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Top 100 Most Cited Articles on Acne Vulgaris

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Abstract: Background: Acne vulgaris is a common skin condition presentation seen by dermatologists for which clinicians are well armed to manage. Bibliometric analysis scientifically assesses the impact of published research in any given field and identifies clinical issues of current interest. Objective: The aim of the study was to elucidate the 100 most cited journal articles on the topic of acnze vulgaris and their influence on understanding the pathophysiology and management of this presentation. Methods: The search term 'Acne vulgaris' was used within the Scopus database to determine the top 100 most cited articles on acne vulgaris with only articles with a primary focus on acne vulgaris being included in the study. Year of publication, subject matter, journal of publication, authorship and impact factor were ascertained. Results: The number of citations ranged from 131 to 713. Over half of the articles were published after 2000. The USA, UK and Germany were the countries that contributed most to the top 100. Review articles were the most highly cited article category. Discussion Treatment was the focus of the most cited articles within the top 100, with many reviewing therapies such as photodynamic therapy and laser therapy. Established effective therapies for moderate to severe acne like isotretinoin were less commonly reviewed. Conclusion: New therapies such as phototherapy, photodynamic therapy and laser are the primary focus of current research suggesting the evolution of new directions in understanding and managing acne vulgaris.

Keywords: Acne Vulgaris, Most Cited, Treatment, Year of Publication, Subject Matter, Journal of Publication, Authorship, Impact Factor

1. Introduction

Acne Vulgaris is a common dermatological presentation with significant effects on the psychological well-being of individuals [1, 2]. Clinicians have a range of effective treatment options for this condition. This bibliometric analysis utilises statistical models to bring to the forefront data that has had the largest impact on clinical decision making, indicated by an article's annual and absolute number of citations [3]. Bibliometric analyses have already been conducted in the fields of psoriasis, melanoma, and rosacea. To our knowledge there is yet to be one produced for acne vulgaris [4, 5, 6]. This article aims to shed light on the 100 most cited articles on acne vulgaris and delves into their characteristics.

2. Method

2.1. Search Strategy

The search term 'acne vulgaris' was used in the Scopus database and articles were ranked from most to least cited to determine the top 100 most cited articles on the topic of acne. The search did not involve any limitations on the language, document type, or period of publication.

When more than one article had the same number of citations, the most recently published article was ranked higher, as it would have had less time to accumulate citations. The obtained results were screened so that only articles with a primary focus on acne vulgaris were included in the study.

2.2. Data Extraction and Bibliometric Parameters

The 100 most cited articles on acne vulgaris were recorded on Microsoft office excel 2020. The title, first and last author, year of publication, journal of publication, and total number of citations were directly obtained from the search results. The titles, abstracts and key words of the articles were utilised to determine the subject matter of the articles. Evidence levels of the articles within the top 100 were determined in consultation with the Australian National Health and Medical Research Council evidence hierarchy [7].

The details of the first author determined the country, institute and department of each article. The 2018 Incites Journal citation was used to determine the impact factor [8]. The top 100 articles were subsequently subdivided into six groups based on their subject matter: associated morbidity, epidemiology, pathogenesis, treatment, multiple areas and other.

2.3. Statistical Analysis

The acquired data was then analysed by Statistical Package for the Social Sciences (SPSS) in which the frequency of contribution of journals, countries, institutions, authors, articles of varying levels of evidence and conflicts of interest and funding were determined.

3. Results

Upon searching the Scopus database 15,600 publications were found. The top 100 articles on acne vulgaris are shown in *Supplementary Table 1* alongside the total number of citations achieved by each article.

3.1. Year of Publication

The 100 most cited articles on acne vulgaris were published between 1969 and 2016. Prior to 1990 only 13 articles made the top 100 most cited articles; 29 were published between 1990 and 2000, 52 between 2000 and 2010, and 6 from 2010 onwards. 'Topical Vitamin A Acid in Acne Vulgaris' published in the *Archives of Dermatology* was the oldest article in the top 100 published in 1969 with 263 citations. 'Guidelines of care for the management of acne vulgaris' was published the most recently in 2016 in *The Journal of the American Academy of Dermatology* with 311 citations.

3.2. Citations

The number of citations ranged from 131 to 713 with the sum of the citations of the top 100 articles amounting to 21,322. 'Management of acne: a report from a global alliance to improve outcomes in acne' published in *The Journal of the American Academy of Dermatology* in 2003 had the greatest number of citations (713). The article that had the greatest average number of citations per year (77.75) was 'Guidelines of care for the management of acne vulgaris' published in the *Journal of the American Academy of Dermatology* in 2016; it had the 13th highest number of total citations (311).

3.3. Journal of Publication

The articles within the top 100 most cited articles on acne vulgaris came from a total of 29 journals with 17 of these journals contributing two or more articles (Table 1). The *British Journal of Dermatology* was the top contributor with 21 articles (39% of articles) and the *New England Journal of Medicine* was the journal with the highest impact factor (70.67). Out of the 10 most cited articles three were published in both the *Journal of the American Academy of Dermatology* and *British Journal of Dermatology,* journals that did not had the highest impact factors within the study.

Table 1. *Contributing journals to the top 100 articles cited in the Acne Vulgaris literature.*

Journal	No of articles in top 100	Impact factor
British Journal of Dermatology	21	6.714
Journal of the American Academy of Dermatology	18	7.102
Journal of Investigative Dermatology	8	6.29
Archives of Dermatology	6	2.309
Dermatology	5	2.497
British Medical Journal	3	27.604
Clinical and Experimental Dermatology	3	2.868
Journal of the American Medical Association	3	7.995
New England Journal of Medicine	3	70.67
Journal of the European Academy of Dermatology and Venerology	3	5.11
Lancet	3	59.102
Dermatologic Surgery	2	2.19
Drugs	2	4.69
Experimental Dermatology	2	2.868
International Journal of Dermatology	2	1.794
Lasers in Surgery and Medicine	2	3.262
Medical Journal of Australia	2	5.332
American Journal of Clinical Nutrition	1	6.77
Clinics in Dermatology	1	2.47
Cutis; cutaneous medicine for the practitioner	1	0.09
Infection and immunity	1	3.256
Journal of Dermatological Science	1	3.986

Journal	No of articles in top 100	Impact factor
Journal of Ethnopharmacology	1	3.115
Journal of Steroid Biochemistry	1	3.785
Medical electron microscopy	1	2.16
Nature Reviews drug discovery	1	57
Obstetrics and gynaecology	1	4.982
PLoS ONE	1	2.776
Research in Microbiology	1	3.701

Table 2. *Countries of origin and top institutions that contributed to the top 100 papers on Acne Vulgaris.*

Country	No of articles
US	35
UK	25
Germany	5
Multiple Countries (across Europe)	4
Multiple Countries (across Europe, Asia, USA, UK, Australia)	3
Japan	3
Australia/ New Zealand	3
Denmark	2
France	2
Turkey	2
US + Africa	2
Germany + UK + US	2
Australia + Finland	1
Belgium	1
Demark	1
Iran + Germany	1
Netherlands	1
Canada	1
Thailand	1
UK + Canada	1
UK + USA	1
US + France	1
Multiple countries: US + Sweden + Australia	1
Multiple countries: USA + China + Germany	1
Institution	
University of South Florida	10
General Infirmary – Leeds	9
University of Nottingham	8
University of Cincinnati College of Medicine	3
University of Pennsylvania	3
Washington Institute of Dermatologic Laser Surgery	3
Bispebjerg Hospital (University of Copenhagen)	2
Charité University Medicine Berlin	2
Harvard School of Public Health	2
Jefferson Medical College	2
Massachusetts General Hospita	2
Royal North Shore Hospital	2

3.4. Countries, Institutes, Departments and Corresponding Authors

Many countries have contributed to the top 100 most cited articles on acne vulgaris. The US produced the greatest number of articles (n=35) followed by the UK (25). Of note 9 of the papers were a result of the combined efforts of several countries. Among institutions, the University of South Florida in the USA contributed the most (n=10) followed by the General Infirmary Leeds in the UK (n=9).

The first authors who have contributed the most based on impact factor were Eady E. A from the University of Pennsylvania Hospital and Leyden J. J from the University of Leeds (n=4). The last author with the most publications was Cunliffe W. J (n=9).

3.5. Article Type and Research Focus

Most of the articles were review articles (n=53), closely followed by prospective studies (n=23). There appears to be a poor correlation between the likelihood of citation and level of evidence as more than half (n=55) of the articles were level IV and V evidence. Even the top 10 articles included in the analysis had just one article with level I evidence i.e. 'Guidelines of care for acne vulgaris management' published in the *Journal of the American Academy of Dermatology* in 2007.

The top 100 most cited articles on acne vulgaris were divided into six subgroups: treatment (n=44), pathogenesis (n=24), associated morbidity (n=11), epidemiology (n=11), multiple areas (n=7) and other (n=3) depending on their area

of focus. All sixteen of the randomised controlled trials (RCTs) within the top 100 looked into the treatment options for acne. Seven of the RCTs were based around the use of photodynamic therapy, laser therapy and phototherapy in the treatment of acne.

3.6. Conflicts of Interest and Funding

More than half of the articles within the top 100 had an unclear conflict of interest (n=72) and/or an unclear source of funding (n=67). This did not correlate with country, institution or author. There were also more declarations of no conflicts of interest (n=17) when compared with declarations of the existence of conflicts of interest (n=11). Sources of funding were declared on more occasions (n=24) than they were considered unrequired (n=9). Of the articles that received funding, most were funded by pharmaceutical companies (n=16) with the rest being funded by the government (n=5) and private sponsors (n=3).

4. Discussion

The area of coverage and new developments on the topic of acne vulgaris was determined through analysing the top 100 most cited articles on acne vulgaris, examining their level of influence (determined by their citation number) and the roles played by authors, countries and journals. Areas such as the management of Propionibacterium acnes resistance and the role of light and laser therapy in the treatment of acne have been highlighted as being worthy of future exploration.

The majority of the articles within the top 100 were review articles. Such articles appear to be commonly cited, potentially as they tend to provide overall summaries on a topic integrating data from diverse studies and narratives and showing knowledge progression over time [8]. They are of interest to a broad readership including those with less knowledge on the topic. They also help to identify alliances, divisions, and omissions within the literature [9]. However we found that these most commonly cited review articles provided data with mostly low levels of evidence (Level V) and referencing preferences may give undue prominence to such data.

For instance, even the most commonly cited article is 'Management of acne: a report from a global alliance to improve outcomes in acne' which was published in 2003 in the *Journal of the American Academy of Dermatology* is an expert opinion piece and of relatively low evidence and hence more robust studies are required. The publication appears to have provided influential guidelines for the treatment of acne and had the largest number of citations (713) and fourth highest citations per year. The article has a continued significant influence on clinical practice despite being published in 2003 with 87% of the articles in the top 100 being published after the occurrence of the conference. The article examined the consensus of a panel of physicians and researchers on the pathogenesis and treatment options for acne in terms of topical retinoids, combination therapies, anti-microbial therapies, hormonal therapies, oral retinoids, general management and adjunctive treatments. It is likely that this article received several citations as it provides expert opinion such as that of Gollnick H. and Cunliffe W. More robust studies including randomised controlled trials are needed to verify many current understandings.

Acne therapy discussed in the top 100 articles

A large proportion of the top 100 articles (44%) related to the treatment of acne vulgaris. The earlier articles seem to be centred around establishing the safety and efficacy of medications such as topical retinoids, the oral contraceptive pill and isotretinoin in the treatment of acne, while more recent articles examined the use of photodynamic and laser therapies [10-19].

Table 3. *Established treatment modalities for Acne Vulgaris.*

Treatments	
Non-pharmacological management	Taking an adequate history and engaging in patient education [20, 24] Assessing sequelae of acne such as scarring and psychological impact with questionnaires can contribute to more holistic treatment [21, 24]
Topical therapies	Topical retinoids have long been known to be used first line for the treatment and prevention of acne vulgaris, with salicylic acid and azelaic acid used as less potent alternatives [2, 10, 20, 24, 25, 26]
Systemic therapies	Oral antibiotics such as tetracyclines (can be used alongside topical retinoids and/or benzoyl peroxide) [24, 27, 28]
Hormonal therapies	Can be used in females who require contraception and may be particularly effective at reducing acne when it occurs alongside hirsuitism and virilism. [11, 20, 24]
Isotretinoin	It is the treatment of choice for severe acne that is refractory to other modalities of treatment [24]
Acne Scarring treatment	Scarring may be addressed with therapies such as fractionated laser treatments, subcision, punch excision, laser resurfacing, dermabrasion, and chemical peels. Open comedones may be extracted and closed comedones incised with a bevelled needle with larger comedones treated via electrocautery or laser [19, 20, 21, 29]
Alternative therapies	Lauric acid Chemical peels Aloe vera Pyridoxine Fruit derived acids Kampo Ayurvedic herbal treatments [1, 2, 20]

The modalities of treatment are largely covered in the articles 'New insights into the management of acne: an update from the Global Alliance to Improve Outcomes in Acne group' published in the *Journal of the American academy of the Dermatology* and 'Acne Vulgaris' published in the *Lancet*. The well-established treatment modalities are outlined in table 3. Though the articles within the top 100 also expand upon the use of novel therapies such as lasers, light sources and photodynamic therapy (PDT) [20, 21]. PDT is thought to be for individuals who have not responded to standard topical and oral acne medications and are not suitable for oral isotretinoin. It carries with it benefits that are not experienced with other treatments such as: topical treatments often cause skin irritation and rely on daily usage; antibiotics can promote anti-bacterial resistance and isotretinoin involves monitoring and is associated with several adverse effects. Commonly experienced adverse effects with PDT include erythema (23.9%), oedema (11.3%) and pain post procedure (6.8%) [22]. Additionally vaccinations containing dead forms of Propionibacterium acnes and sialidase based vaccines may be able to be used in the future, making this area of great research interest [20, 23].

The use of the Scopus database is a limitation of the study as the database appears to have less coverage than Web of Science meaning that the true contribution of particular authors may have been underestimated [30]. Despite this, the Scopus database is recognised as a suitable alternative to the Web of Science database [30]. Whilst this article provides insight into the most cited articles on acne vulgaris to date, it does not give a reliable indication of the probability of future citations [31, 32]. Additionally, calculations of number of citations included self-citations and citations found in lectures and conferences which may have skewed the results. Author bias in having a fondness for citing articles from a particular journal was not taken into account in this article. [32]

Several of the articles (11%) declared conflicts of interests with some of the authors receiving sponsorship from the pharmaceutical companies responsible for producing the drugs utilised within the study, making it difficult to determine the impact of funding on the results of the studies.

5. Conclusion

In summary this review article set out to highlight the 100 most cited articles on acne vulgaris and their features including individuals who contributed significantly to the top 100. It also brought to the forefront novel therapeutic agents for the treatment of acne vulgaris that have been minimally studied, paving the areas of need for further research into evidence-based understanding of the aetiology and treatment of acne vulgaris.

Conflicts of Interest

All the authors do not have any possible conflicts of interest.

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