Original Article

Trends and frontiers of research on pharmacoeconomics from 2012–2021: a scientometric analysis

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Background: Research on pharmacoeconomics (PE) promotes the rational allocation of medical resources, which has received attention in the last decade. We conducted a scientometric analysis of PE to determine the current status and frontiers, and promote cooperation and development.

Methods: The Web of Science Core Collection-Science Citation Index Expanded was adopted to retrieve publications associated with PE from 2012–2021. After screening publications, CiteSpace 3.8.R3 was used to conduct a scientometric analysis. We analyzed terms, including publications and citations, countries/regions, institutions, journals, authors, keywords, and references.

Results: In total, 4,715 documents published from 2012–2021 were included in this study, of which 3,829 were articles and 886 were reviews. The documents were cited 54,596 times, at an average of 11.58 times per document. 121 countries/regions and 410 institutions were involved. The top 3 countries/regions by the number of publications were the United States of America (n=1,790), England (n=601), and China (n=403), while the institution with the most publications was Pfizer. *Pharmacoeconomics* was the main journal of PE, with 310 publications in all, and the top 3 cited journals were *New England Journal of Medicine* (citation times =1,620), *Value in Health* (citation times =1,306), and *Lancet* (citation times =1,255). Bin Wu was the most productive author (n=16), while World Health Organization was the most influential author (citation times =387). 524 keywords altogether were found, and the top 3 keywords by frequency were therapy (frequency =318), impact (frequency =305), and cost-effectiveness (frequency =296). The keyword "modifying antirheumatic drug" associated with rheumatoid arthritis (RA) has continued bursting from 2016–2021. *Guide to the methods of technology appraisal 2013* by the National Institute for Health and Care Excellence, was the most frequently cited publication on PE (citation times =65). Cluster 0 labeled as "cost-effectiveness analysis" (CEA) was the largest and latest cluster, and its citing articles focused on the CEA of first-line treatment for non-small cell lung cancer (NSCLC).

Conclusions: The economic analysis of disease-modifying antirheumatic drugs related to RA was a popular topic in the last 6 years, and CEA of NSCLC first-line treatment was at the frontier of PE.

Keywords: Pharmacoeconomics (PE); scientometrics; rheumatoid arthritis (RA); non-small cell lung cancer (NSCLC); modifying antirheumatic drug

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Introduction

Pharmacoeconomics (PE), is a subdiscipline of health economics that studies the costs and benefits of drug therapy (1). PE research of various diseases can promote the rational distribution of medical resources and reduce waste (2). Currently, more than 40 guidelines have been published worldwide that refer to PE, including guidelines on pharmacoeconomic analysis methods, outcome indicators, and costing methods (2,3).

Scientometric analysis, often in combination with visualization maps, aims to quantitatively study scientific fields based on bibliometric analysis, while bibliometric analysis gives quantitative summaries of publications (4). Scientometric analysis has been applied in various areas, such as health care and nanotechnology (5-7). Given the attention paid to PE, relevant studies have accumulated in the last decade. However, existing scientometric or bibliometric analyses either focused on studies before 2012 or concentrated on the period from inception of databases to 2020 without sub-analyses of specific periods, both of which lack of latest information on PE (8,9). Hence, we aimed to conduct a scientometric analysis of PE in the last decade to present the current situation, and identify recent hotspots and trends to provide a reference for further cooperation and development in this field.

Methods

Data source and searching strategy

We searched for and retrieved PE-related documents published from 2012 to November 2021 in the Web of Science Core Collection-Science Citation Index Expanded (WoSCC-SCIE) database. The search strategy and screening process are shown in *Figure 1*. Search terms, such as "economic" and "cost," were adopted to retrieve economic studies, categories were limited to "Pharmacology Pharmacy" to exclude studies unrelated to pharmacy, and the document type was refined to "articles" (original works) or "review articles" (reviews) to improve the accuracy of the results.

Scientometric and statistical analysis

CiteSpace is a scientometric analysis tool developed by Professor Chao-Mei Chen of Drexel University, which can perform a comprehensive bibliometric analysis of the literature from WoSCC-SCIE (5,10). CiteSpace 5.8.R3 was used in this study. We presented the annual publications and citations by Web of Science. We used CiteSpace to analyze the distribution of countries/regions and institutions, the number of journals and cited journals, the productive authors and influential authors, the frequency of keywords, and the co-citation situation of the references. A burst detection of keywords was conducted to identify hotspots in different periods, and a cluster analysis of references was conducted to identify possible trends. The results are presented in tables and network maps. All variables were shown as numbers in this statistical descriptive analysis, and no statistical inference was conducted.

The functional parameters of CiteSpace were adjusted according to the data. In the CiteSpace network map, a node represented a field type (e.g., an author). The node size reflected the occurrence frequency or cited times of a field. Each link represented the connection relationship between the fields. The color, ranging from dark to light, on the map indicated the year from far to near. Centrality was a measure of the degree to which a node was connected to other nodes, and a value >0.1 indicated a hub node in the network. Burst detection was used to identify nodes with an instant increase in frequency in a specific period, which represented the focus or hotspots of that period (5,11).

Results

Annual publications and citations

A total of 4,715 documents were retrieved, including 3,829 (81.21%) articles and 886 (18.79%) reviews. Additionally, there were 45,831 citing articles, 54,596 cited times, and 11.58 citation times per publication. The annual number of publications and citations of PE from 2012 to 2021 are shown in *Figure 2*. From 2012 to 2021, the number of literature citations increased annually, and the highest number of articles (i.e., 10,787 citations) were cited in 2020, a figure about 51 times that of 2012. The number of literature publications on PE fluctuated each year. The fewest articles (i.e., 367 publications) were published in 2013, and the most articles (i.e., 597) were published in 2019, a figure about 1.6 times that of 2013.

Countries/regions and institutions

One hundred twenty-one countries/regions and 410 institutions were involved in PE research, and the top 10 countries/regions and institutions by the number of

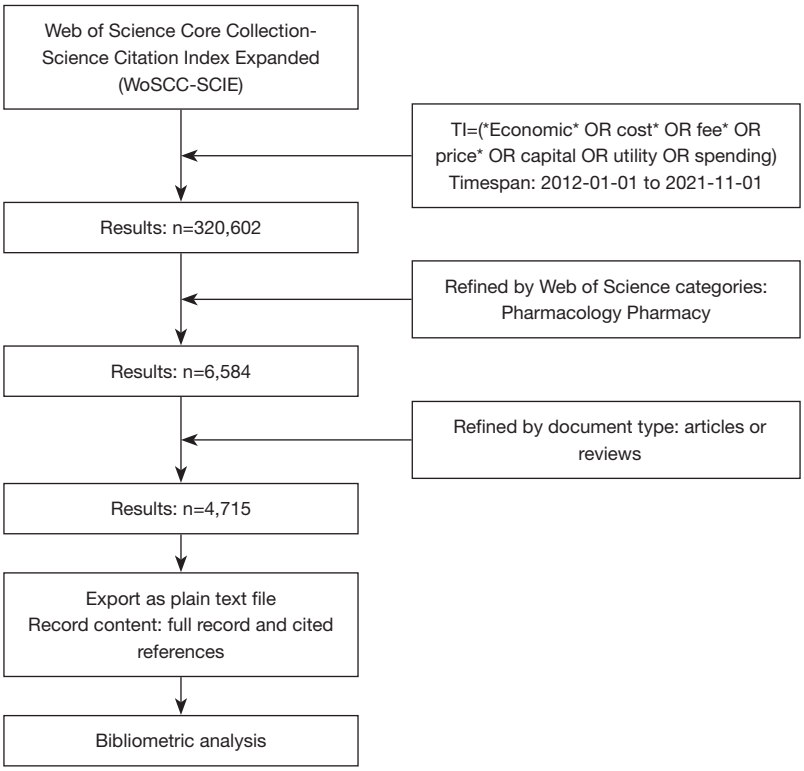

Figure 1 Flowchart for searching and exporting publications associated with PE. *, a wildcard which represented any group of characters or no character in the searching strategy. TI, title; PE, pharmacoeconomics.

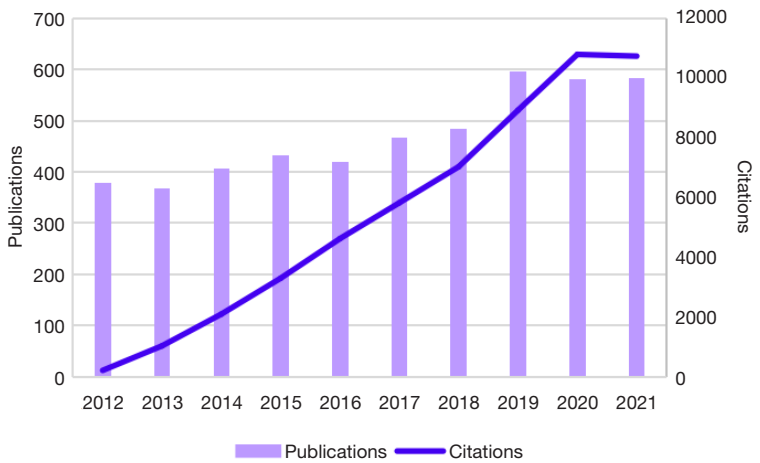

Figure 2 Annual publications and citations for PE in the period 2012–2021. PE, pharmacoeconomics.

publications from 2012–2021 are shown in *Tables 1,2*. The top 3 countries/regions by the number of publications were the United States of America (USA; n=1,790), England (n=601), and China (n=403). The top 3 countries/regions by centrality were Saudi Arabia (centrality =0.82), the Czech Republic (centrality =0.72), and Israel (centrality =0.55). The country collaboration network map shows little collaboration among the top 10 countries/regions in terms of the number of articles (see *Figure 3*). Pfizer was the institution with the highest number of publications (n=63).

Table 1 The top 10 countries/regions by the number of publications and by centrality on PE

No.	Country/Region	Publication	Country/Region	Centrality
1	USA	1,790	Saudi Arabia	0.82
2	England	601	Czech Republic	0.72
3	China	403	Israel	0.55
4	Canada	271	Iraq	0.37
5	Netherlands	246	Jordan	0.35
6	Germany	228	Argentina	0.3
7	Italy	220	Ghana	0.27
8	Australia	218	Bangladesh	0.24
9	Spain	199	Malaysia	0.21
10	France	185	Croatia	0.2

PE, pharmacoeconomics.

Table 2 Top 10 institutions by the number of publications and by centrality on PE

No.	Institution	Publication	Institution	Centrality
1	Pfizer (USA)	63	Sanofi (UK)	0.29
2	Anal Grp Inc (USA)	62	Eli Lilly & Co (USA)	0.28
3	Novartis Pharmaceut (Switzerland)	57	Amgen Inc (USA)	0.25
4	Erasmus Univ (Netherlands)	52	Express Scripts (USA)	0.17
5	Amgen Inc (USA)	52	Evidera (USA)	0.16
6	Univ Washington (USA)	52	Univ Utrecht (Netherlands)	0.13
7	Univ Toronto (Canada)	51	China Pharmaceut Univ (China)	0.13
8	Univ York (USA)	48	Bristol Myers Squibb (USA)	0.12
9	Bristol Myers Squibb (USA)	48	Rutgers State Univ (USA)	0.12
10	Univ Groningen (Netherlands)	47	Monash Univ (Australia)	0.11

PE, pharmacoeconomics.

In terms of centrality, the top 3 institutions were Sanofi (centrality =0.29), Eli Lilly and Co (centrality =0.28), and Amgen Inc (centrality =0.25). The map of the institutional collaboration network is shown in *Figure 4*.

Journals and cited journals

In total, 276 journals and 107 cited journals were included in the study, and the top 10 journals and cited journals are set out in *Table 3*. *Pharmacoeconomics* was the leading journal of PE with 578 published articles from 2012–2021, followed by *Expert Review of Pharmacoeconomics Outcomes Research* (n=468), and *Journal of Managed Care Specialty Pharmacy* (n=310). The most-cited journal was *New England Journal of Medicine* (citation times =1,620), followed by *Value in Health* (citation times =1,306), and *Lancet* (citation times =1,255). The top 3 cited journals by centrality were *PLoS One* (centrality =0.46), *New England Journal of Medicine* (centrality =0.22), and *Pharmacoeconomics* (centrality =0.2). The cited journal network map is shown in *Figure 5*.

Authors and cited authors

A total of 526 authors published articles associated with PE

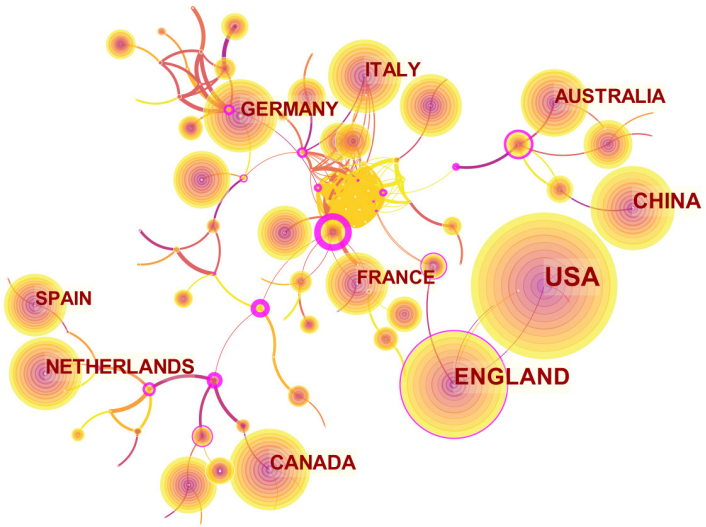

Figure 3 Network map of countries/regions publishing articles on PE. PE, pharmacoeconomics.

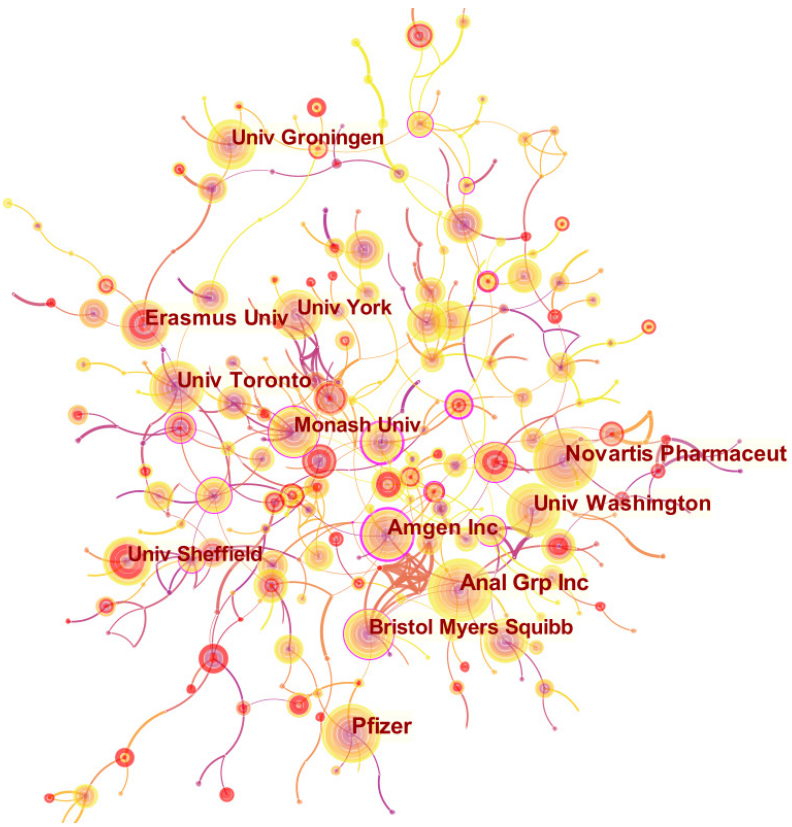

Figure 4 Network map of institutions publishing articles on PE. PE, pharmacoeconomics.

Table 3 The top 10 journals and cited journals for PE

No.	Journal	Publication	Cited journal	Citation times
1	*Pharmacoeconomics*	578	*New England Journal of Medicine*	1,620
2	*Expert Review of Pharmacoeconomics Outcomes Research*	468	*Value in Health*	1,306
3	*Journal of Managed Care Specialty Pharmacy*	310	*Lancet*	1,255
4	*Clinical Therapeutics*	183	*Pharmacoeconomics*	1,188
5	*Advances in Therapy*	170	*PLoS One*	1,153
6	*Frontiers in Pharmacology*	108	*Jama-Journal of the American Medical Association*	1,101
7	*Clinical Drug Investigation*	107	*Annals of Internal Medicine*	690
8	*Journal of Antimicrobial Chemotherapy*	63	*BMJ-British Medical Journal*	655
9	*Antimicrobial Agents and Chemotherapy*	55	*Journal of Medical Economics*	644
10	*American Journal of Health System Pharmacy*	53	*Current Medical Research and Opinion*	582

PE, pharmacoeconomics.

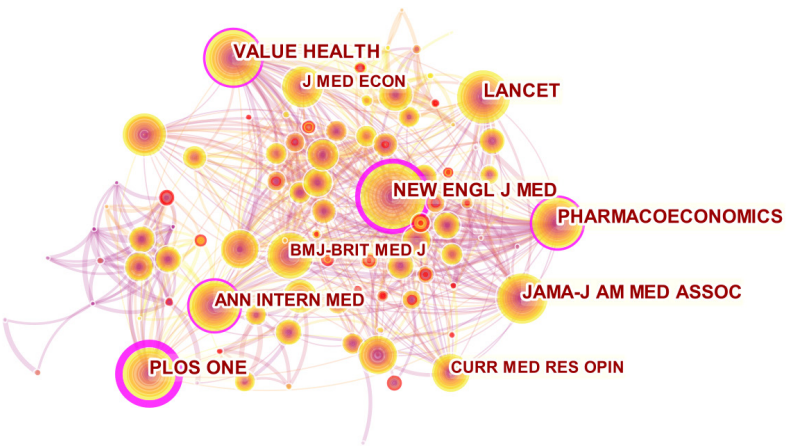

Figure 5 Network map of cited journals for PE. PE, pharmacoeconomics. *New Engl J Med*, *New England Journal of Medicine; Value Health*, *Value in Health; Jama-J Am Med Assoc*, *Jama-Journal of The American Medical Association; Ann Intern Med*, *Annals of Internal Medicine; Bmj-Brit Med J*, *BMJ-British Medical Journal; J Med Econ*, *Journal of Medical Economics; Curr Med Res Opin*, *Current Medical Research and Opinion*.

from 2012 to 2021, among whom Bin Wu published the most (n=16), followed by Postma, Liew, and Tan (n=13) (see *Table 4*). The top 3 cited authors were World Health Organization (WHO; citation times =387), Briggs (citation times =195), and Husereau (citation times =179). The network of the cited authors is shown in *Figure 6*.

Keywords

A total of 524 keywords were found. The top 10 keywords in terms of frequency and centrality are shown in *Table 5*, and the keyword co-occurrence network map is shown in *Figure 7*. The top 3 keywords by frequency were therapy (frequency =318), impact (frequency =305), and cost-effectiveness (frequency =296). A cost-effectiveness analysis (CEA) is a commonly used analysis method in PE. The keyword with the highest centrality was health care cost (centrality =0.2), which connects various aspects of PE research.

The burst detection revealed 13 keywords with strong

Table 4 Top 10 authors and cited authors contributing to articles on PE

No.	Author	Publication	Cited Author	Citation times
1	Bin Wu	16	World Health Organization	387
2	Maarten J Postma	13	Briggs A	195
3	Danny Liew	13	Husereau D	179
4	Chongqing Tan	13	National Institute for Health and Care Excellence	155
5	Lieven Annemans	12	Moher D	152
6	Eric Q Wu	12	Neumann PJ	144
7	Barnaby Hunt	11	Drummond MF	141
8	Samuel Coenen	10	Briggs AH	133
9	Xiaohui Zeng	10	Stoddart G	126
10	Robin Bruyndonckx	10	Drummond M	122

PE, pharmacoeconomics.

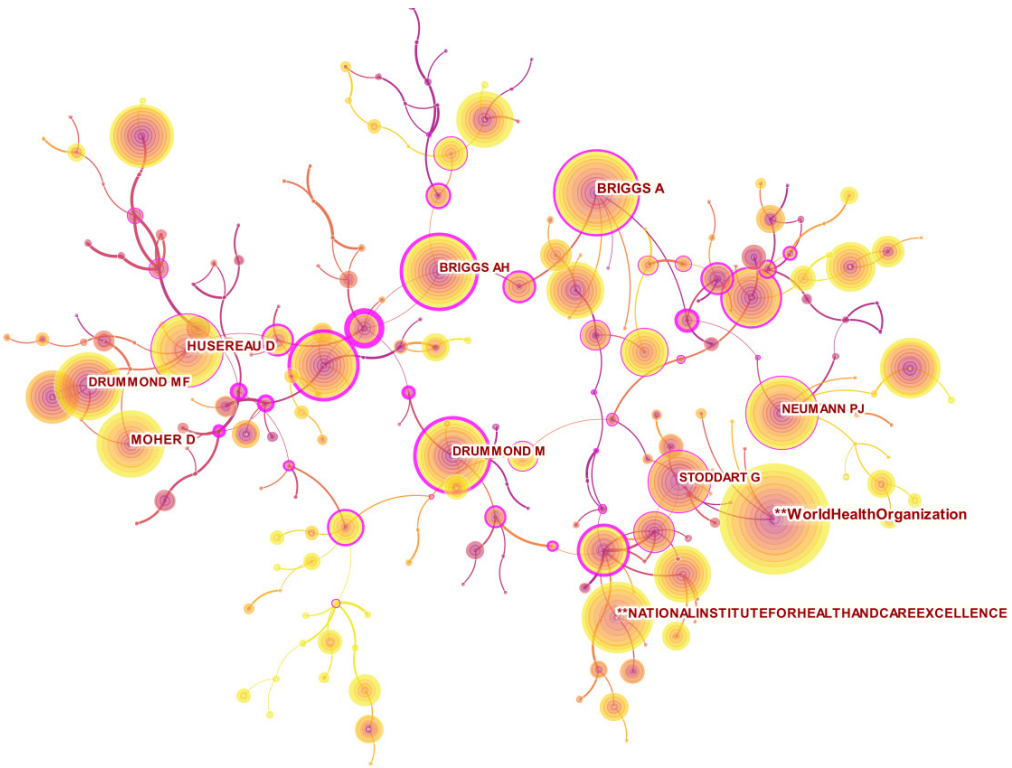

Figure 6 Network map of cited authors for PE. PE, pharmacoeconomics. **, an institution as a cited author instead of an individual.

frequency bursts (see *Table 6*). From 2012 to 2015, the burst keywords were stroke, placebo, coronary heart disease, overweight, antiretroviral therapy, pharmacology, and controlled trial. From 2014 to 2019, the burst keywords were oral anticoagulant, expenditure, uncertainty, state, and length of stay. The burst keyword that continued until 2021 was "modifying antirheumatic drug", which suggests that this has been a popular topic in PE research recently.

Table 5 Top 10 keywords by frequency and by centrality on PE from 2012–2021

No.	Keyword	Frequency	Keyword	Centrality
1	Therapy	318	Health care cost	0.2
2	Impact	305	Predictor	0.19
3	Cost-Effectiveness	296	Rheumatoid arthritis	0.15
4	Management	277	Inhibition	0.15
5	Quality Of Life	268	Inhibitor	0.15
6	Care	246	Growth	0.14
7	Cost	246	Mutation	0.14
8	Risk	221	Recipient	0.13
9	Economic Evaluation	193	Cardiovascular disease	0.12
10	Prevalence	193	Prophylaxi	0.11

PE, pharmacoeconomics.

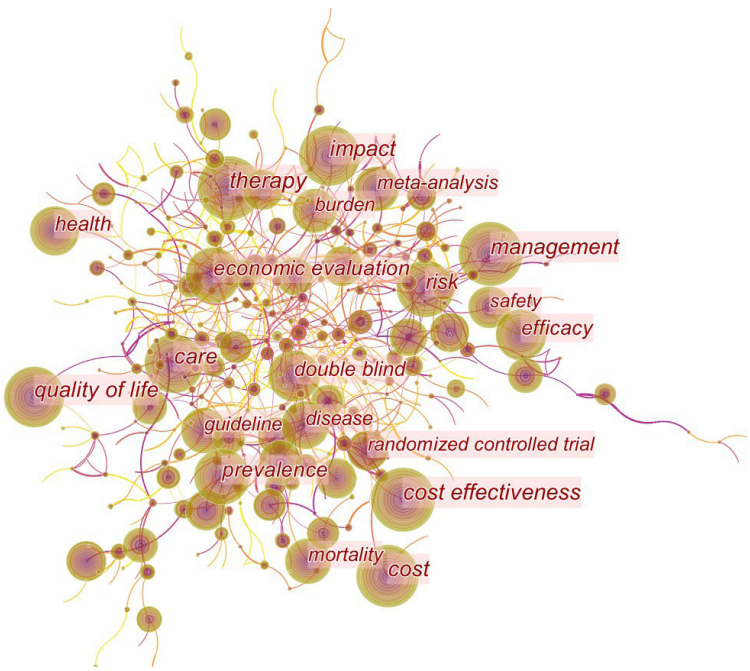

Figure 7 Network map of keywords on PE. PE, pharmacoeconomics.

References

A co-cited reference analysis is an analysis of the ensemble of publications that are co-cited by a portion of articles (11). The top 10 most-cited articles in the co-cited analysis are shown in *Table* 7, with *Guide to the methods of technology appraisal 2013* published by the National Institute for Health and Care Excellence (NICE) having the highest citation frequency (n=65). A cluster analysis was conducted, and 8 clusters were revealed, as seen in *Figure 8*. Cluster 0 was the largest (size =32) and the latest cluster (mean year =2018) and was labeled "cost-effectiveness"——a word abstracted from literature titles.

Table 6 Top 13 keywords with the strong frequency bursts. Every colorful short line in the table represented a year. The red line denoted frequency bursts of the corresponding keyword in that year while the green line didn't

Keywords	Year	Strength	Begin	End	2012–2021
Stroke	2012	5.1	2012	2015	
Placebo	2012	3.5	2012	2015	
Coronary heart disease	2012	3.38	2012	2015	
Overweight	2012	3.28	2012	2015	
Antiretroviral therapy	2012	2.95	2012	2015	
Pharmacology	2012	2.62	2012	2015	
Controlled trial	2012	2.43	2012	2015	
Oral anticoagulant	2012	2.96	2014	2017	
Expenditure	2012	2.76	2014	2018	
Uncertainty	2012	3.82	2015	2018	
State	2012	3.37	2015	2018	
Length of stay	2012	5.75	2016	2019	
Modifying antirheumatic drug	2012	3.17	2016	2021	

Table 7 Top 10 cited references by frequency on PE

No.	Author	Year	Title	Frequency	Burst	Centrality	Source
1	NICE	2013	Guide to the methods of technology appraisal 2013	65	17.76	0.12	*Guide to the Methods of Technology Appraisal*
2	Sanders GD	2016	Recommendations for conduct, methodological practices, and reporting of cost-effectiveness Analyses: Second panel on cost-effectiveness in health and medicine	63	14.15	0.05	*Jama-Journal of the American Medical Association*
3	Neumann PJ	2014	Updating cost-effectiveness—the curious resilience of the $50000-per-QALY threshold	39	9.59	0.4	*New England Journal of Medicine*
4	Vemer P	2016	AdViSHE: A Validation-Assessment Tool of Health-Economic Models for Decision Makers and Model Users	35	6.87	0.11	*Pharmacoeconomics*
5	Patel MR	2011	Rivaroxaban versus warfarin in non-valvular atrial fibrillation	29	10.85	0.09	*New England Journal of Medicine*
6	Husereau D	2013	Consolidated Health-Economic Evaluation Reporting Standards (CHEERS)—Explanation and elaboration: A report of the ISPOR Health-Economic Evaluation Publication Guidelines Good Reporting Practices Task Force	29	8.91	0	*Value in Health*
7	Bray F	2018	Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries	27	–	0.01	*CA-A Cancer Journal for Clinicians*
8	Drummond M	2015	Methods for the economic evaluation of health-care programs	26	10.51	0.11	*Methods for the Economic Evaluation of Health Care Programmes*
9	Yang WY	2018	Economic costs of diabetes in the US in 2017	23	8.29	0.02	*Diabetes Care*
10	Briggs AH	2012	Model parameter estimation and uncertainty: A report of the ISPOR-SMDM Modeling Good Research Practices Task Force—6	23	7.63	0.23	*Value in Health*

PE, pharmacoeconomics; NICE, the National Institute for Health and Care Excellence.

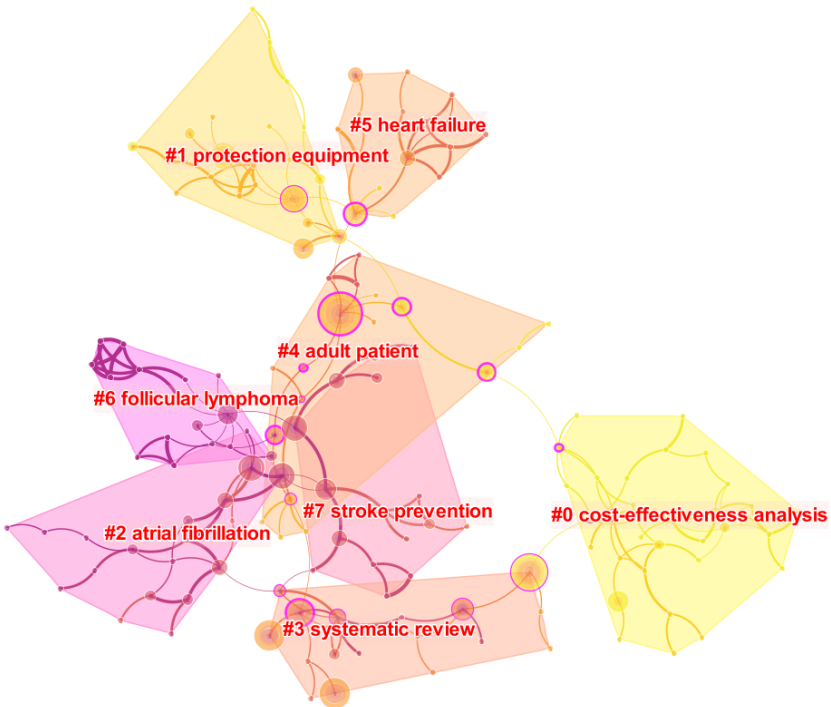

Figure 8 Cluster view of cited references on PE. PE, pharmacoeconomics. #, a cluster.

Discussion

General information

This study used CiteSpace to conduct a scientometric analysis of research on PE in the last decade. A total of 4,715 publications were included in this analysis, and the number of annual citations of PE articles increased year by year. Indeed, in 2020, the number of annual citations of PE articles was approximately 51 times that of 2012. However, the number of publications fluctuated every year, reaching a maximum of 597 in 2019, a figure 1.6 times that of 2013. The country/region with the most publications in PE was the USA, and 6 of the top 10 institutions for PE by the number of publications were also located in the USA. China ranked 3rd in terms of the number of published articles on PE, and was the only developing country among the top 10 countries/regions. *Pharmacoeconomics* was the main journal publishing PE articles. Bin Wu was the most productive author on PE, while WHO received the most attention and citations.

The keyword analysis revealed that the burst keyword phrase, "modifying antirheumatic drug," was popular from 2016 to 2021, appeared to be the research focus of the last 6 years, and was possible to last its burst in the short term. The clustering of references revealed that cluster 0, which was labeled "cost-effectiveness", represented the largest and latest cluster, and the citing articles from this cluster indicated CEAs of first-line non-small cell lung cancer (NSCLC) regimens, including atezolizumab and nivolumab, should be at the frontier of PE research. We would discuss the recent research hotspot and frontier by reviewing the top 5 citing articles for "modifying antirheumatic drug" by reference to the citations and the top 5 citing publications of cluster 0 by reference to the coverage nodes in more detail below.

RA and DMARDs

With 460 people per 100,000 worldwide suffering from rheumatoid arthritis (RA), the costs of RA and disease-modifying antirheumatic drugs (DMARDs) are a concern (12). In 2017, Schmier *et al.* modeled the cost of providing infusion therapy for RA in a hospital infusion center with case drugs, including abatacept, tocilizumab, infliximab, or rituximab, and found that biologics accounted for the largest share of costs (i.e., 87% to 91% of the total annual costs) and were the highest single cost associated with infusion care in RA (13). A study funded by Sanofi and

Regeneron Pharmaceutical in 2017 compared treatment persistence, cost, and cost per persistent patient among the mechanism of action (MOA) switchers versus tumor necrosis factor inhibitor (TNFi) cyclers after RA patients failed in primary TNFi treatment (14) and found that MOA switching was associated with higher treatment persistence and lower health-care costs than TNFi cycling, which suggested that the reimbursement policy of cycling TNFi before switching MOA might be suboptimal for patients and payers.

In 2018, Fazal *et al*. reviewed several prescribed DMARDs that targeted RA pathophysiology and made significant contributions to improving the disease outcomes, including synthetic and biological DMARDs, and discussed the global economic burden of RA (15). In 2018, a study that comparatively analyzed the prices of biologics for RA treatment in 17 European countries suggested that the introduction of biosimilars in national markets would result in a significant reduction in the reimbursement prices paid by public funds and facilitate public access to biological therapy, but the price reductions upon market entry of biosimilars would be less pronounced than those of commodity generics (16). Shafrin *et al.* investigated the economic burden of anti-citrullinated protein antibody (ACPA)-positive patients with RA and showed that, compared with ACPA-negative patients, positive patients were more likely to use conventional (71.2% *vs.* 49.6%; P<0.001) or biologic (20.3% *vs.* 11.8%; P<0.001) DMARDs, with higher total annual RA-related expenditures in ACPA-positive patients (Δ=$2,698; P=0.002), and higher DMARD overall expenditures (Δ=$1743; P=0.001) (17).

CEA in NSCLC

Lung cancer ranked 2nd in the total number of cancer cases worldwide in 2020, with approximately 2.21 million cases (18). NSCLC is a common type of lung cancer and accounts for about 85% of all types of lung cancer (19). CEAs of NSCLC therapeutics have been the focus of recent PE studies, dominated by CEAs of first-line regimens, including atezolizumab and nivolumab.

In 2021, Peng *et al.* evaluated the cost-effectiveness of treatment with atezolizumab, a first-line treatment for metastatic NSCLC with high programmed death-ligand 1 expression, based on a USA payer perspective, and found that compared to platinum-based chemotherapy, atezolizumab yielded an additional 1.32 quality-adjusted life years (QALYs) [2.08 life years (LYs)] with an incremental cost of US$224,590, and the probability of atezolizumab being cost-effective at the willingness-to-pay (WTP) thresholds of $100,000/QALY and $150,000/QALY was 10.28% and 37.71%, respectively, indicating that atezolizumab was not cost-effective (20). They also analyzed the cost-effectiveness of nivolumab plus ipilimumab with 2 cycles of chemotherapy (NIC) as the first-line treatment for advanced NSCLC from a USA payer perspective and found that NIC cost of $264,278 compared to chemotherapy alone, produced an additional 0.80 QALYs and resulted in an incremental cost-effectiveness ratio (ICER) of $202,275/QALY, an incremental net health benefit (INHB) of –0.28 QALYs, and an incremental monetary benefit (INMB) of –$41,865 at a threshold of $150,000/QALY, for which the regimen was not cost-effective (21). In the same year, Wan *et al.* assessed a similar regimen above and found that compared with chemotherapy, nivolumab plus ipilimumab produced 0.62 QALYs, with a cost of $104,238 per QALY, and had probabilities of cost-effectiveness of 50.7% and 66.2% when the WTP values were $100,000/QALY and $150,000/QALY, respectively (22).

In addition to the CEA of nivolumab-included regimens, 2 studies evaluated the cost-effectiveness of atezolizumab combined with carboplatin plus nab-paclitaxel chemotherapy from different perspectives. In 2020, Lin *et al.* estimated the cost-effectiveness of atezolizumab plus carboplatin/nab-paclitaxel for untreated advanced non-squamous NSCLC from a USA payer perspective and found that at a WTP of $180,000/QALY, carboplatin/nab-paclitaxel had a 98.6% probability of being cost-effective, but reducing the acquisition cost of atezolizumab by 43.4% would make atezolizumab/carboplatin/nab-paclitaxel more cost-effective than the former (i.e., adding atezolizumab to carboplatin/nab-paclitaxel in the common case would not be cost-effective in advanced non-squamous NSCLC, but reducing the acquisition cost of atezolizumab might improve cost-effectiveness) (23). In 2021, Yang *et al.* evaluated the above regimen from the perspective of the Chinese health-care system (24) and showed that atezolizumab plus chemotherapy increased 0.34 LY and 0.19 QALY compared with chemotherapy alone, with ICERs of $180,560.15/LY and $325,328.71/QALY, respectively, and atezolizumab plus chemotherapy was 0% cost-effective at a WTP of $30,828/QALY, and 50% cost-effective at $325,000/QALY. Thus, atezolizumab in combination with first-line therapy for advanced non-squamous NSCLC was not cost-effective from the perspective of the Chinese health-care system (24).

Limitations and strengths

This study had some limitations. First, due to the lack of articles from other databases, such as Medline and Scopus, some information may have been missed. However, it should be noted that the stringent conditions by which WoSCC-SCIE collects publications ensure the quality of the documents, and WoSCC-SCIE has been widely applied in scientometrics or bibliometrics (25-28). Second, the document type was limited to articles or review articles. It was difficult to design search strategies due to the wide scope of PE and other document types, such as letters and book chapters, only accounted for a small proportion of total search results. Refinement by document type ensured the accuracy of the search results to some extent. Third, given the original searching strategy which was not refined to a country, such as China, we were unable to give a sub-analysis of PE in a specific country in this study. To explore scientometric results in a country, further research can be carried out.

This study summaries information on countries/regions, authors, institutions, journals, hotspot, frontier, etc. in the field of PE in the last decade and provides a good way to promote cooperation and development in PE. For example, researchers interested in PE can quickly undertake cutting-edge research, collaborate with well-known institutions and scholars, and publish findings in authoritative journals in this field to expand influence. Further, clinicians are able to make better decisions based on existing PE information and give feedback for PE development from clinical perspectives. What's more, government personnel can analyze the facts behind the data and formulate policies to inspire PE development.

Conclusions

This study presented a scientometric analysis of PE studies from 2012 to 2021. The economic analysis of RA and its modifying antirheumatic drugs has been a popular area of research for the last 6 years, and CEAs of first-line NSCLC regimens, including atezolizumab and nivolumab, are at the frontier of research. Relevant researchers, clinicians, and government personnel could greatly benefit from the results of this study.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-1050/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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