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## Article

# Economic Burden of Acne Vulgaris: A Cost of Illness Analysis

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## Capsule Summary:

- This article adds to the existing knowledge by quantifying the economic burden of Acne Vulgaris in Pakistan, highlighting the substantial financial impact based on treatment.
- This article underscores the necessity for dermatologists in Pakistan to consider the economic burden of Acne & aims to reduce the financial strain on patients

**Abstract: Background & Objective:** Acne Vulgaris is a common skin disease, with 5 % prevalence in Pakistan and has a significant physiological, psychological, emotional and social impact on the population, our study aims to estimate its annual economic burden per person in Pakistan.

**Methodology:** Economic burden was estimated by using Cost of Illness analysis. All types of costs, including direct medication costs, direct non-medical costs and indirect costs due to loss of work. Data were collected from online databases and literature reviews. **Results:** Cost of illness analysis

estimated that the cost of Acne Vulgaris treatment varies for mild, Moderate and severe acne. Acne is causing an annual economic burden of PKR 1,92,366 PKR per person (direct cost is PKR 1,86,366 and indirect cost 6,000) for an expensive treatment and PKR 53,550 (direct cost is PKR 47550 and indirect cost 6,000) for a cheap treatment. **Limitation:** Being an LMIC, Pakistan needs extensive

study on the pharmacoeconomic analysis of Acne for proper and rational allocation of resources. **Conclusion:** Acne has a significant economic burden in Pakistan. Even with significant impact of Acne, there is very minute work done about Acne in Pakistan.

**Keywords:** Acne vulgaris; cost of illness; economic burden; direct medical costs; indirect costs; pakistan

## Introduction

Acne vulgaris, commonly known as acne, is a chronic skin condition affecting the pilosebaceous units, hair follicles and sebaceous glands (Mahto, 2017). **Propionibacterium acnes** is a microorganism effecting the face, upper chest and back areas that have high sebaceous follicle density (Federman and Kirsner, 2000). It is mainly an adolescent disorder however; it can affect all age groups. It can present as non-inflammatory comedones, inflammatory papules, pustules, nodules, cysts, or a mixture of lesions. The prevalence of acne is nearly equal in Black and White people (Taylor et al., 2002).

Acne scars can cause frustration, stress, depression and anxiety among individuals who are afraid of their appearance may affect academia, professional relationships, and future employment

prospects (Baldwin, 2002). Prior to its external appearance, psychological stress may indirectly contribute to acne pathogenesis by increasing sebum excretion rate, free fatty acid production, and endocrine activity (Hughes et al., 1983). Acne can have severe psychological and quality of life consequences, with long-term complications like scarring (Lasek and Chren, 1998). Treatment regimens are basically of three types, on the basis of the severity i.e., mild, Moderate and severe acne. Mild acne is generally treated with topical treatments. Combined therapy of topical adapalene or benzyl peroxide with antibiotics is used for Moderate acne. Most costly yet effective therapy is with isotretinoin used for severe acne (Mavranezouli et al., 2022). Various clinical treatments and therapies including Vitamin D also play a vital role in acne management. Vitamin D deficiency is more common in acne patients and inversely correlates with disease severity, suggesting it may contribute to acne pathogenesis (Mohamed et al., 2019). Acne is a very common disorder targeting 5% of total population of Pakistan, among which 85% are the youth and adolescents (Babar and Mobeen, 2019). Acne has a huge Global economic Burden. As by a market survey, Global economic burden of Acne medication in 2023 is 11.57 billion USD that is continuously increasing and in 2032, it is estimated to increase more than 18 billion USD. Thus, Acne has a huge impact on the national economy and budget (Research, march 2024).

While acne has a well-established therapeutic therapy but the economic burden of acne vulgaris is still a problem and not well understood. Research on economic cost of Acne Vulgaris treatment in Pakistan is limited, despite the condition's prevalence (Naveed et al., 2021). Both direct medical expenditures, like prescription drugs and doctor visits, as well as indirect costs, such missed productivity, will be taken into account when estimating the overall financial burden.

By estimating the financial impact of acne vulgaris, this study aims to close the gap through a Cost of Illness (COI) analysis.

## Methodology

**Literature Review:** An extensive review was conducted on the data available on search engines included Google Scholar and PubMed.

**Data Collection:** Data on direct medication regimens was taken from scientific research-based data and patient prescriptions. Indirect costs were estimated through surveys administered to individuals with acne vulgaris, capturing productivity losses due to decreased work or school performance.

**Cost Estimation:** Direct medical costs were calculated by using the price data from various databases such as Dvago Pharmacy and Wellness Expert. Cost for the expensive and cheap brands were compared. Indirect cost of illness including hospital visits was also calculated to assess the economic burden of acne vulgaris in Pakistan.

## Results

Our analysis estimated the direct medical costs and indirect costs associated with acne vulgaris. Direct medical costs included dermatologist visits, medications (e.g., topical retinoids, antibiotics), and procedures (e.g., chemical peels, laser therapy). Indirect costs encompassed productivity losses due to decreased work or school performance, including missed work or school days and reduced efficiency. With data collected and calculations, total annual cost of Acne treatment per person was calculated.

### Cost of Illness Calculations:

Cost of Illness calculations consists of basically two main parts: (Tu et al., 2012)

- a) Calculation of direct costs including direct medical & direct non-medical cost.
- b) Calculation of indirect costs of Acne Vulgaris.

This cost of illness calculation will then help to estimate the total Economic burden of Acne Vulgaris in Pakistan by multiplying the total cost with the total prevalence of the disease (Tu et al., 2012).

### **Direct Medical Cost:**

The direct medical cost of Acne Vulgaris basically represents the recognition of all the resources utilized in the treatment of Acne Vulgaris in terms of money (Sousa et al., 2022). The direct cost is estimated on the basis of previous data and studies regarding prevalence of Acne Vulgaris in Pakistan (Babar and Mobeen, 2019) (Abbas et al., 2021) and also by assessing different scientific research articles and online databases, treatment regimens and costs associated with the respective regimes, total direct cost of treatment of Acne Vulgaris was evaluated (Sane et al., 2020) (Wei et al., 2012).

Direct Medical Cost in total related to Acne Vulgaris treatment plan includes the total cost of out-patient visit and cost of medication used for treatment. Acne Vulgaris patients mostly don't need hospitalization thus no cost of hospital admission and hospital stay is included (Layton et al., 2021).

Moreover, this medication is estimated to be used for 1 – 2 weeks and mostly the proper treatment for Acne Vulgaris extends from 3 weeks to 6 weeks (Sane et al., 2020). To calculate total cost of illness we need to extrapolate the costs calculated for cost of 6 weeks medicine.

The cost comparison of hospital visits between expensive and cheap options shows a significant difference. For the expensive hospital, the cost per visit is PKR 2500, and for the cheap hospital, it is PKR 1000. Both options assume the same number of visits per year, which is 4. Consequently, the total annual cost for hospital visits amounts to PKR 10,000 for the expensive option and PKR 4000 for the cheap option. Costs per hospital visit is estimated from online database (Roden et al., 2006)

### **Total direct cost will be calculated as**

$$= \text{Total medication cost} + \text{hospital visit cost}$$

### **Direct Non-Medical Cost**

The direct non-medical cost basically includes cost of travelling to the hospital for check-up or cost of meals during the visit (Tu et al., 2012). The data for this was also estimated from online databases and also from interviewing some patients from The University of Lahore Teaching Hospital. Studies also show that cost of travelling and food in more for patients from rural areas than in urban areas because they need to travel more from rural to urban area to have better healthcare facility and thus this travelling also cause more expense of outside food (2021-22). The direct non-medical costs associated with hospital visits include expenses for traveling and food. For each visit, the cost for traveling is PKR 1000 and the cost for food is also PKR 1000. Assuming four visits per year, the total annual cost for traveling amounts to PKR 4000 ( $1000 \times 4$ ), and the total annual cost for food also comes to PKR 4000 ( $1000 \times 4$ ). However, one most important point is not calculated regarding patient perspective and willingness to pay by the patient.

### **Indirect Cost**

Acne has a direct psychosocial impact on one's life regarding job and study and even social gatherings. People with Acne tend to have less chance to get a job as compared to other competitor (Layton et al., 2021).

Moreover, Indirect costs include any leave from job or work loss or productivity loss. The annual cost of absentees for medical leave was calculated by multiplying the days taken for medical leave by the average daily-salary. Mostly Acne patients are young females, who earn a basic salary with an average of 50,000 PKR per month and average per day salary was recorded as 1500 PKR per day (Abbas et al., 2021).

$$\text{Indirect cost for Acne Vulgaris treatment} = \text{annual cost of absenteeism from work}$$

$$= \text{cost per absentee} \times \text{number of leaves for hospital visits}$$

$$=1500 \times 4 = 6000 \text{ PKR}$$

### Economic Burden of Acne Vulgaris in Pakistan

To estimate the total economic burden of Acne Vulgaris in Pakistan we use the cost calculations from above data. Also, data from literature was gathered to find out the prevalence of the disease in Pakistan. Studies show that there is almost 5% prevalence of Acne in Pakistan and more than 80% is amongst young females (Babar and Mobeen, 2019). Acne Vulgaris exist in three pathological conditions; mild, Moderate, moderate. Economic burden of all these three forms will be calculated from the above data. We have chosen two basic economic classifications; expensive treatment and cheap treatment.

### Economic Burden & Cost of illness of Acne Vulgaris per Annum

Above data shows that most of the economic burden of Acne Vulgaris is for Severe Cases. Also, it suggests that patients who are willing to pay for the cheap treatment plan, suffer from more burden of direct non-medical costs.

Thus, Acne Vulgaris is causing an annual economic burden of PKR 1,92,366 per person for an expensive treatment and PKR 53,550 for a cheap treatment. Direct cost for severe treatment is PKR 1,86,366 and direct cost for cheap treatment is PKR 47,550, which is about 4 times less than the expensive treatment. 5% prevalence of Acne means 11.7 million population. However, more extensive research is needed to calculate Economic burden for total population with 5% prevalence of Acne.

### Discussion

Acne, a very common skin disease, caused by Acne Vulgaris, has a huge impact on physical, psychological, emotional and social life. Acne, mostly seen as face pimples, marks and lesions target almost 85% of the young and adolescent population (Durai and Nair, 2015). Acne is highly spreading disease being the top eighth most prevalent disease. It has a prevalence of 9.4% all over the world (Tan and Bhate, 2015). The economic burden of Acne is very high globally and in Asia-Pacific region (LMICs like Pakistan), the acne-medication economic burden comes on the second after North America (Research, march 2024).

Thus it is necessary, especially in LMICs like Pakistan to analyse and assess the economic burden for the management of Acne (2021-22).

Economic Analysis of any disease explains how that disease and its management is affecting the budget, economy and buying power of the population. It helps in proper allocation of resources with equity (Mavranzouli et al., 2022). Acne is a very serious topic of research and discussion but unfortunately there is very less work regarding the pharmacoeconomic analyses of Acne, especially in Pakistan (Naveed et al., 2021). As by our information, this is the first Cost of illness analysis of Acne treatment in Pakistan. A study by The Department of Dermatology Research, USA, in 2009 stated that economic analysis for the treatment regime of Acne is very crucial for choosing a rational treatment plan but there is a huge lack of pharmacoeconomic data for Acne Vulgaris (Inglese et al., 2008). We have extrapolated the results up to 6 weeks as some treatments may take up to 6 weeks for complete cure. Similarly, in a study in India showed the economic burden of the treatment plan that was up to 6 months rather than 3 weeks (Jain, 2020). We have gathered the prices of 2 categories, expensive and cheap for 3 stages of acne, mild, Moderate and severe. Out of these 3, severe is the costliest treatment plan and most costly are the retinoids. However, economic analysis of different treatment regimens for Acne show that medications for severe acne, especially the retinoids show the highest cost-effectiveness (Jain, 2020). Thus, we can say that may be the cost is higher for severe Acne, but it the most effective one. According to, the retinoid therapy costs about 33, 234 PKR for 6-week therapy, which is \$120. In US, a survey in 2005 suggested that the retinoid therapy costs \$323 for 12 week therapy (Weiss, July 1, 2005). Another study by Simpson show that the cost per Isotretinoin treatment is £306 (Simpson, 1993). Thus, this cost is less in Pakistan than in US & UK. Moreover, a

study in 2004 estimated that Acne is amongst the top 5 diseases to share the highest economic burden of skin diseases regarding direct cost for their treatment. Acne medication cost comes at the second highest position after skin ulceration (Bickers et al., 2006).

According to above calculations and data gathered, the total annual economic burden of Acne per person in Pakistan is estimated to be PKR 1,92,366 for an expensive treatment and PKR 53,550 for a cheap treatment. A literature review in 2013 on Economic burden of Acne in US shows that the total economic burden of Acne is \$1.2 billion per year (Proshenska 2023). Moreover, indirect cost also needs to be evaluated properly. As well-said by Simpson, Acne is targeting the young age population, thus targeting the working group of the population. Thus, the cost of absenteeism from work will be higher and it will keep increasing with the increasing prevalence (Simpson, 1993). This shows a high increase in cost of treatment, especially the cosmetic products.

Acne, being a social stigma is related to appearance and cosmetics, that is very important in today's world of aesthetic beauty and cosmetics. A Cost of illness analysis is necessary to assess the need and value of new treatments for Acne Vulgaris. Enough working is needed to increase the effectiveness and decrease the economic burden of Acne in Pakistan. This will improve the overall quality of life and self-confidence amongst the population (Naveed et al., 2021).

## Conclusions

This study highlights that there is a strong economic burden of acne vulgaris in Pakistan based on both types of direct costs, direct cost, and indirect cost. The direct expenses consist of the prescription medicines, doctors' billets, procedures, and other treatments that you must go through, while informal ones include the productivity losses due to absenteeism from work or school. The fact that this case is such an exhaustive COI (Cost of Illness) study behind the economic aspects of acne, makes a particular stress on the necessity of the acne problem not only as a dermatological issue but also as an important socioeconomic factor (Durai and Nair, 2015).

The case of severe acne has the highest cost in COI analysis. The cost of severe acne medicine may run up to PKR 77,520 per year if premium products are used, while cheaper ones can cost as little as PKR 14,808. In order to possibly reduce expenses, early identification and treatment become essential.

A direct medical cost associated with an acne can significantly fluctuate depending on its severity. Severe acne has one treatment that is very costly. An important factor in the total economic burden of acne is absenteeism and lower productivity brought on by psychological impacts including social disengagement and low self-esteem. Effective management strategies are essential to mitigate the economic burden of acne vulgaris and improve the quality of life for individuals affected by this condition. There is a strong need in Pakistan for pharmacoeconomic studies regarding Acne and its treatment regimens to decrease the economic burden and improve the Quality of life of the population of Pakistan.

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**Conflicts of Interest:** None declared.

**Institutional Review Board Statement:** Reviewed and approved by IRB, The University of Lahore.

**Patient Consent:** Not applicable.

## Appendix

**Table A1.** Cost of medication for different types of Acne.

Mild Acne					
Sr No.	*Medication	Expensive brand (A)	**Price per pack (A)	Cheap Brand (B)	***Price per pack (B)

1	Adapalene	Adapco Forte Gel 15G	PKR 494	Epilene Gel 15g	PKR 260
2	Clindamycin lotion	Dalacin T Lotion 30ml	PKR 290	Clinda Derm Lotion 30ml	PKR 200
3	Salicylic acid+ Glycolic acid facewash	CeraVe Cleanser 237ml	PKR 6600	Dermoteen Face Wash 100ml	PKR 1160
	Total		PKR 7384		PKR 1620

**Moderate Acne**

Sr No.	*Medication	Expensive brand (A)	**Price per pack (A)	Cheap Brand (B)	***Price per pack (B)
1	Adapalene+Benzoyl peroxide	Acne-pearl plus Gel 30g	PKR 395	Differin Gel 15g	PKR 270
2	Clindamycin lotion	Dalacin T Lotion 30MI	PKR 290	Clinda Derm Lotion 30MI	PKR 200
3	Azithromycin Tab (6 tab)	Azomax 500mg	PKR 472	Zetro 500mg	PKR 207
4	Salicylic acid+ Glycolic acid facewash	CeraVe Cleanser 237ml	PKR 6600	Dermoteen Face Wash 100ml	PKR 1160
	Total		PKR 7757		PKR 1837

**Severe Acne**

Sr No.	*Medication	Expensive brand (A)	**Price per pack (A)	Cheap Brand (B)	***Price per pack (B)
1	Adapalene+Benzoyl peroxide	Acne-pearl plus Gel 30g	PKR 395	Differin Gel 15g	PKR 270
2	Clindamycin lotion	Dalacin T Lotion 30MI	PKR 290	Clinda Derm Lotion 30MI	PKR 200
3	Doxycycline Tab (6 tab)	Vibramycin 100mg	PKR 96	Adoxa tab 100mg	PKR 80
4	Isotretinoin cream	Arynooin Plus Gel 10g	PKR 425	Skin-A cream 10g	PKR 150
5	Isotretinoin Tab	ROACCUTANE 20mg (30 tab)	PKR 5114	ACCUTANE 20mg (10 tab)	PKR 608
6	Salicylic acid+ Glycolic acid facewash	CeraVe Cleanser 237ml	PKR 6600	Dermoteen Face Wash 100ml	PKR 1160
	Total		PKR 12920		PKR 2468

\*Medication regimens are selected from the study (Sane et al., 2020).

Prices (\*\*Expensive & \*\*\*Cheap) are evaluated from online databases (Wei et al., 2012).

**Table A2.** Annual Direct Cost for Total Treatment Regime of Acne Vulgaris.

Sr No.	Annual Direct Cost for Total Treatment Regime of Acne Vulgaris	Expensive x 6 weeks	Cheap x 6 weeks
1	Mild Acne	$7384 \times 6 = 44304$	$1620 \times 6 = 9720$
2	Moderate Acne	$7757 \times 6 = 46542$	$1837 \times 6 = 11022$
3	Severe Acne	$12920 \times 6 = 77520$	$2468 \times 6 = 14808$

**Table A3.** Total Annual Direct Cost for different types of Acne.

<b>Mild Acne</b>			
Sr No.	Total Annual Direct Cost	Expensive	Cheap
1	Annual Medication Cost	PKR 44304	PKR 9720
2	Total cost of hospital visits per year	PKR 10,000	PKR 4000
		PKR 54304	PKR 13720
<b>Moderate Acne</b>			
Sr No.	Total Annual Direct Cost	Expensive	Cheap
1	Annual Medication Cost	PKR 46542	PKR 11022
2	Total cost of hospital visits per year	PKR 10,000	PKR 4000
		PKR 56542	PKR 15022
<b>Severe Acne</b>			
Sr No.	Total Annual Direct Cost	Expensive	Cheap
1	Annual Medication Cost	PKR 77520	PKR 14808
2	Total cost of hospital visits per year	PKR 10,000	PKR 4000
		PKR 87520	PKR 18808

**Table A3.** Economic Burden & Cost of illness of Acne Vulgaris per Annum.

Sr No.	Unit of Cost	CoI Expensive	CoI Cheap	CoI % of Expensive	CoI % of Cheap
1	Direct Cost	PKR 44304	PKR 9720	23%	18%

	Medication cost for Mild				
2	Medication cost for Moderate	PKR 46542	PKR 11022	24%	20.5%
3	Medication cost for Severe	PKR 77520	PKR 14808	41%	28%
4	Hospital visit cost	PKR 10,000	PKR 4000	5%	7.5%
5	Direct non-medical Travelling	PKR 4000	PKR 4000	2%	7.5%
6	Food	PKR 4000	PKR 4000	2%	7.5%
	Total Direct Cost	PKR 186366	PKR 47550	97%	89%
7	Indirect Loss of wage due to absenteeism	PKR 6000	PKR 6000	3%	11%
	<b>Total Cost of Illness</b>	<b>PKR 192366</b>	<b>PKR 53550</b>	<b>100%</b>	<b>100%</b>

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