HTA in CEE Countries: A Bibliometric Analysis of Research

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Abstract: Background: Health Technology Assessment (HTA) is an impartial old medical technology assessment tool used by health policymakers to aid in reimbursement decisions. Although HTA is usually adopted by wealthy countries given the surplus in financial and human capital, yet, nowadays, more and more low and middle income (LMIC) countries are realizing the value of HTA in the long run and are starting to adopt this tool for healthcare reimbursement decisions. Aim: This study aims to provide a summary of the existing academic research related to the field of HTA in nine Central and East European Countries (CEE), namely; Poland, Czech Republic, Hungary, Romania, Bulgaria, Slovenia, Slovakia, Croatia, and Serbia. Materials and methods: A Scoping literature review was done by the authors for the published journal articles in "Scopus" database to date. The search criteria were set for academic articles written in the English language with full text available. The resulting articles were further skimmed to include only those articles from such journals which were indexed in the "Scimago" ranking system. Extracted articles were analyzed quantitatively using Excel 365, SPSS, and R studio software. Results: 94 full-text academic articles were finally extracted for the analysis. 47% of HTA related literature was published in Q1 journals, 38% in Q2 journals, 11% in Q3 journals, and less than 1% in Q4 journals. 67% of the papers were published in the past 4 years (2016-2019). "International Journal of Technology Assessment in Health Care", "Value in Health: Regional Issues" and "Health Policy" were the top three journals with the highest number of publications in the field. Leading articles, countries, and authors in the field were identified based on the number of papers generated and citation scores. Conclusion: The scoping review methodology seems to be an excellent tool to investigate emerging topics such as HTA. To the authors' knowledge, no previous researchers have recorded the entirety of scholarly conversation in this field. Regional research progression in the field has started to gain attraction in the past 4 years indicated by the number of publications. Further directions were suggested to help field researchers in building their research framework.

Keywords: HTA, Health Technology Assessment, CEE, Bibliometric

1   Research Background

In the 1960's the concept of Health Technology Assessment (HTA) was first formulated in the United States, and the first systematic report published was in 1976 by the U.S. Office of Technology Assessment (OTA) [1]. The WHO basically defines HTA as an evaluation of health technologies, where direct, indirect as well as intended and unintended effects of certain health technology are addressed, quantified, and compared. The aim of HTA is mainly to keep health decision-makers well-informed regarding the value/cost-effectiveness of health technologies in order to select the best therapeutic intervention for public reimbursement [2]. Since then, HTA has become an important tool in decision making for healthcare professionals worldwide, given the recent complexity of evolving new therapies and the crucial need to assign a monetary value, especially for expensive interventions. This interest followed and has grown considerably in North and Latin America, Europe, Australia, and Asia following the path of more developed countries [1].

The European Union (EU) played an important role in developing HTA systems, not only in the EU member states but also in some developing countries outside the EU zone [3]. For instance, The European Commission (EC) has funded the EUR-ASSESS project to explore possibilities to improve the coordination of HTA in Europe [4]. This project was followed by the HTA-EUROPE project [5]. The HTA-EUROPE project was not aimed for further improvement of the coordination, but rather to carry out some systematic recommendations, such as the development of country guidelines on HTA in the EU Member States. [6]. Later, the project EUnetHTA was funded by the EC with the aim of continuing the development of HTA activities and methodologies to fit EU member states' interests [7].

These three EC projects have added a huge improvement for HTA coordination efforts, making HTA more effective and accessible across Europe. At present, national and regional public programs for HTA can be noticed in most EU member states to provide guidance and facilitate information exchange between member states. Currently, most high-income EU members have already established separate HTA entities publishing assessments publicly on a regular basis. In the Central and Eastern European (CEE) region, the attention towards HTA broke through noticeably in the past 10 years.

In this work, the academic literature on the HTA topic has been assessed for the selected 9 CEE countries namely, Poland, Czech Republic, Hungary, Romania, Bulgaria, Slovenia, Slovakia, Croatia, and Serbia. A scoping literature review of the published articles in the field is presented. This will provide a deeper understanding of HTA research trends in the region [8]. Furthermore, statistical analysis will be employed to identify bibliometric correlations, means, and keyword co-occurrences. Additionally, this work will help researchers to develop

a conceptual framework for the HTA field and allow them to explore the current research directions in the region.

2 Methods

To achieve the objectives of this study, a combination of systematic, objective, and quantitative literature review methods along with content analysis tools were applied. The starting point was a systematic search for the related literature in the selected database. Scopus database was chosen because of the ease of discovery of peer-reviewed research, the proper development, and the vast range of medical research work.

The extraction of the articles was based on specific searching criteria to ensure the relevance of the selected articles. The following keywords and boolean search criteria were used: TITLE-ABS-KEY ("HTA" OR "Health Technology Assessment" AND "Poland" OR "Czech" OR "Hungary" OR "Romania" OR "Bulgaria" OR "Slovenia" OR "Slovakia" OR "Serbia" OR "Croatia") AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")). The search was done on the 1st of October 2019 for all previously published literature. The search was limited to the journal articles published in English language whose full text was available. 94 journal articles were identified and drawn from Scopus database into a tabular format. The extracted articles' search results were downloaded in Comma Separated format (CSV). Next, Microsoft Excel 365 was used to rank each article with its corresponding SJR rank, taking into consideration the publishing year and the journal rank during that specific year. Later, both SPSS statistical analysis software and R studio were used for statistical analysis. The database was imported into the statistical software in CSV format to conduct Pearson, ANOVA, and co-occurrence analysis. Only journal articles that were published in SJR ranked journals were included in the analysis.

Bibliometric variables included in the analysis were - the title of the article corresponding journal name, SJR rank, year of publication, author names, country affiliation, number of citations, and index keywords. Figure 1 shows an overview of the work done in this study.
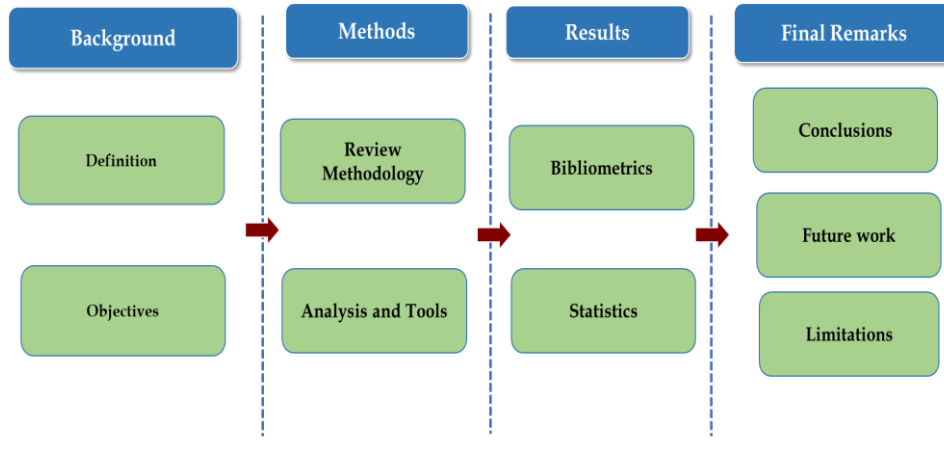
Overview

Background — Definition — Objectives

Methods — Review Methodology — Analysis and Tools

Results — Bibliometrics — Statistics

Final Remarks — Conclusions — Future work — Limitations

Figure 5. Research workflow

3 Results

The following sections show the bibliometric and statistical analysis results. Using these methods helped in better quantifying the association level and relationship between the different bibliometric variables [9].

All the articles extracted in this work were published in SJR ranked journals. Thus, no articles were excluded, and the final number of articles used in this analysis was 94. Table 1 shows a general overview of the extracted articles. The 94 extracted articles were written by 369 authors between 1995 and 2019, with an average of 3.93 authors per document. The average citations per document were 14.36, while the average citations per year per document were 2.29. It is worth noting that only 6 articles were single-authored papers.

Table 4. Overall characteristics of the included studies.

Description	Results
Timespan	1995 - 2019
Average citations per documents	14.36
Average citations per year per doc	2.297
Authors	369
Authors of single-authored documents	5
Authors of multi-authored documents	364

Description	Results
Single-authored documents	6
Documents per Author	0.255
Authors per Document	3.93
Co-Authors per Documents	5.11

3.1   Bibliometric analysis

3.1.1   Output measures

The yearly number of published articles in the field of HTA in the targeted countries was calculated and further analysis was also done to weigh published articles in each Scimago ranking category (Q1, Q2, Q3, and Q4). Figure 2 shows the total number of articles published each year, categorized as per their corresponding SJR for that specific year. It can be noticed that most publications discussing the HTA topic were published in the recent 10 years. This demonstrates the recent increased attention towards the HTA topic in the CEE region. Another notable thing here is that more than two-thirds of the articles (87%) were published in highly ranked journals (Q1 and Q2), this indicated that it is a hot topic as the most prestigious journals are interested in publishing articles related to the HTA topic. This is also confirmed in figure 3 where it can be seen that most articles in the field were published in the highest-ranked journals. Almost half (47%) of the total number of publications were published in Q1 ranked journals, 40% in Q2, and only 13% were published in Q3 or Q4 SRJs.
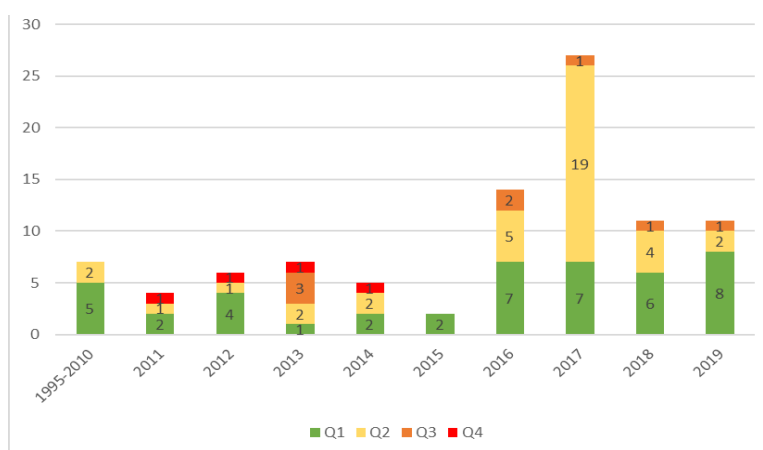

Figure 6. HTA publications per year colour coded as per SJR.
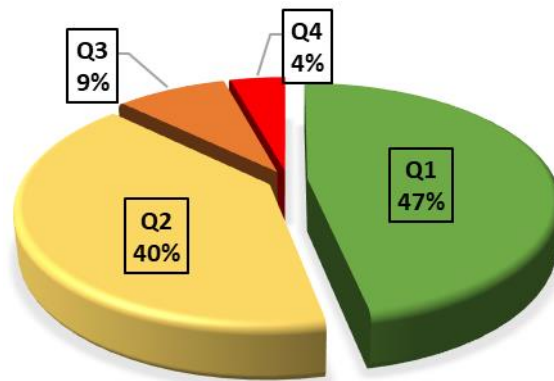
Figure 7. HTA publication share by SJR rank.

3.1.2 Top journals

Journals active in the field were also identified and analyzed. The top 5 journals active in the field identified as per the number of publications shown in their corresponding SJR rank color are in the bar chart in figure 4. The extracted articles were published in 41 journals in total. Almost 30% of the journals active in the field published one article only, while 70% published two or more articles. This can shed light on the journal's specialty and direction. The "International Journal of Technology Assessment in Health Care" has the highest number of publications (i.e. 17 publications), while the journals "Value in Health Regional Issues" and "Health Policy" have 13 and 11 publications, respectively. Almost 50% of the region's articles were published in these 5 journals shown in figure 4.
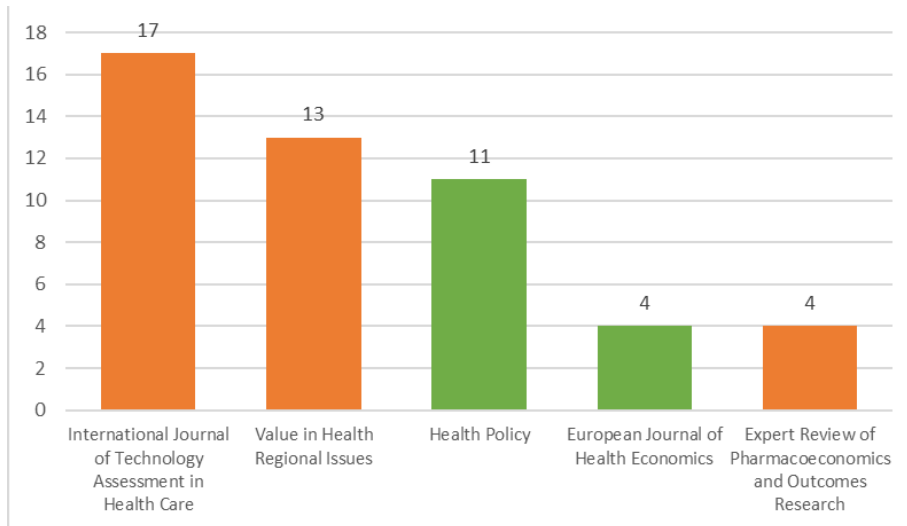
Figure 8. Top journals publishing in the field of HTA in CEE region (~50% of total articles).
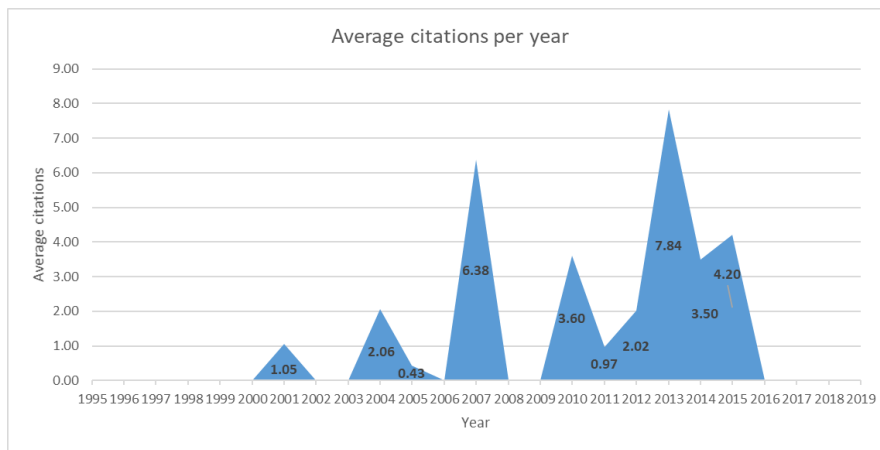
3.1.3 Top cited articles

One of the most used factors to determine the importance and popularity of a specific publication is the number of citations. Thus, the most cited articles in the field were flagged and listed in table 2. "Priority setting for health technology assessments: A systematic review of current practical approaches" published in "International Journal of Technology Assessment in Health Care" (Q1 SJR) was the most cited article since it was published in 2007 with 79 citations to date. This article's popularity was followed by "Health technology assessment in Poland, the Czech Republic, Hungary, Romania and Bulgaria" and "EAES recommendations on the methodology of innovation management in endoscopic surgery" article, with 43 and 35 citations, respectively.

Moreover, it can also be observed that most of the top-cited articles were published in Q1 JSR ranked journals. Only one of the top-articles i.e. "Capacity building for HTA implementation in middle-income countries: The case of Hungary" was -at that time- published in a Q3 ranked journal (i.e. Value in Health Regional Issues journal). It is worth mentioning that this journal is a subdivision of "Value in Health" which concentrates on health research in regions outside of the US. The journal itself is of high quality and it is only a matter of time that the journal will rise to the rank of Q1 as currently, it has already moved to be a Q2 article.

Besides the top-cited articles, the average number of citations per year was also calculated to show the yearly rate of citations in the HTA field. Figure 5 shows that articles published in 2013 are the most cited articles compared to other years

while no citations were made for any of the articles published after the year 2016 yet.

Citations per country were also analyzed to give an indication of the leading countries in this field. Figure 6 shows the top countries ranked by the total number of citations and average citations per article. It is obvious that the United Kingdom is the most cited country, even though the UK is out of the geographical scope of this study. Furthermore, the UK has considerably more citations than the Czech Republic. This indicates the high quality of HTA research in the UK which is highly appreciated and utilized by the scientific society in the CEE.
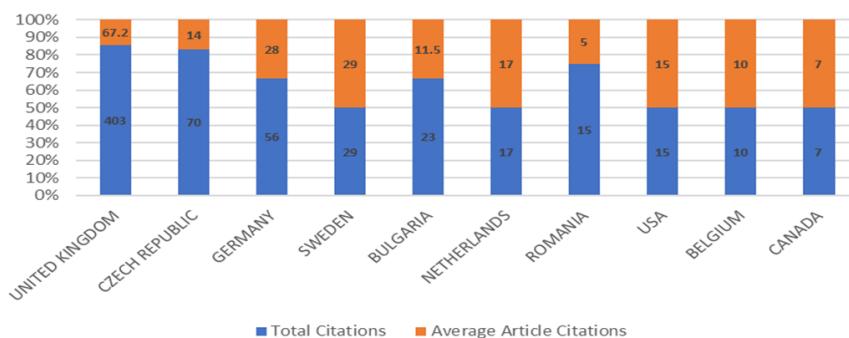

Figure 9. Average citations per year.

Table 5. Most cited articles in the field with their corresponding journal titles publication and publishing year.

| Top Cited Articles			
Article Title	**Journal Title**	**Year Published**	**Number of citations**
Health technology assessment in Poland, the Czech Republic, Hungary, Romania and Bulgaria	European Journal of Health Economics	2014	43
Priority setting for health technology assessments: A systematic review of current practical approaches	International Journal of Technology Assessment in Health Care	2007	79
Issues for countries considering introducing the "fourth hurdle": The case of Hungary	International Journal of Technology Assessment in Health Care	2004	33
EAES recommendations on methodology of innovation management in endoscopic surgery	Surgical Endoscopy	2010	35
Capacity building for HTA implementation in middle-income countries: The case of hungary	Value in Health Regional Issues	2013	34
Multi-criteria decision analysis for supporting the selection of medical devices under uncertainty	European Journal of Operational Research	2015	29

Figure 10. Top cited countries, their corresponding number of citations, and average citations per article.

3.1.4 Affiliation & Authors analysis

The affiliation country of the article's authors was analyzed as per the total number of publications. This gives an indication on which CEE country was more active in publishing in the HTA field. Figure 7 shows the affiliation country analysis result. Poland came on top as the most active country in HTA with 84 publications, which makes over 17% of the total HTA published articles in the region. Some countries outside the target regional population such as the UK, Netherlands, Germany, USA, Canada, and Spain were also active publishers for the region. Hungary was among the top, by contributing nearly 13% of the total publications. Figure 7 also confirms that HTA research in the targeted CEE countries received help from authors in the field from outside the EU, mostly from the USA and Canada. Figure 8 on the other hand, shows the top 5 authors' productivity and citations per year. "Kalo Z" and "Loblova O" were the most productive and highest cited authors in the past two years in the field of HTA within the CEE region.
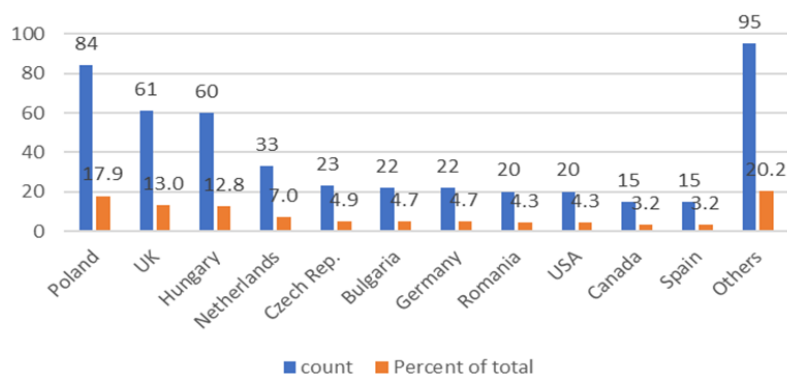
Figure 11. Affiliation country of authors in the field by document count.
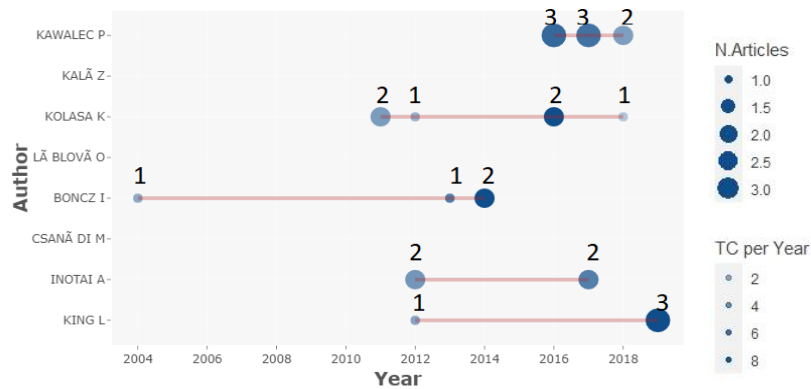
Figure 12. Top 5 Authors based on the number of publications over the time horizon.

Statistical analysis

To explore and discover further underlying patterns and trends in the bibliometric data collected, statistical analysis was employed. Specifically, Pearson's correlation and ANOVA were used to compare means and identify correlations. The results of the analysis can be found in tables 3 and 4. ANOVA results indicate that there is a significant difference in the number of citation means for SJR. This proves that papers published in higher-ranked journals are more likely to get a higher number of citations. Correlation results on the other hand, indicate a clear significant correlation between the publication year and the number of citations which is expected, as the older the article, the more time it had to get more citations, and the higher the snowball reach.

Table 3. ANOVA analysis between SJR rank and number of citations

ANOVA: SJR vs Number of Citations					
SJR Rank	N	Mean	Std. Deviation	95%Confidence Interval for Mean	
				Lower Bound	Upper Bound
Q1	44	12.89	14.735	8.41	17.37
Q2	36	10.08	43.134	-4.51	24.68
Q3	10	9.30	10.822	1.56	17.04
Q4	4	7.50	5.916	-1.91	16.91
Total	94	11.20	28.563	5.35	17.05

Table 4. Pearson's correlations between the number of citations, SJR rank, and publication year.

Pearson's Correlation		Number of citations	SJR Rank	Publication year
Number of citations	Pearson Correlation	1.00	-0.06	**-.233***
	Sig. (2-tailed)		0.59	**0.02**
SJR Rank	Pearson Correlation	-0.06	1.00	0.00
	Sig. (2-tailed)	0.59		0.97
Publication year	Pearson Correlation	**-.233***	0.00	1.00
	Sig. (2-tailed)	**0.02**	0.97	
	N	94.00	94.00	94.00

3.1.5 Keywords Co-Occurrences

Further analysis of keywords using a keyword co-occurrence matrix was done to identify keyword connections if any. Figure 9 shows the resulting keywords co-occurrence matrix built by R studio. Using the words co-occurrences, the relation between keywords can be mapped to build a conceptual structure of micro research trends within HTA. The results clearly show that the most frequent keywords have the strongest relation with each other. Moreover, keywords such as "technology assessment", "biomedical technology assessment", and "health care policy" are not only amongst the most frequent keywords but also have the strongest relations with each other. Some other less frequent keywords were found to have a strong relationship with the keywords "decision" and "health care" as well. This shows the concomitant relation between HTA and research topics like "decision making" and "health care systems". Some related but less frequent research topics were also identified like practice guidelines, organization and management, and health care costs.
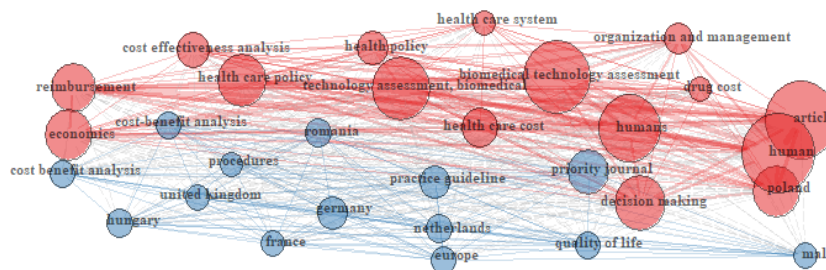

Figure 13. Keywords co-occurrence matrix

Conclusions

The results of this work support the premise that HTA in the CEE countries has been progressing notably in the last 10 years. Leading articles and journals were identified to aid future researchers in the field in establishing their research framework and future HTA research agenda. Statistical analysis showed a clear difference in the citation count means between the SJR ranks and a correlation although identified as significant, yet it was of a low correlation value. The most active authors, top-cited articles, and most active countries were also identified to pinpoint HTA research regional hotspots (i.e. United Kingdom, Germany, and the Czech Republic, respectively). Moreover the relation matrices between keywords were also identified showing the high connectivity of HTA to decision making in health systems.

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