Medicine®

OPEN

Predicting article citations using data from 100 top-cited publications in the field of Psoriasis Vulgaris and biological agents (PVBA) since 1991
A bibliometric analysis

Chieh-Hsun Chen, MD[a], Tsair-Wei Chien, MBA[b] iD, Sam Yu-Chieh Ho, MD[c], Feng-Jie Lai, MD, PhD[d,e,*]

Abstract

Background: Psoriasis Vulgaris is a chronic inflammatory disease characterized by keratinocyte hyperproliferation. Bibliometric analysis helps determine the most influential article on the topic of "Psoriasis Vulgaris and biological agents (PVBAs)", and what factors affect article citation remain unclear. This study aims (1) to identify the top 100 most cited articles in PVBA (PVBA100 for short) from 1991 to 2020, (2) to visualize dominant entities on one diagram using data in PVBA100, and (3) to investigate whether medical subject headings (MeSH terms) can be used to predict article citations.

Methods: The top 100 most cited articles relevant to PVBA (1991–2020) were downloaded by searching the PubMed database. Citation analysis was applied to compare the dominant roles in article types and topic categories using pyramid plots. Social network analysis (SNA) and Sankey diagrams were applied to highlight prominent entities. We examined the MeSH prediction effect on article citations using its correlation coefficients.

Results: The most frequent article types and topic categories were research support by institutes (46%) and drug therapy (88%), respectively. The most productive countries were the United States (38%), followed by Germany (13%) and Japan (12%). Most articles were published in *Br J Dermatol* (13%) and *J Invest Dermatol* (11%). MeSH terms were evident in the prediction power of the number of article citations (correlation coefficient=0.45, *t*=4.99).

Conclusions: The breakthrough was made by developing one dashboard to display PVBA100. MeSH terms can be used for predicting article citations in PVBA100. These visualizations of PVBA100 could be applied to future academic pursuits and applications in other academic disciplines.

Abbreviations: CC = correlation coefficient, CD = centrality degree, DS = descriptive statistics, PMC = PubMed Central, PVBA = Psoriasis Vulgaris and biological agents, RA = research achievement, RD = research domain, SCI = Scientific Citation Index, SNA = social network analysis, VBA = visual basis for application

Keywords: bibliometric, biological agents, citation analysis, medical subject heading, Psoriasis Vulgaris, Sankey diagram, social network analysis

1. Introduction

Psoriasis Vulgaris is a chronic inflammatory skin disease with genetic predisposition and immune-mediated pathogenesis,[1] leading to uncontrolled keratinocyte proliferation and dysfunctional differentiation.[1] It occurs commonly worldwide in literature. A systematic review found that the prevalence of psoriasis ranged from 0.5% to 11.4% in adults and 0% to 1.4% in children.[2] Patients with psoriasis should receive appropriate therapy to improve long-term outcomes.[3] Limited

skin disease can be frequently managed with topical agents, while patients with moderate to severe disease may need phototherapy or systemic therapy.[3,4] In recent years, the management of psoriasis has revolutionized with the development of biological therapies,[4–7] and the issue of biologics has been widely discussed.

Bibliometric analysis is a statistical evaluation of previously published articles, offering an effective way to measure the impact of a study by applying mathematical methods and techniques within a certain field.[8,9] Citation analysis of the

Highlights:

- Social network analysis and Sankey diagram analysis were performed to display the articles related to article types and topic categories.
- This study was a breakthrough made for readers to understand article citations that can be predicted using MeSH terms and interpreted using the Sankey diagram.
- Many articles related to the 100 top-cited publications used numerous tables and figures to report study findings. Only several figures and one table were enough to present informative messages to readers because the Sankey diagram and hyperlinks were applied to the articles to condense knowledge on the Internet.

top-cited articles demonstrates useful and interesting information about scientific development in a research field.[10] Previously published bibliometric analysis articles merely focus on a specific journal[11,12] or specific country.[13] However, insufficient information was provided to readers on their messy visual displays and on those entities of interest that are not synergistically, and complementarity showed an integrated diagram. That is, there is no study integrating several variables related to the topic of interest (e.g., author-affiliated countries, publication journals, article types, and other relevant entities) into a visual representation.

In addition, one of the most important bibliometric criteria for judging the impact of research and authors' work is article citations.[14,15] However, the citation count was hard to know until years after publication time.[14] We wondered if there is a prediction model that could help researchers identify future citation counts in advance.

In this study, our aims are are (1) to identify the top 100 most cited articles in "Psoriasis Vulgaris and biological agents (PVBA)" (PVBA100) within the period from 1991 to 2020, (2) to visualize dominant entities on one diagram using data in PVBA100, and (3) to investigate whether medical subject headings (MeSH terms) can be used to predict article citations.

2. Methods

2.1. Data source and searching strategy

We searched PubMed Central (PMC) using the keywords "('1991'[Date - Publication]: '2020'[Date - Publication]) and Psoriasis Vulgaris and biological agents" on January 11, 2022. A total of 921 articles were retrieved within the period from 1991 to 2020, without limitations on language or document type. All studies on PVBA or research containing PVBA as the main part were included in this study. Articles that only mentioned "Psoriasis Vulgaris" or only "biological agents" articles focusing on other topics or articles including PVBA as a small part were excluded from this study. The list of PVBA100 was ranked in descending order by the number of citations (see Supplementary Digital Content 1, http://www.healthup.org.tw/html100/psoriasis.htm).[16] Article titles, year of publication, journal of publication, total citation counts, author-affiliated countries, article types (defined by publication types in PubMed), and topic categories (defined by MeSH terms in PubMed) were extracted from the search results. Because all the data were obtained from the database publicly available in PubMed, this study does not require ethical approval.

Depending on the titles and abstracts of PVBA100, 10 article types and four topic categories were identified. Ten article types were defined as research support, clinical trial, review,

case report, and so on, while four topic categories were classified based on MeSH terms, including dermatitis, drug therapy, genetics, and immunoconjugates. Citation analysis was applied to compare the dominant roles in article types and topic categories using pyramid plots.

2.2. Creating visualization in a dashboard based on Google Maps

Social network analysis (SNA)[17] was applied to cluster different variables, including origin countries, journal of publication, article types, and topic categories (MeSH terms), all together into one picture presented as a dynamic dashboard. This dashboard for displaying article types and other relevant entities was laid on Google Maps. Closer entities appeared in an identical subnetwork (i.e., cluster), while entities with a higher centrality degree (CD) were highlighted in the subnetwork. The bubble is sized by its CD and collared by its cluster.

It was designed to allow our readers to manipulate the dashboard on their own to have a quick look at detailed information on different entities by clicking on each hyperlink involved in this study. A Sankey diagram was particularly used to interpret the association of the most dominant entities in the network.

2.3. Major MeSH topic used in this study

The number of connections for a specific MeSH term in an article was computed. The MeSH terms were defined by major MeSH topics with an asterisk (denoted by the symbol *) in PubMed. For instance, drug therapy was selected as a major MeSH topic instead of psoriasis in an article because only drug therapy had an asterisk in the string of psoriasis/*drug therapy/metabolism/pathology in an article. Although psoriasis and drug therapy are simultaneously defined in an article, only drug therapy was used to define the article instead of psoriasis.

2.4. Calculation of the weighted MeSH terms

Mean citations per article were computed for each article type and topic category in comparison using a pyramid plot. The weights for the number of citations on MeSH terms per article were computed by proportions and citations in an article using the equations (Eq.) from (1) to (5) below:

$$\text{MeSH}_i = \frac{1}{A_L}, \tag{1}$$

where A_L denoted the number of MeSH in an article. The weighted count of a specific MeSH term was defined in Eq. (2).

$$\text{MeSH}_{Tp} = \sum_{j=1}^{n} MeSH_{ji}(\frac{1}{A_L}), \tag{2}$$

where n was equal to 100 in this study; similarly, the weighted citation was in Eq. (3).

$$\text{MeSH}_{TC} = \sum_{j=1}^{n} MeSH_{ji}(C_j \times \frac{1}{A_L}), \tag{3}$$

where C_j is the citation in article j, and the mean citation for a MeSH term can be computed by Eq. (4), similar to the implication of the impact factor (IF) for a journal.

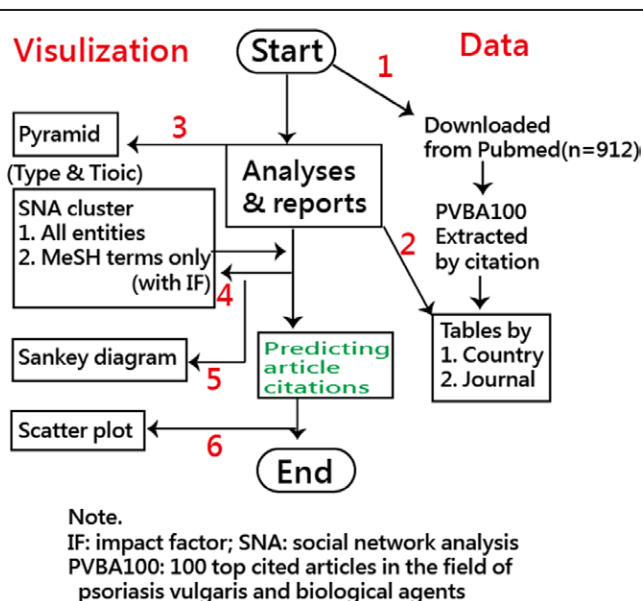$$\text{MeSH}_{IF} = \frac{\text{MeSH}_{TC}}{\text{MeSH}_{Tp}}. \tag{4}$$

Figure 1. Study flowchart.

As such, the weighted MeSH for an article can be yielded by Eq. (5), which was therefore used to predict the original citations.

$$\text{Article}_w = \frac{\sum_{i=1}^{L} MeSH_{IFi}}{A_L}. \tag{5}$$

2.5. Statistics of the prediction power between MeSH terms and citation counts

The correlation coefficient (CC) was used to determine the prediction power between the weighted MeSH terms and the original article citations. The CC t value was calculated by the formula $= \left(\frac{CC}{\sqrt{\frac{1-CC^2}{n-2}}}\right)$. A prediction equation was produced by using simple regression analysis using MedCalc 9.5.0.0 for Windows (MedCalc Software). The significance level was set at Type I error at 0.05. The study process is presented in Figure 1. An MP4 video was deposited in Supplementary Digital Content 2, https://youtu.be/uRyhGvBKYuc.

3. Results

A total of 921 publications were retrieved from the PubMed database within the period from 1991 to 2020, searching the keyword "Psoriasis Vulgaris and biological agents". PVBA100 was later chosen manually from the 921 publications by citations in descent order. These articles were elucidated in Supplementary Digital Content 1, http://www.healthup.org.tw/html100/psoriasis.htm, where readers were invited to examine all 100 articles included in this study. The total citation counts of PVBA100 were between 10 and 276 in PMC, with a sum of 3,224 citations. The mean citation of the PVBA100 was 32.2 times.

3.1. Article types and topic categories

Among the PVBA100, 46 (46%) were regarding research support by institutes, 15 (15%) were journal articles, and 12 (12%) were clinical trials, which demonstrated that research support (46%) was the most frequent article type in PVBA receiving a total citation count (n=1410). PVBA100 was classified into four topic categories based on MeSH terms, such as drug therapy (n=88), genetics (n=7), immunoconjugates (n=4), and dermatitis (n=1), ranked by the amount of article output. The dominant roles with the most publications in article types and topic categories were research support (46%) and drug therapy (88%), as displayed in the pyramid plot (Fig. 2).

3.2. Author-affiliated countries and journals of publication

PVBA100 was from 19 different countries (Table 1), and the most productive countries were the United States (n=38), followed by Germany (n=13) and Japan (n=12). Furthermore, these PVBA100 were published in 45 different journals (Table 2). Most articles were published in the *British Journal of Dermatology* (n=13) and *Journal of Investigative Dermatology* (n=11). Among the journals listed in Table 2, it was easy to find that research support accounted for the largest proportion (46%) of article types, followed by journal articles (15%) and clinical trials (12%). As a corresponding author, Dr. Lowes from Rockefeller University (NY) in the US produced the highest cited article (PMID = 18200064), with 276 citations.[18]

3.3. Most dominant entities on a dashboard and a Sankey diagram

All of those most dominant entities, including author-affiliated countries, publication journals, article types, and topic categories with MeSH terms, were all highlighted in a dynamic dashboard laid on Google Maps, as shown in Figure 3. As a picture is worth a thousand words, readers are invited to click on the link at Supplementary Digital Content 3, http://www.healthup.org.tw/gps/skin2020a2.htm, and examine the details or other relevant
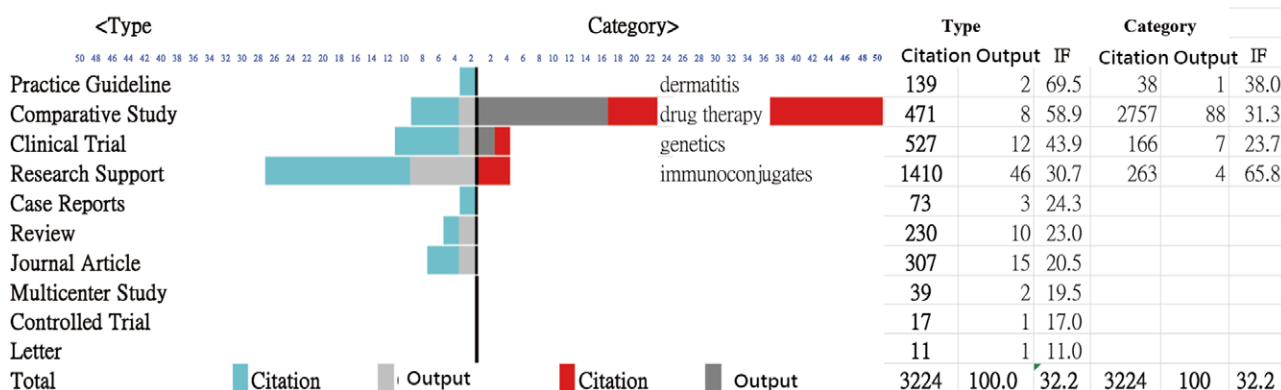

Figure 2. Citation analysis of article types and topic categories. Note: The most dominant (ranked by the output), the most influential (ranked by the citation) article types, and topic categories are illustrated by pyramid plots. The IF (impact factor) of each entity was calculated by the formula = (citation/output).

Distribution of publications across countries over the years.

Country	1991-->	2011	2012	2013	2014	2015	2016	2017	2018	n	Ci	IF
U.S.	28		1	2	1	1	2	2	1	38	1770	46.6
Germany	11	1				1				13	420	32.3
Japan	10			1				1		12	237	19.8
China	3			1	1			1		6	102	17.0
Italy	2	1	1		2					6	116	19.3
Denmark	1	2				1	1			5	100	20.0
Netherlands	4				1					5	131	26.2
Canada	1		1					1		3	79	26.3
Poland	3									3	57	19.0
Austria	1									1	11	11.0
Belgium	0						1			1	19	19.0
Estonia	1									1	11	11.0
Greece	0	1								1	16	16.0
Hungary	0			1						1	13	13.0
India	0		1							1	10	10.0
Portugal	1									1	41	41.0
South Korea	1									1	70	70.0
Taiwan	1									1	21	21.0
n	68	5	4	5	5	3	4	5	1	100	3224	32.2

entities. The most dominant entities demonstrated in this picture were "research support" in article types, "drug therapy" in topic categories, and "US" in first author affiliated countries. In addition, the top three articles that received the most citation counts, "*Psoriasis Vulgaris lesions contain discrete populations of Th1 and Th17 T cells* (276 citations)," "*Increased expression of interleukin 23 p19 and p40 in lesional skin of patients with Psoriasis Vulgaris* (231 citations)", and "*CTLA4Ig-mediated blockade of T cell costimulation in patients with Psoriasis Vulgaris* (132 citations)," were linked by the red triangular lines to be easily recognized (Fig. 3).

By viewing the word colors, it is easy to discriminate countries by red, journals by purple, MeSH terms (topic categories) by blue, and article types by green, which is different from the traditional word cloud,[19] which displays only one entity in a picture. Seven article types, including research support, journal articles, clinical trials, reviews, comparative studies, and practice guidelines, were classified into different subnetworks distinguished by different colors of bubbles, and they were surrounded by other relevant entities all in one picture.

To further highlight the association among entities in a picture, a Sankey diagram was drawn in Figure 4.[20] Only the top dominant entities with the closest relationships were displayed and connected by the curve lines from the left side to the right side. Other weaker cited lines between entities were removed from the diagram. For instance, the year 2008 is merely connected with the highly cited article with PMID = 18200064) with 276 citations, which is sequentially liked to the next entity of the US, and then the journal *J Invest Dermatol.*, the article type of research support, and the MeSH term of drug therapy. Bubbles were colored by the clusters and sized by the cited weights. As such, the top three (i.e., the US, research support, and drug therapy) connected by a triangle at the middle-top side are highlighted in the Sankey diagram (Fig. 4). Readers are invited to scan the link at reference[20] to examine the details about the information on entities.

3.4. MeSH clusters and MeSH weights

For citation analysis, four topic categories with MeSH terms are clustered in Figure 5. The top three most frequently occurring categories were drug therapy (n=88), followed by genetics (n=7), and immunoconjugates (n=4) (see Supplementary Digital Content 4, http://www.healthup.org.

tw/gps/skin2020a.htm). In addition, the MeSH weights calculated in our study are presented as red numbers in Figure 4, with drug therapy showing 5.2 and both immunoconjugates and genetics showing 5.0.

The reason why psoriasis is not frequently observed in these 100-cited articles is attributed to the frequency which is lower than that of its counterparts (e.g., drug effect and drug therapy) in an identical cluster based on the definition of a major MeSH topic with an asterisk in PubMed. Particularly, the bubble is sized by its weighted citations instead of the frequent counts in 100 top-cited articles.

3.5. Prediction model utilizing MeSH terms

To utilize the MeSH weights to predict article citations, according to our results, MeSH terms were evident in prediction power on the number of article citations (correlation coefficient=0.45, t=4.99) (Fig. 6). The regression equation is defined as Article citation(y) = $-0.01700 + 1.1155 \times$ Weight(x) of the MeSH term. The slope coefficient presented statistical significance (F=28.04, P<.001).

3.6. Online dashboards shown on Google maps

All dashboards in the figures would appear once the link is clicked on the links.[20–23] Readers are advised to examine the details of each entity's information.

4. Discussion

4.1. Using MeSH terms to predict article citations in bibliometrics

The bibliometric analysis explores the characteristics of previous scientific publications based on specific and reliable parameters.[8,9,24,25] PVBA100 may be a highly recognized article in a certain area, which could offer available and enormous information about the impact of a study and further reflect the dynamic research changes in the particular field.[9,26] The number of article citations is a quantitative index to measure the article's quality, provide information about the dominant areas in a certain discipline, and offer insights into the future direction in a specific field.[27]

The current study establishes a prediction model using MeSH terms to predict the number of citations based on the original PVBA100 downloaded from the PubMed database. Numerous

Table 2

Dispersion of journals and article types.

Journal	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	n
Br J Dermatol			2		3				7	1	13
J Invest Dermatol		1	1	1		1			7		11
J Allergy Clin Immunol		1	1						4		6
J Am Acad Dermatol		2			1		1		2		6
J Immunol		1	1						4		6
Eur J Immunol									4		4
Arch Dermatol	1	1			1						3
Clin Exp Dermatol					2					1	3
Clin Immunol									3		3
J Dermatol Sci			1		1				1		3
J Eur Acad Dermatol Venereol					1			2			3
Clin Chim Acta									1	1	2
J Dermatol		1							1		2
J Exp Med			1		1						2
J Huazhong Univ Sci Technolog Med Sci					1				1		2
Lab Invest					1				1		2
PLoS One					1				1		2
Acta Dermatovenerol Croat					1						1
Am J Clin Dermatol									1		1
Ann Rheum Dis									1		1
Annu Rev Med									1		1
BMC Dermatol	1										1
Brain Behav Immun									1		1
Clin Exp Rheumatol										1	1
Curr Opin Mol Ther	1										1
Curr Opin Rheumatol										1	1
Cytokine									1		1
Dermatol Clin									1		1
Dermatol Ther		1									1
Dis Model Mech									1		1
Ernst Schering Res Found Workshop										1	1
Exp Dermatol									1		1
Hum Immunol									1		1
J Autoimmun			1								1
J Biol Regul Homeost Agents							1				1
J Clin Immunol					1						1
J Clin Invest		1									1
J Dtsch Dermatol Ges										1	1
J Immunol Res										1	1
J Transl Med		1									1
Proc Natl Acad Sci U S A		1									1
Rheumatol Int		1									1
Semin Cutan Med Surg									1		1
Trends Immunol									1		1
n	3	12	8	1	15	1	2	2	46	10	100

Note: A1 = Case Reports; A2 = Clinical Trial; A3 = Comparative Study; A4 = Controlled Trial; A5 = Journal Article; A6 = Letter; A7 = Multicenter Study; A8 = Practice Guideline; A9 = Research Support; A10 = Review

models have been published in previous studies to predict the citation count of an article.[14,15,25] Accordingly, we know that it is important to predict future citations instead of requiring citations to slowly build over time.[15] Such models offer a way to evaluate the influence of recent work rather than waiting for years to know the blast spot. In our study, topic categories were classified by applying SNA with MeSH terms.[28] We found that the prediction model can provide us with information about which MeSH terms have higher weights (i.e., the prediction power) related to the article receiving the most citation counts. The correlation coefficient was 0.45 between the MeSH weights and citation counts in this PVBA100, revealing that MeSH terms were evident in prediction power on the number of article citations, similar to the findings in previous studies.[29–31]

4.2. The most cited article in PVBA100

According to the results of our study, the article with the greatest number of citations, "*Psoriasis Vulgaris Lesions Contain Discrete Populations of Th1 and Th17 T Cells*," authored by Dr. Lowes MA in 2008, received 276 citations in sum.[18] The high citation counts indicated that the article may be of interest to readers, may have helped generate new knowledge, and/or may be informative to pursue further academic achievements. The reason why it received the most citations may be caused by the sprout of the biologicals at that time period, which reflected the increased possibility of the development of highly effective therapies utilizing the inflammatory pathway responsible for the disease. The article mentioned the discovery of T helper 17 (Th17) cells in inflammation and autoimmunity in psoriasis, which challenged the conventional Th1–Th2 classification system,[5] thereby promoting a cascade of novel biological agents.[6,7,32–34]

4.3. The findings from the PVBA100

In this study, a total of 912 abstracts were identified from the PubMed database, searching the keywords "Psoriasis Vulgaris and biological agents" from 1991 to 2020. We particularly
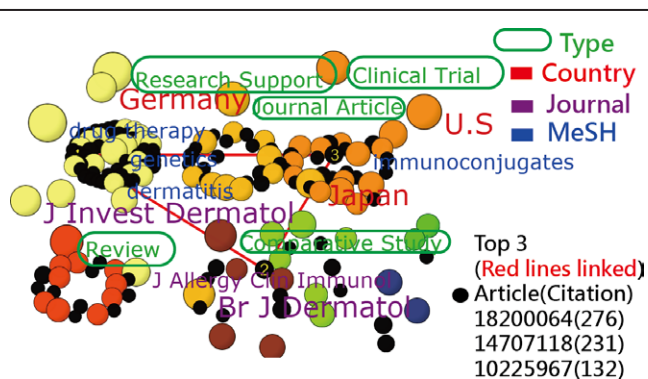
Figure 3. Top three entities among different variables. Note: Seven article types are clustered by different colors of bubbles in the picture. Different variables, including author-affiliated countries (red words), journals (purple words), article types (green words), and topic categories with MeSH terms (blue words), are all integrated into a picture demonstrated using social network analysis and laid on Google Maps. The top three most cited articles are emphasized by the red triangular lines. The article PMID and the citations are shown in the bottom-right corner.

listed PVBA100[16], which was ranked by the number of article citations.

Four tasks were achieved and illustrated below:

(1) The top three most frequent article types were research support, journal articles, and clinical trials;
(2) The most dominant article categories were drug therapy, genetics, and immunoconjugates;
(3) The most productive countries were the United States, followed by Germany and Japan;
(4) The journals with the most articles were the *British Journal of Dermatology* and *Journal of Investigative Dermatology,* but the journal *J Invest Dermatol* earned many more citations and associations in the PVBA100 network, as shown in Figure 4.

4.4. The unique feature of using the Sankey diagram in this study

Social network analysis (SNA) was commonly applied in previous studies,[17,35,36] but there was no research, except for the one,[37] integrated different entities into SNA, such as author-affiliated nations, journals, article types, and topic categories with

MeSH terms, and then displayed the dominant ones onto the Sankey diagram[20] while searching the string of "social network analysis network" and "Sankey diagram" in PubMed database thus far.

Second, this research was distinctly different from others in the literature by (1) applying SNA to cluster entities and (2) highlighting the dominant entities using visual representations laid on Google Maps. If the entity bubble is clicked on the article of interest, the abstract will immediately appear on PubMed and allow the readers to examine the details of the article. This animated dashboard has also been used in applications in other scientific fields to demonstrate entity characteristics in networks.[17,35,36] It is worth further providing knowledge and information for the readership to the Sankey diagram[31,38,39] in the future.

Third, the "MeSH term" was extracted from the major MeSH terms highlighted by the asterisk (*) in each article, and "drug therapy" was analyzed to be the most dominant topic category according to our results. It is necessary to further subdivide "drug therapy" into four types of biological agents, including "anti-TNF-α," "anti-IL-12," "anti-IL-17," and "anti-IL-23 agents".[6] Etanercept, biologics approved by the FDA in 2004 for the treatment of psoriasis, followed by more TNF-α antagonists.[6,7,40] In theory, TNF-α antagonist should be the most discussable subtype in the topic category of "drug therapy," since it developed earliest in these four biological agents. It is worth investigating which subtype in drug therapy could earn the most citation counts in the future.

4.5. Strengths and limitations

One distinct strength of our study is to cluster different variables into one picture (or diagram) by SNA displayed on Google Maps, which highlighted the most dominant entities in which we are interested. Readers can manipulate the links to better understand the association between the entities we are concerned about in this study. In addition, using MeSH terms to predict the number of article citations is a useful feature to identify the most dominant topic category in the field of PVBA, which helps future academic pursuits in the dermatologic field. The research approach used in this study may have the potential to be applied to other topics, not just limited to the topic of PVBA.

Furthermore, the selection of top-cited articles essentially comes from the contribution made by the insights of the editorial boards (e.g., *J Invest Dermatol*, *J Exp Med*, and *J Clin Invest* shown in PVBA100 [16]). MeSH terms that were provided in Figure 5 can be a reference and clue for readers and the
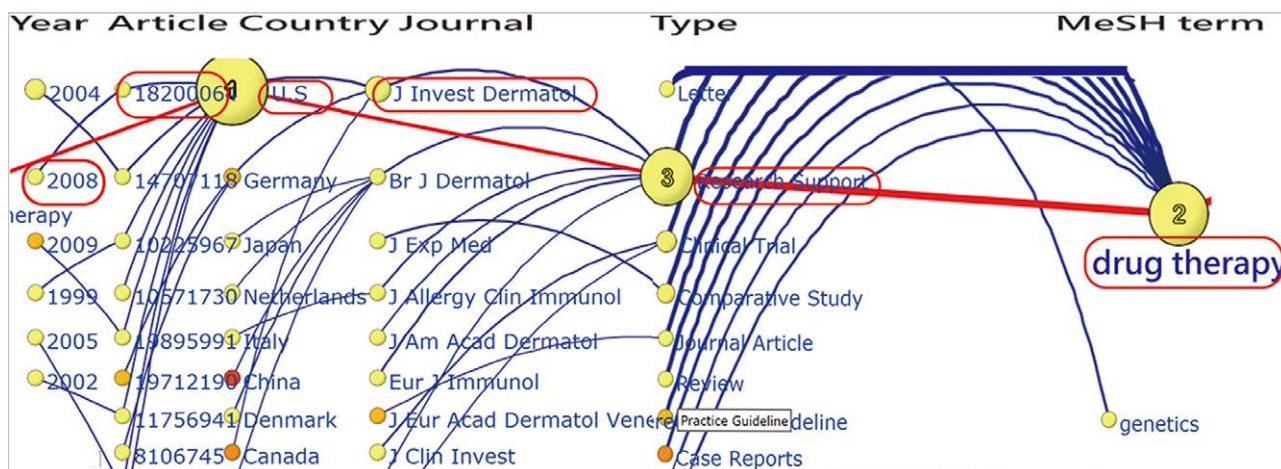

Figure 4. The association of the top dominant entities is shown in the Sankey diagram. Note: Each entity is directly connected by solid lines. We can examine them from the left to right sides, such as water flow in tunnels. The closed association between two entities is easily seen by observing the wider blue lines. The three red lines represent the top three with higher centrality degrees in the social network.
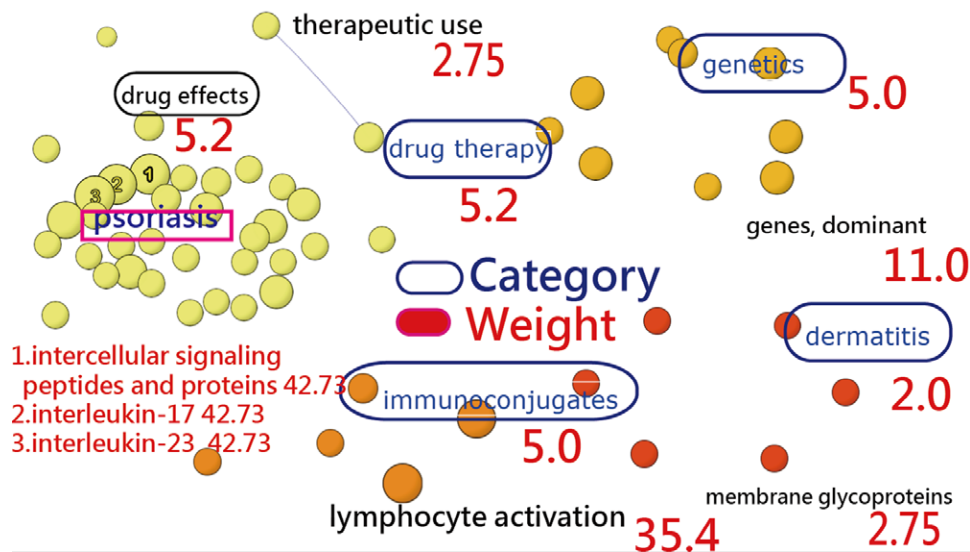
Figure 5. MeSH clusters and MeSH weighted citations. Four topic categories with MeSH terms were clustered by different colors with larger bubbles and blue captions. The MeSH weighted impact factors were calculated and are presented in red font.
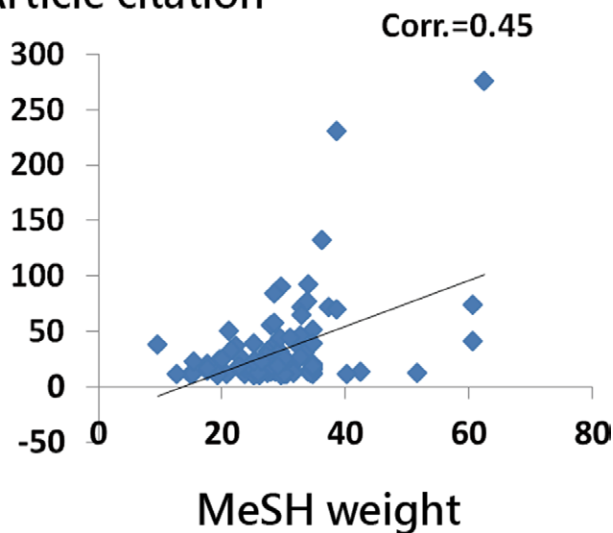

Figure 6. Using MeSH terms to predict article citations. Note. The 100 top-cited articles are demonstrated in the linear regression, with the x-axis representing the weight of MeSH terms and the y-axis representing the article citation. The regression equation is defined as $y = -0.01700 + 1.1155 \times x$. The correlation coefficient (CC) is 0.45, which was statistically significant (F=28.04, P<.001). It is very obvious that MeSH in the model is collinear with the number of article citations.

Using MeSH terms to predict the future citation count based on PVBA100 might have some limitations, and more factors should be considered to reach a more valid prediction.

Third, there are numerous indicators available to identify the influence of research, including paper citation counts, author *h-index*,[44,45] and journal impact factor.[15] Citation counts, which were the simplest and the most direct in these indicators, were applied in our study to represent the importance of a paper.[15] The result of the prediction power might be different if other indicators were used.

5. Conclusions

This study made a breakthrough by developing a dashboard showing the overall knowledge concept of PVBA100 regarding PVBA. MeSH terms were also found to be available for predicting article citations on PVBA. As a result, researchers will be able to produce effective research on visualization technology, improve the efficiency of research work, and provide deeper insights into the relationships among the features of their research achievements. These visualizations regarding PVBA100 could help future academic pursuits and applications in other academic disciplines in the dermatologic field.

Acknowledgments

Author contributions

CH developed the study concept and design. TW and YC analyzed and interpreted the data. FJ monitored the process of this study and helped respond to the reviewers' advice and comments. WC drafted the manuscript, and all authors provided critical revisions for important intellectual content. The study was supervised by FJ. All authors read and approved the final manuscript.

editorial boards to conduct or publish articles with potentially higher citations in the future.

However, there are still some limitations to this study. First, the database was exclusively extracted from PubMed. The results of the most frequent article types and topic categories might be different if the articles were applied from other major citation databases, such as Scopus or EMBASE.

Second, there are numerous extrinsic factors that might influence the number of article citations, such as journal impact factors, authors' achievements, or even publication time.[4,15,41] The number of article citations requires the accumulation of time.[15,42,43] The citation count may be higher if there is a longer duration since publication, as there are more readers.

References

[1] Rendon A, Schäkel K. Psoriasis pathogenesis and treatment. Int J Mol Sci. 2019;20:1475.

[2] Michalek IM, Loring B, John SM. A systematic review of worldwide epidemiology of psoriasis. J Eur Acad Dermatol Venereol. 2017;31:205–12.

[3] Gisondi P, Del Giglio M, Girolomoni G. Treatment approaches to moderate to severe Psoriasis. Int J Mol Sci. 2017;18:2427.

[4] Kim WB, Jerome D, Yeung J. Diagnosis and management of psoriasis. Can Fam Physician. 2017;63:278–85.

[5] Aggarwal S, Ghilardi N, Xie MH, et al. Interleukin-23 promotes a distinct CD4 T cell activation state characterized by the production of interleukin-17. J Biol Chem. 2003;278:1910–4.

[6] Hawkes JE, Yan BY, Chan TC, et al. Discovery of the IL-23/IL-17 signaling pathway and the treatment of psoriasis. J Immunol. 2018;201:1605–13.

[7] Rønholt K, Iversen L. Old and new biological therapies for psoriasis. Int J Mol Sci . 2017;18:2297.

[8] Iftikhar PM, Ali F, Faisaluddin M, et al. A bibliometric analysis of the top 30 most-cited articles in gestational diabetes mellitus literature (1946-2019). Cureus. 2019;11:e4131.

[9] Wang Y, Zhang H, Fang R, et al. The top 100 most cited articles in rosacea: a bibliometric analysis. J Eur Acad Dermatol Venereol. n/a(n/a).

[10] Ho Y-S. A bibliometric analysis of highly cited articles in materials science. Current Sci. 2014;107:1565–72.

[11] Yadava SM, Patrick HS, Ananth CV, et al. Top-cited articles in the journal: a bibliometric analysis. Am J Obstet Gynecol. 2019;220:12–25.

[12] Bickers DR, Modlin RL. A review of the Journal of Investigative Dermatology's most cited publications over the past 25 years and the use of developing bibliometric methodologies to assess journal quality. J Investig Dermatol. 2012;132(3, Part 2):1050–60.

[13] Yuan JT, Aires DJ, DaCunha M, et al. The h-index for associate and full professors of dermatology in the United States: an epidemiologic study of scholastic production. Cutis. 2017;100:395–8.

[14] Fu LD, Aliferis C. Models for predicting and explaining citation count of biomedical articles. AMIA Annu Symp Proc. 2008;2008:222–6.

[15] Zhu, X.P, Ban Z, Citation count prediction based on academic network features, in 2018 IEEE 32nd international conference on advanced information networking and applications (AINA). 2018:534–541.

[16] Chien TW. The 100 top-cited in this study. Available at: http://www.healthup.org.tw/html100/psoriasis.htm. [Access November 11, 2021].

[17] Chien TW, Chang Y, Wang HY. Understanding the productive author who published papers in medicine using national health insurance database: a systematic review and meta-analysis. Med (Baltim). 2018;97:e9967.

[18] Lowes MA, Kikuchi T, Fuentes-Duculan J, et al. Psoriasis Vulgaris lesions contain discrete populations of Th1 and Th17 T cells. J Invest Dermatol. 2008;128:1207–11.

[19] Atenstaedt R. Word cloud analysis of the BJGP: 5 years on. Br J Gen Pract. 2017;67:231–2.

[20] Chien TW. Sankey diagram used for highlighting the dominant entities on a diagram. 2021/11/3. Available at: http://www.healthup.org.tw/gps/skinsankey.htm.

[21] Chien TW. Figure 3 in this study. Available at: http://www.healthup.org.tw/gps/skin2020a2.htm. [Access date October 1, 2022].

[22] Chien TW. Figure 4 in this study. Available at: http://www.healthup.org.tw/gps/skinsankey.htm. [Access date October 1, 2022].

[23] Chien TW. Figure 5 in this study. Available at: http://www.healthup.org.tw/gps/skin2020a.htm. [Access date October 1, 2022].

[24] Mingers J, Leydesdorff L. A review of theory and practice in scientometrics. Eur J Oper Res. 2015;246:1–19.

[25] Glänzel W, Moed HF, Journal impact measures in bibliometric research. Scientometrics. 2002;53:171–193.

[26] Lefaivre, KA, Shadgan B, O'Brien PJ. 100 most cited articles in orthopedic surgery. Clin Orthop Relat Res. 2011;469:1487–97.

[27] Park BS, Kim IH, Park KM. Top 100 cited articles on sleep medicine: a bibliometric analysis. Eur Neurol. 2020;83:111–20.

[28] Bai X, Zhang F, Lee I. Predicting the citations of scholarly paper. J Informetr. 2019;13:407–18.

[29] Yang TY, Chen CH, Chien TW, et al. Predicting the number of article citations on the topic of Pemphigus Vulgaris with the 100 top-cited articles since 2011: a protocol for systematic review and meta-analysis. Med (Baltim). 2021;100:e26806.

[30] Lin CH, Chien TW, Yan YH. Predicting the number of article citations in the field of attention-deficit/hyperactivity disorder (ADHD) with the 100 top-cited articles since 2014: a bibliometric analysis. Ann Gen Psychiatry. 2021;20:6.

[31] Liu PC, Lu Y, Lin HH, et al. Classification and citation analysis of the 100 top-cited articles on adult spinal deformity since 2011: a bibliometric analysis [published online ahead of print, 2021 Oct 25]. J Chin Med Assoc. 2021.

[32] Minguet F, Salgado TM, Santopadre C, et al. Redefining the pharmacology and pharmacy subject category in the journal citation reports using medical subject headings (MeSH). Int J Clin Pharm. 2017;39:989–97.

[33] Krueger, JG. The immunologic basis for the treatment of psoriasis with new biologic agents. J Am Acad Dermatol. 2002;46:1–23; quiz 23-6.

[34] Marinoni B, Ceribelli A, Massarotti MS, et al. The Th17 axis in psoriatic disease: pathogenetic and therapeutic implications. Auto Immun Highlights. 2014;5:9–19.

[35] Chien TW, Wang HY, Chang Y, et al. Using Google Maps to display the pattern of coauthor collaborations on the topic of schizophrenia: a systematic review between 1937 and 2017. Schizophr Res. 2019;204:206–13.

[36] Chien TW, Wang HY, Kan WC, et al. Whether article types of a scholarly journal are different in cited metrics using cluster analysis of MeSH terms to display: a bibliometric analysis. Med (Baltim). 2019;98:e17631.

[37] Kuo YC, Chien TW, Kuo SC, et al. Predicting article citations using data of 100 top-cited publications in the journal medicine since 2011: a bibliometric analysis. Med (Baltim). 2020;99:e22885.

[38] Lamer A, Laurent G, Pelayo S, et al. exploring patient path through Sankey diagram: a proof of concept. Stud Health Technol Inform. 2020;270:218–22.

[39] Mica L, Niggli C, Bak P, et al. Development of a visual analytics tool for polytrauma patients: proof of concept for a new assessment tool using a multiple layer Sankey diagram in a single-center database. World J Surg. 2020;44:764–72.

[40] Strober BE, Menon K. Alefacept for the treatment of psoriasis and other dermatologic diseases. Dermatol Ther. 2007;20:270–6.

[41] Chien TW, Chow JC, Chang Y, et al. Applying Gini coefficient to evaluate the author research domains associated with the ordering of author names: a bibliometric study. Med (Baltim). 2018;97:e12418.

[42] Tahamtan I, Safipour Afshar A, Ahamdzadeh K. Factors affecting number of citations: a comprehensive review of the literature. Scientometrics. 2016;107:1195–225.

[43] Yaminfirooz M, Ardali FR. Identifying the factors affecting papers' citability in the field of medicine: an evidence-based approach using 200 highly and lowly cited papers. Acta Inform Med. 2018;26:10–4.

[44] Hirsch JE. An index to quantify an individual's scientific research output. Proc Natl Acad Sci USA. 2005;98:16569–72.

[45] Bayramlar H, Uslu H, Bayramlar OF, et al. Comparison of the h-indices of the editorial board members of seven ophthalmic subspecialty journals. J Fr Ophtalmol. 2019;42:349–53.