lowest (13.63). In the topical group, the CADI score decreased significantly from 13.63 at baseline to 0.53 at 12 weeks, indicating that effective treatment significantly improved quality of life. In the topical plus systemic group, the score decreased from 15.00 at baseline to 0.00 at 12 weeks, also reflecting substantial quality of life improvement. Nevertheless, the topical plus laser group showed the most dramatic drop in scores, from 14.93 at baseline to 0.00 at 8 weeks and maintained this figure until 12 weeks. Statistical analysis using the Friedman test shows a p-value of 0.000 for all groups, indicating a statistically significant decrease in CADI scores over time. This suggests that all treatment methods effectively improving the quality of life.

Table 3. Quality of Life Scores for Topical, Systemic+Topical and Laser+Topical Using the Friedman Test

No	Treatment	CADI					Sig.
		baseline	2-weeks	4-weeks	8-weeks	12-weeks	
		Mean	Mean	Mean	Mean	Mean	
1	Topical	13.63	9.50	5.03	3.90	0.53	0.000
2	Systemic + Topical	15.00	10.00	5.00	3.33	0.00	0.000
3	Laser + Topical	14.93	5.00	0.07	0.00	0.00	0.000

Clinical Outcome: Treatment satisfaction

The satisfaction score was calculated by looking at the patient's satisfaction score after treatment. The calculation of satisfaction in this research using the Friedman test can be seen in the following table. The table shows table 4. that all treatment modalities significantly increased patient satisfaction from baseline to week 12, with a p-value of 0.000. Topical treatment gradually increased satisfaction from 2.97 to 9.63, while topical plus systemic treatment sharply increased at 2 weeks (7.83), fluctuated slightly, and reached 9.93 at 12 weeks. Topical plus laser treatment had the most rapid and stable improvement from 3.70 to 9.97 from week 4, indicating consistent patient satisfaction. Statistical analysis using the Friedman test

showed a p-value of 0.000 for all groups, indicating a statistically significant increase in satisfaction over time for all type of treatment.

Table 4. Satisfaction Score of Topical, Topical Plus Systemic, and Topical Plus Laser Treatment with the Friedman Test

No	Treatment	Satisfaction					Sig.
		baseline	2-weeks	4-weeks	8-weeks	12-weeks	
		Mean	Mean	Mean	Mean	Mean	
1	Topical	2.97	4.57	6.47	8.13	9.63	0.000
2	Systemic + Topical	2.80	7.83	6.50	7.80	9.93	0.000
3	Laser + Topical	3.70	7.90	9.97	9.97	9.97	0.000

Cost of Treatment

After therapy began, there was a difference in costs based on the type of treatment. In the topical group, the cost of USD 46.16 came from the combined cost of consultation (USD 14.06) and topical medication (USD 32.10), and this amount remained constant from week 2 to week 12, reflecting continued use of topicals. The topical + systemic group showed a fixed cost of USD 71.16 throughout week 2 to week 12, consisting of consultation fees (USD 14.06) and a combination of topical and systemic medications (USD 57.10). Meanwhile, the topical + laser group showed high costs at weeks 2 and 4 of USD 177.51, which included consultation (USD 14.06) and laser and topical therapy packages (USD 163.45). However, there were no additional costs at weeks 8 and 12, indicating that the laser treatment cost was paid in full upfront. The results of the Friedman statistical test showed a significant value ($p = 0.000$) for all groups, indicating a significant difference in costs between types of treatment.

Table 5. Treatment cost in USD

No	Treatment	Cost in USD					Sig.
		baseline	2-weeks	4-weeks	8-weeks	12-weeks	
		Mean	Mean	Mean	Mean	Mean	
1	Topical	14.06	46.16	46.16	46.16	46.16	0.000
2	Systemic + Topical	14.06	71.16	71.16	71.16	71.16	0.000
3	Laser + Topical	14.06	177.51	177.51	0.00	0.00	0.000

The reduction in the number of lesions in each treatment group showed a closed relationship with the cost of treatment incurred. Topical plus laser treatment showed the most significant reduction in number of lesions, with a mean of 21.17 to 0.10, a reduction of 21.07 lesions with a total cost of USD 369.08, followed by topical plus systemic with a reduction of 15.33 lesions, from 15.50 to 0.17 with a cost of USD 298.71, and lastly topical monotherapy with a reduction of 14.77 lesions from 15.17 to 0.40 with a cost of USD 198.71.

In terms of cost per lesion removed, topical monotherapy was the cheapest treatment modality (USD 13.45 per lesion), followed by topical plus laser therapy (USD 17.51 per lesion). Conversely, topical plus systemic therapy (USD 19.49 per lesion) was the most expensive treatment modality (USD 19.49 per lesion). However, although the cost of treatment per lesion with topical plus systemic therapy is higher than topical monotherapy, this treatment provides a much more significant reduction in lesions in a shorter time, making it more efficient and reducing the need for follow-up treatments.

Table 6. Reduction in Acne Lesion Count for Each Treatment From Baseline To Week 12.

No.	Treatment	Baseline (Mean Lesions)	Week 12 (Mean Lesions)	Reduction (Lesions)
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1	Topical	15.17	0.40	14.77
2	Systemic + Topical	15.50	0.17	15.33
3	Laser + Topical	21.17	0.10	21.07

IGA Score Reduction

Based on the IGA score throughout 12 weeks of treatment, all acne treatment modalities significantly reduced acne severity. At the baseline, most patients in the topical group had mild to moderate acne (96.6%), and the topical plus systemic group was dominated by moderate acne (90%). In comparison, most of the topical plus laser group (76.7%) had experienced severe acne. The topical plus systemic group showed comparable but slightly lower outcomes, with 96.7% achieving clear skin, slightly below the 100% clearance observed in both the topical monotherapy and topical plus laser groups. This indicates that all interventions were effective in reducing IGA scores from mild, moderate, or severe conditions to clear skin, with the fastest and most consistent score reduction seen in the topical plus laser group, which has exhibited optimal results since week 4 of treatment and sustained until the end of the study.

Table 7. IGA Score Reduction

No.	Treatment	Baseline Saverity	Clear Skin After 12 Weeks	Partial Improvement
1	Topical	96.6% mild to moderate acne	100%	0%
2	Systemic + Topical	90% moderate acne	96.7%	3.3%
3	Laser + Topical	76.7% severe acne	100%	0%

Cost-Effectiveness Ratio (CER)

The cost-effectiveness ratio (CER) compares the total cost of treatment with the average reduction in the number of lesions over 12 weeks of treatment. Based on the analysis, topical therapy incurred a total cost of USD 198.71 with a reduction of 14.77 lesions, resulting in a CER of approximately USD 13.45 per lesion reduced. Topical plus systemic treatment cost USD 298.71 and reduced 15.33 lesions, yielding a CER of USD 19.49 per lesion. Meanwhile, despite having the highest total cost of USD 369.09, topical plus laser treatment showed the most significant reduction in lesions (21.07), leading to a CER of USD 17.51 per lesion. Thus, although topical plus laser therapy involves a higher upfront cost, it substantially reduces lesions with a competitive cost per lesion, making it a clinically and economically valuable option, especially when rapid and significant improvements are desired.

Incremental Cost-Effectiveness Ratio

Based on the Incremental Cost-Effectiveness Ratio (ICER) analysis, the combination of topical and laser therapy provides significant cost-efficiency compared to topical therapy or a combination of topical and systemic therapy. Although the initial cost is higher, this therapy produces more significant clinical improvement, making the additional cost commensurate with the benefits. In other words, topical and laser therapy provide optimal added value in terms of effectiveness and economics, making it a clinically and cost-wise rational choice. Based on the Incremental Cost-Effectiveness Ratio (ICER) analysis, topical plus laser treatment compared to the other two therapies topical alone and systemic plus topical demonstrates cost-efficiency.

The sentence compares the cost-efficiency of topical + laser therapy with two other therapies, namely topical monotherapy and a combination of topical + systemic, using the Incremental Cost-Effectiveness Ratio (ICER) approach. Compared with topical alone, topical + laser

therapy has a cost difference of USD 170.38, resulting in a reduction in IGA scores of 2.37, so the ICER is USD 71.89 per unit of score reduction. Meanwhile, compared with topical + systemic therapy, the cost difference is only USD 70.38 with an increase in effectiveness of 1.50, resulting in a lower ICER of USD 46.92 per unit of reduction. This shows that although topical + laser is more expensive, the increase in effectiveness obtained is relatively comparable to the additional costs, especially when compared with topical + systemic therapy.

These results indicate that although the initial cost of topical plus laser treatment is higher, the increase in clinical effectiveness achieved is much greater, with comparable or even better cost efficiency compared to other therapies. These results show that although topical plus laser treatment has a higher initial cost, the clinical effectiveness achieved is much greater, and the cost-efficiency per unit of clinical improvement is also comparable when compared with systemic + topical therapy. This indicates that topical plus laser is the treatment option worth considering from a cost-effectiveness perspective, especially for patients keen for fast and significant results.

Discussion

Sociodemographic Data

Based on sociodemographic data, the 16 to 28-year-old age group dominated all types of therapy, especially topical therapy (83.3%), while systemic and laser treatments were more common in the 29 to 48-year-old age group. However, the differences were not statistically significant. Gender differences were more pronounced where topical therapy was used exclusively by women (100%), systemic treatment involved 33.3% of men, and laser therapy was chosen mainly by women (90%). These significant gender differences suggest that, in general, women were more concerned about acne and sought treatment than men.

Several studies have shown that gender influences acne treatment preferences, which may explain the treatment patterns in our study. For example, a cross-sectional study in India involving 100 adolescents and young adults evaluated differences in the psychosocial impact of acne vulgaris by gender (Cecilia et al., 2022). Research shows that women tend to be more active in seeking appropriate acne treatments than men. The primary reason is the desire for clear, blemish-free skin, as acne significantly impacts their emotions, leading to embarrassment, anxiety, and decreased self-confidence. Furthermore, it has been found that women, especially young women, prefer more advanced treatments that can accelerate acne healing, such as lasers, chemical peels, and medical cosmetic products, despite their higher costs, because they are more concerned about the appearance of their facial skin.

One study used 1450 nm diode laser therapy to treat mild to moderate inflammatory acne. Treatment was performed in three sessions spaced 3-4 weeks apart, resulting in a total treatment duration of approximately 9-12 weeks. This study involved young patients, and the results showed that young women were more likely to choose laser therapy because it was perceived as more modern, practical, and provided faster aesthetic results. These findings highlight the growing preference for advanced dermatological technology among the younger generation, especially women (Little et al., 2011).

This is also supported by findings reporting that women prefer therapies that provide quick results and are more open to acne treatments such as facials or peels to achieve clear skin. At the same time, men tend to seek treatment after their acne condition has become severe. Furthermore, women are also more interested in combination therapy and aesthetic procedures, such as lasers and are more sensitive to side effects. In conclusion, women are more active in seeking treatment and tend to choose treatments that address aesthetic concerns, while men are

more pragmatic and prefer simpler or longer-term therapies. This study concludes that acne treatment approaches should consider psychosocial aspects and gender differences, as patient motivation and perceptions of acne can influence adherence to treatment outcomes. This study shows that topical treatments plus lasers provide the most significant reduction and fastest results in lesion treatment, which can be considered for women with aesthetically motivated acne (Amiri et al., 2022).

The study demonstrated that the combination of Nd: YAG laser therapy and topical therapy resulted in faster inflammatory and non-inflammatory lesions reduction than topical therapy alone. The study also noted that female patients preferred this combination due to its more cosmetically visible results and faster achievement of clear skin. These findings support the relevance of this study, which stated that topical + laser therapy is more clinically effective and preferred by women with high aesthetic motivation. Younger age groups, especially women, are more likely to accept laser therapy despite its higher cost because it is perceived as modern, provides quick results, and improves self-image, which shows that younger generations are more open to advanced dermatology technologies that offer instant aesthetic benefits. Thus, previous research supports the conclusion that investment in Topical + Laser therapy is clinically and economically efficient and aligns with the needs and expectations of the acne patient demographic.

CADI (Cardiff Acne Disability Index)

The CADI measures the impact of acne on patients' quality of life, including physical and emotional aspects. The group receiving topical plus laser treatment showed the most significant reduction in CADI, with scores approaching zero at week 12, indicating a significant reduction in the impact of acne on their quality of life. CADI score reductions were also observed in the topical monotherapy, topical plus systemic therapy, and topical plus laser groups. Both prospective studies showed that topical therapy and the combination of topical and systemic therapy can significantly improve the quality of life of acne patients by reducing CADI scores. The study's results, which showed improvements in CADI scores and self-esteem starting in the third month in patients receiving combination topical and systemic therapy or isotretinoin, align with the findings of this study that all acne treatment modalities can improve quality of life. However, our study showed that the combination of topical and laser treatment resulted in a more rapid and significant reduction in CADI scores than conventional therapy, suggesting that laser therapy substantially impacts quality of life in a shorter period.

This study only assessed improvements in quality of life based on the Acne-QoL-BR questionnaire without evaluating changes in lesion count, IGA score, CADI, or costs. In contrast, our study used a more comprehensive approach, combining objective clinical indicators, quality of life, patient satisfaction, and cost-effectiveness, providing a more comprehensive and applicable picture for selecting value-based acne therapies. Several studies have compared the effectiveness of laser, topical, and systemic therapies in treating acne. These studies have shown that laser therapies such as IPL and Nd: YAG effectively reduce inflammatory lesions, even more rapidly than topical treatments. They found that combining pulsed-dye laser and topical treatments was superior to topical treatments alone. Meanwhile, our study compared laser, topical, and combined systemic-topical treatments and concluded that laser treatment provided rapid results. However, the combination of oral and topical treatments was more effective in the long term.

A meta-analysis by (Mehrabi et al., 2022) confirmed that combined laser-topical and oral-topical therapies were more effective than monotherapy. These findings support using a multimodal approach for optimal clinical and psychosocial outcomes. Generally, they did not

include cost-efficiency analyses or comprehensive assessments of satisfaction and quality of life. Meanwhile, our study not only compared the clinical effectiveness of topical, topical + systemic, and topical + laser therapies but also evaluated costs, patient satisfaction, and quality of life, thus providing a more comprehensive and relevant approach to support value-based acne therapy selection.

Evaluate and Compare with Other People's Research Results

There is a paucity of data in the literature comparing clinical effectiveness, satisfaction, and costs among various acne treatment modalities, such as topical monotherapy, topical plus systemic treatment, and topical plus laser treatment. This study attempts to address this gap. Furthermore, there is a lack of information on the comparative costs of each treatment modality, which could help clinicians and patients choose a treatment based on clinical effectiveness and affordability. In our study, the acne treatment cost at Erha Clinic was USD 198.33 for topical, USD 298.71 for topical + systemic, and USD 369.09 for topical + laser. Compared with other studies, these costs are moderate. For example the cost of oral + topical antibiotic therapy in the US at USD 200–400, while laser therapy costs reach USD 500–700 per session in East Asia. Therefore, the costs at Erha for topical and systemic treatments are relatively lower. At the same time, laser therapy is indeed more expensive, but it is still lower than clinics in developed countries and commensurate with the clinical results achieved.

Previous studies have assessed the effectiveness and costs of acne therapies, but few have calculated the cost per lesion reduction. In our study, we calculated the total costs of therapy at USD 198.33 (topical), USD 298.71 (topical + systemic), and USD 369.09 (topical + laser), and compared them with the number of lesions reduced. The NICE analysis focused on total cost, or QALYs, rather than cost per lesion. Therefore, our study is one of the first to provide a cost-effectiveness analysis based on a direct clinical indicator: cost reduction per lesion. It concluded that a combination of topical therapy and light was effective for mild to moderate acne. Conversely, a combination of topical therapy and oral isotretinoin was most cost-effective for moderate to severe acne. Patients in the study were adolescents and young adults, with a prescribed treatment duration of one year. Effectiveness was measured based on symptom improvement, Quality-Adjusted Life Years (QALYs), and cost analysis within the UK National Health Service (NHS) healthcare system. Compared with our study, which focused on patients at a Medan dermatology clinic over 12 weeks, effectiveness was measured based on lesion reduction, IGA scores, actual costs, and patient satisfaction. Our study was more practical and based on direct clinical data, while Mavranetzouli's study used a long-term simulation model.

In one study, patients with severe acne were willing to pay high prices for treatments like chemical peels for quick and visible results, despite their relatively low clinical efficacy and suboptimal benefit-to-cost ratio. Their motivation was more influenced by psychological and social factors, such as the desire to boost self-esteem and social pressure. In contrast, in our study, patient decision-making was based on rational considerations of measurable clinical effectiveness and true cost-effectiveness. Patients in our study preferred objectively proven therapies, such as a combination of topical and systemic lasers, based on lesion reduction, IGA scores, and satisfaction with results. Thus, unlike Xiao's study, which emphasised subjective patient motivation, our study emphasises the importance of an evidence-based approach and efficiency in determining optimal acne therapy.

A study showed that topical therapy is the most economically efficient option for acne treatment, as it is low-cost yet still provides adequate clinical results, especially for mild to moderate acne cases. Meanwhile, combination therapies such as topical and oral therapies or

procedures (e.g., laser) are more clinically effective. However, they are significantly more expensive, resulting in a lower cost-effectiveness-to-cost ratio. The study measured effectiveness based on lesion reduction, acne severity scores, and in some cases, QALYs (Quality-Adjusted Life Years). Topical therapy costs USD 100–150 per treatment cycle, while combination therapy can reach USD 300–500 or more. Therefore, although combination therapy provides better clinical results, Pyne et al. concluded that topical therapy remains the most cost-effective option, especially in resource-constrained healthcare systems.

Combination topical and systemic therapy is a viable alternative for patients who cannot use isotretinoin, as it still provides good clinical efficacy without the risk of serious side effects often associated with isotretinoin, such as hepatotoxicity, lipid disturbances, and teratogenic potential. The study by (Penna et al., 2014) did not explicitly detail the costs of combining topical and systemic treatment. However, based on the literature and estimates from other studies using similar regimens such as the combination of adapalene-BPO with doxycycline or minocycline the average cost of therapy for one treatment cycle (approximately 12 weeks) is estimated to be between USD 150 and USD 300. This estimate includes the cost of topical adapalene-BPO, which ranges from USD 100–150, and oral antibiotics, which can reach USD 50–150, depending on the type and dose used. With good clinical efficacy and a lower risk of side effects than isotretinoin, this combination therapy is considered a relatively affordable and viable alternative for patients who cannot undergo isotretinoin treatment for medical reasons.

This study emphasises that the effectiveness of acne therapy is not solely determined by medical costs and clinical outcomes, but is also influenced by non-medical costs such as transportation, lost time, and administrative barriers like access to services and insurance processes. This is important because these factors can impact patient adherence and overall therapy success. These findings are relevant to our study, which also considered patient satisfaction and cost-effectiveness from the patient's perspective, thus supporting a holistic approach to assessing the effectiveness of acne treatments (Shah et al., 2021). Compared with our study, it broadens our understanding of acne treatment efficacy by emphasising the importance of considering non-medical costs and administrative barriers, such as transportation, wasted time, and access to services. Therefore, while Shah's study highlights the importance of systemic context in evaluating treatment efficacy, our study reinforces this with real-world clinical and economic data that directly consider patient perspectives. These two studies complement each other in emphasising the need for a holistic approach to assessing acne treatment effectiveness.

Discuss the use of generic drugs to improve the cost-effectiveness of acne therapy, particularly in resource-constrained healthcare systems. The authors raise this issue because the cost of acne treatment can be prohibitive, especially when using more expensive brand-name drugs. Generic drugs offer equivalent efficacy at a lower price, thus expanding patient access to effective treatment (Zhang et al., 2017). Although this study does not focus on therapies such as lasers or combination procedures, this idea remains relevant to our article, particularly when discussing cost-effectiveness in intermodality comparisons. This recommendation can support the argument that effective therapies do not have to be expensive, and that less expensive, evidence-based options, such as generic topical combinations, may be a reasonable alternative. This helps strengthen the discussion about accessibility and economic considerations when choosing acne therapies, especially in developing countries (Mavranzeouli et al., 2022).

Emphasise the importance of value-based therapy, which considers clinical outcomes relative to cost. For mild to moderate acne, multimodal topical therapy is often necessary. A fixed-dose combination of adapalene BPO and clindamycin BPO is cost-effective for most patients.

Topical retinoid lotion formulations may benefit patients who have difficulty tolerating other formulations. Clascoterone is a newer topical antiandrogen that is more expensive than other topical therapies, but may complement other topical therapies and is well tolerated (Shields & Barbieri, 2023). Our study aligns with the perspective of Shields and Barbieri, who emphasise the importance of value-based therapy, namely considering clinical effectiveness relative to cost. In our study, the topical + systemic combination proved to be the best balance between effectiveness and cost-efficiency, supporting the treatment options for moderate to severe acne as suggested in the literature. Meanwhile, the topical + laser combination demonstrated the highest clinical effectiveness but at a higher cost, reflecting that higher expenditures may be justified if they provide significant benefits. We also added aspects of patient satisfaction and quality of life, which were rarely addressed in previous studies, thus enriching the value-based therapy approach by more comprehensively considering patient perceptions and preferences.

This study evaluated the cost-effectiveness of dermatologists' treatment of adolescent acne (aged 10–18) compared to that of paediatricians from a payer perspective (insurance or third-party in the US). Using a Markov model over 2 years, results showed that patients treated by dermatologists were more likely to be acne-free (42.3%) than those treated by paediatricians (28.0%). Treating adolescent acne through a dermatologist was more effective in improving quality of life, although more expensive, and still considered cost-effective. Therefore, it is recommended that insurance companies consider providing incentives to refer patients to dermatologists for acne treatment. A comparative study between dermatologists and paediatricians showed that, despite higher costs for dermatologist-led care, clinical outcomes and quality of life were better and remained cost-effective. Meanwhile, this study showed that combination acne therapy (topical + systemic or laser) was more effective and increased patient satisfaction despite the higher cost. The main difference is that the first study focused on provider effectiveness from a payer perspective, while the second focused on the type of therapy and patient experience.

Conclusion

The study found that all treatment modalities effectively treated acne over 12 weeks. However, the degree of improvement and consistency varied among the three treatment modalities. Laser combined with topical treatment produced the most rapid and consistent clinical improvement, achieving resolution by week 4 and maintaining it through week 12. On the other hand, topical and topical plus systemic treatments showed slower improvement, and many patients receiving these treatments still had acne lesions or mild acne at week 12. Evaluating the cost-effectiveness and patient satisfaction of various treatment modalities for Acne Vulgaris in dermatology clinics indicates that topical treatments are the most economical option. However, their effectiveness is limited for mild to moderate acne. Systemic treatments, such as oral antibiotics and isotretinoin, provide faster results for moderate to severe acne but are more expensive and carry the risk of side effects. Meanwhile, despite being the most expensive, laser treatments offer rapid and significant improvement in acne severity, resulting in the highest patient satisfaction rates. Therefore, the choice of treatment modality should consider acne severity, patient preference, and financial capabilities to ensure optimal clinical and economic outcomes. In summary, although all treatment options showed promising results after 12 weeks, the combination of laser and topical therapy appeared to provide superior benefits in treating acne. Future trials using randomised controlled trials with larger sample sizes and diverse demographics will allow for evaluation of the long-term effectiveness and cost-effectiveness of laser therapy in treating acne vulgaris.

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