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Multiple Criteria Decision Analysis for Off-Patent Pharmaceuticals in Health Care: Bibliometric Analysis and Scoping Review

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ABSTRACT

Background: Multi-Criteria Decision Analysis (MCDA) is a structured approach used for evaluating complex decisions that involve multiple criteria. In the context of healthcare, its use has grown significantly for benefit–risk assessments, formulary decisions, and reimbursement processes. In developing countries, MCDA has been proposed to support evidence-based evaluation of off-patent pharmaceuticals (OPPs), helping improve public health outcomes and access to quality medicines. However, existing reviews remain limited in scope, emphasizing the need for an updated bibliometric overview of MCDA applications in OPPs.

Objectives: This study aims to provide a comprehensive bibliometric analysis of MCDA research in healthcare, with a specific focus on OPPs.

Methods: Searches were conducted in Scopus, PubMed, and Epistemonikos from January 1985 to October 2023. Eligible studies included full-text English articles utilizing MCDA in OPP procurement. Data were extracted on decision contexts, criteria, methodologies, and stakeholder involvement. Bibliometric analysis was conducted using Scopus Analyzer, VOSviewer, and Microsoft Excel.

Results: A total of 2,210 MCDA-related healthcare articles were identified from 1981 to 2023, with a marked increase after 2013. Dominant themes included decision-making, multicriteria analysis, and healthcare. The identification results showed that A.A. Zaidan was the most prolific author. Citation analysis reported 41,882 citations between 2011 and 2023. The scoping review identified seven studies focusing on MCDA for OPPs, highlighting quality as the most prioritized criterion in procurement frameworks.

Conclusion: MCDA frameworks offer a comprehensive approach to improve healthcare decision-making and policy development, particularly in evaluating and procuring OPPs, while supporting adaptable implementation across diverse health systems.

Keywords: Bibliometric analysis; Healthcare; Multicriteria decision analysis; Off-patent pharmaceuticals; Scoping review

INTRODUCTION

The use of Multi-Criteria Decision Analysis (MCDA) across different healthcare decision-making settings has not been fully documented even though several reviews have discussed this topic. In 2022, Gongora-Salazar et al. conducted a systematic review to update the evidence on MCDA applications in various healthcare decisions. However, the review had limitations because it relied only on MEDLINE, Embase, and Google Scholar. Besides, it did not compare its findings with previous MCDA studies.[10] Therefore, a more updated bibliometric analysis is needed to describe global collaboration patterns and track recent developments in MCDA research. A newer bibliometric study conducted by Dai et al. (2022) also had limitations, as it used only the Web of Science

Core Collection (WoSCC) database.[11] Moreover, previous studies did not specifically address the use of MCDA for off-patent pharmaceuticals (OPPs) in healthcare.

Thus, this study aimed to identify key concepts, evidence gaps, and the types of evidence available using a bibliometric analysis method through some databases. Then, to analyze relevant updated studies focusing on the application of MCDA to OPPs in healthcare, we also conducted a scoping review.

This review included more databases and expanded the timeframe to cover studies published as early as 1985. This allows the inclusion of the earliest conceptual uses of MCDA in healthcare and provides a broader historical overview. Therefore, this study aimed to examine MCDA publications and development trends through a bibliometric analysis using the Scopus database, as well as to review updated studies focused on MCDA applications for OPPs in healthcare.

The insights generated from this study can strengthen evidence-based and transparent healthcare decision-making in developing countries, including Indonesia, by identifying global trends, key criteria, and successful examples of MCDA use in pharmaceutical assessment. These findings may also help policymakers adapt MCDA frameworks to improve the procurement of off-patent pharmaceuticals, ensuring better quality, affordability, and alignment with national health priorities.

METHODS

Study Design

This study employed two methods: a scoping review and a bibliometric analysis to systematically examine and map the existing literature on MCDA for off-patent pharmaceuticals in healthcare. A scoping review was considered appropriate because it allows the exploration of broad research areas. Meanwhile, the bibliometric analysis helps identify key concepts, evidence gaps, and the types of evidence available.[1–3]

Search Strategy

The articles used in this study were retrieved from Scopus, PubMed, and Epistemonikos, covering publications from 1 January 1985 to 17 October 2023. The search terms were selected as free-text keywords in the title and abstract fields, following the approaches of Adunlin et al. (2015)[12] and Dai et al. (2022)[11]. Boolean operators (AND, OR) were used to combine the keywords. For Scopus searches, only English-language publications were included, and the records were downloaded as CSV files for the bibliometric analysis. The same records were also downloaded as RIS files for screening in the scoping review. All identified literature was retrieved and saved. Eligibility criteria were defined before screening titles and abstracts. After duplicate records were removed, titles, abstracts, and full texts were assessed. Three authors independently screened the titles and abstracts. Full-text articles selected for inclusion were also reviewed independently by each author. Any disagreements were resolved through discussion and consensus.

Eligibility Criteria

Studies were included if they were in the form of full-text English articles, applied an MCDA framework in the procurement of OPPs, and clearly described the MCDA method used. Studies were excluded if they did not use MCDA, did not meet all steps of the MCDA definition described in the introduction (e.g., identifying relevant criteria without defining or eliciting weights), did not aim to support decisions in the OPP procurement process, or were review articles such as narrative, scoping, or systematic reviews.

Data Extraction

A structured data extraction tool was developed and reviewed to maintain consistency across reviewers. Extracted data included decision contexts, criteria used, methods, data sources, weighting and scoring approaches, and stakeholders involved in addressing uncertainty. Information on the decision-making context, the MCDA techniques applied, and the stakeholders engaged at different stages of MCDA was analyzed using descriptive statistical methods.

Data Analysis

Scopus Analyzer was used to organize search results and identify publication trends, including keyword co-occurrence, co-authorship patterns, and citation metrics. VOSviewer (version 1.6.20) was employed to perform bibliometric network analyses, using the full counting method to ensure equal weighting of each publication, citation, author, and keyword. The resulting bibliometric networks were displayed as visual maps. Microsoft Excel was used to create figures, tables, descriptive statistics, and summarize findings across each step of the MCDA process.[13]

RESULTS AND DISCUSSION

Publication Trends

Using the search strategy described earlier, a total of 2,210 articles were identified in Scopus. Publications began in 1981 (n=1), increased significantly in 2013 (n=49), and reached a peak in 2022 (n=318), followed by a slight decrease in 2023 (n=306). These findings show that MCDA in healthcare continues to grow and remains a promising area for further research.

Co-occurrence Keywords Analysis

The keyword analysis for MCDA in healthcare is shown in Figure 1. A minimum threshold of 50 keyword co-occurrences was applied. Related keywords formed four clusters, represented as red, green, blue, and yellow in Figure 1A. The node size reflects the frequency of each keyword. The five most frequent keywords were “decision making” (n=938), “multicriteria decision analysis” (n=354), “decision support system” (n=316), “health care” (n=306), and “decision support techniques” (n=303). The overlay visualization shows that the average publication year for these keywords ranged from 2016 to 2019 (Figure 1B), with most appearing in works published after 2016, indicated by purple and blue colors.

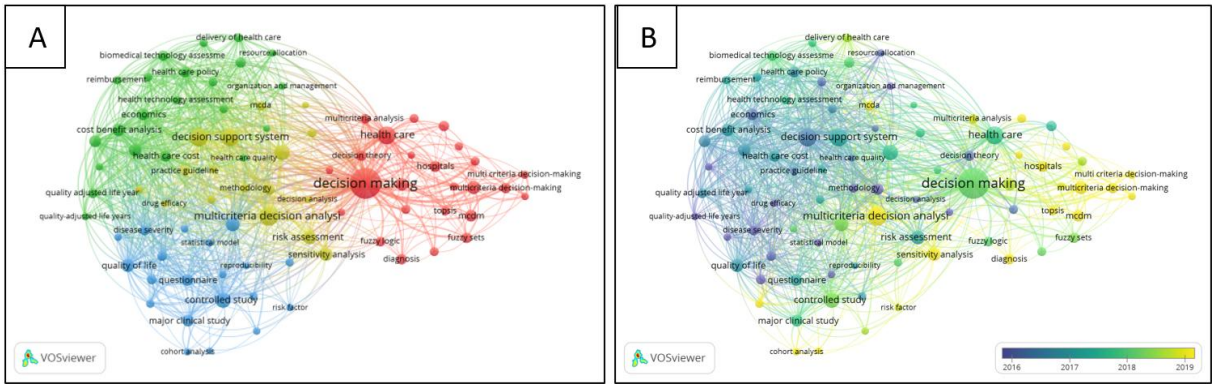

Figure 1. The co-occurrence analysis of the MCDA study in healthcare by (A) network visualizations and (B) overlay visualizations

Co-Authorship Analysis

Based on the Scopus analysis, A.A. Zaidan was the most productive author in MCDA-related healthcare publications, with 33 articles. This was followed by A.S. Albahri and B. Uzun with 31 publications each. A minimum threshold of 10 documents per author was set to include only contributors with substantial output. Out of 7,654 authors, 28 met this threshold. Network visualizations show three major research groups, the largest led by A.A. Zaidan, O.S. Albahri, and A.S. Albahri. The overlay visualization indicated that their average publication year ranged from 2014 to 2019, with most authors’ publications in 2019.

Citation Analysis

The Scopus data showed that MCDA healthcare studies were cited 41,882 times from 2011 to 2023, and 34,915 times excluding self-citations. The citation analysis results are presented in Figure 2 using a minimum threshold of 50 citations. Of 2,210 documents, 248 met this criterion, and the largest connected group contained 132 documents. Figure 2A shows a network of 14 clusters, containing 4 to 17 documents each. The top five cited documents are listed in Table I. The overlay visualization (Figure 2B) shows the average publication year, ranging from 2010 to 2018, with studies published after 2018 appearing in yellow.

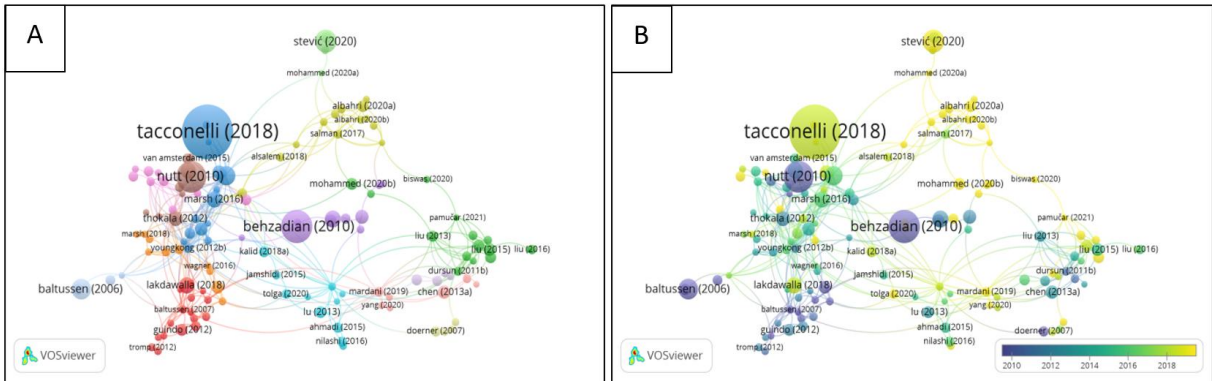

Figure 2. The citation analysis of the MCDA study in healthcare by (A) network visualizations and (B) overlay visualizations

Study Selection of Scoping Review

The database search identified 4,442 articles. After removing 1,141 duplicates, abstracts and full texts were screened based on the eligibility criteria, specifically focusing on MCDA for OPPs.

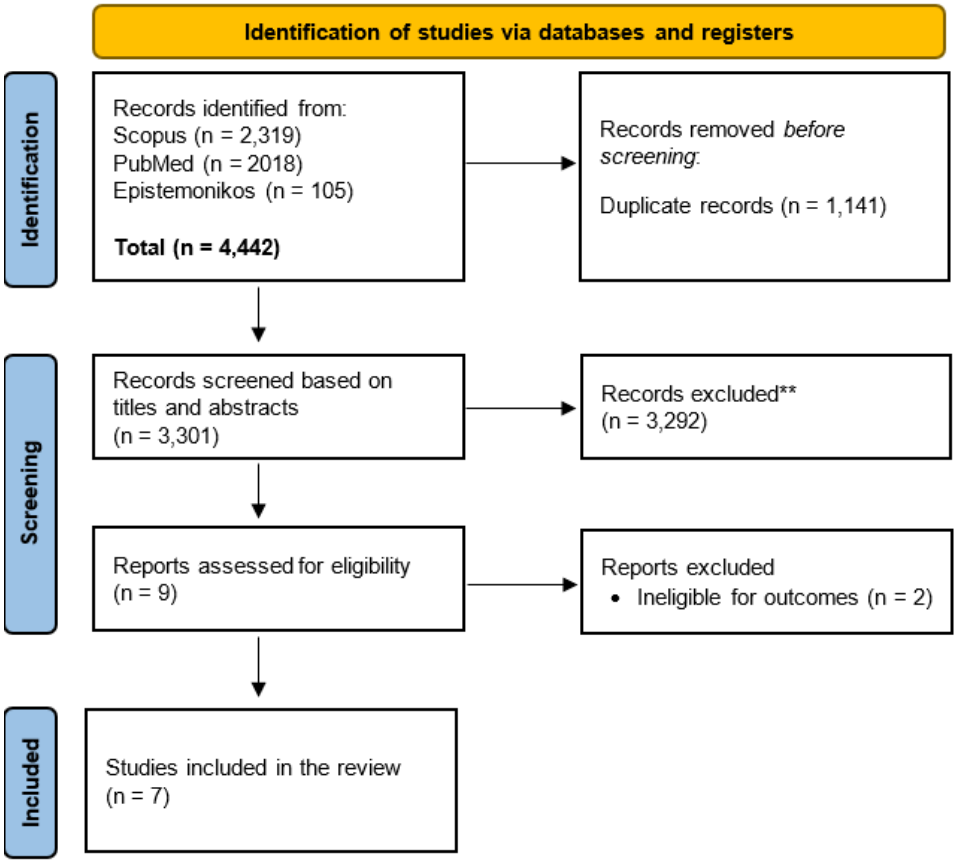

Figure 3. The study selection of the scoping review

General Characteristics of the Eligible Studies

The included studies demonstrate that MCDA has been applied to support decision-making in OPP procurement. The decision contexts were mainly in management and healthcare. Table 1 summarizes these characteristics.

Table I. The summary of general characteristics of eligible studies, Brixner

First Author	Year	Country	Intervention Type	Definition of Criteria and Problem	Stakeholders Involved	Number of Experts	Measurement	Criteria	Number of Criteria	Weights	Types of Problems	Methods Type
Shanlian Hu et al[14]	2015	Republic of China	Management	Literature	Chinese academic and industry expert	18	Qualitative	MCDA	10	0-1	Choice	N/R
Elezbawy et al[21]	2022	Egypt	Healthcare	Decision-makers	Tenders and purchasing pharmaceuticals from several governmental entities	35	Qualitative	MCDA	13	0-100%	Ranking	SMART
Brixner et al[15]	2018	USA	Management	Literature	Academian, ministries of health, drug procurement agencies, and drug pricing and reimbursement agencies.	57	Qualitative	MCDA	22	0-5	Ranking	HTA
Brixner et al[8]	2017	USA	Management	Decision-makers	N/R	57	Qualitative	MCDA	22	5 to 1	Ranking	N/R
Andras Inotai et al[1]	2018	Indonesia	Healthcare	Decision-makers	N/R	20	Qualitative	MCDA	6+1	0-100%	Ranking	SMART
Farghaly et al[16]	2021	United Arab Emirates (UAE)	Healthcare	Decision-makers	N/R	21	Qualitative	9 Efor Criteria	9	0-100%	Ranking	SMART
Abdullah et al[9]	2019	Kuwait	Management	Decision-makers	Pharmaceutical policy	19	Qualitative	MCDA	8	0-100%	Ranking	SMART

Several strategies were used to support OPP evaluation and procurement through MCDA.[14] These include the creation of frameworks for off-patent originators and generics, focusing on pricing and reimbursement; introducing an evidence framework for OPPS review (EFOR) in emerging markets, [15] and applying simple MCDA scoring approaches.[8] Collaboration has also been used to improve MCDA tools for performance indicator–based purchasing of OPPs.[9] In oncology, MCDA has helped compare off-patent medicines using value-based attributes and ranking mechanisms.[16] In some cases, pilot MCDA tools were developed to support repeated use for value-based procurement.[1] Other studies aimed to create national MCDA-based procurement frameworks.[16]

Most studies identified MCDA criteria through workshops or decision-making sessions (n=5), involving stakeholders such as academicians, ministries of health, policy organizations, procurement agencies, and pricing bodies. These stakeholders collaborated through national negotiations (China), technical workshops (Egypt, Indonesia), and consensus-driven adaptations (UAE, Kuwait). Their roles included identifying and weighting criteria, defining priorities, ensuring regulatory alignment, and applying scoring or pricing mechanisms.

Two studies used literature reviews to define MCDA criteria (n=2). The most common weighting approach was the Simple Multi-Attribute Rating Technique (SMART) (n=4). Ranking and swing weighting methods were selected based on expert judgment.

Among the seven included studies, 57% focused on solving management-related problems, such as reimbursement policies, EFOR frameworks, simple scoring, and OPP purchasing. About 29% relied on literature-based identification of criteria, while 71% used expert knowledge and experience. Six studies (86%) used ranking methods, and one (14%) used choice-based methods. SMART was the most frequently applied technique (57%). One study used Health Technology Assessment (HTA) methods (14%), while others did not specify a method.

This study provides a broad bibliometric and scoping review of MCDA use in healthcare, especially for OPPs. The growing number of publications between 2013 and 2022 shows increasing interest. Contributions were geographically diverse, with the United States, the United Kingdom, India, China, and Turkey being the most productive countries.[11,17,18] This indicates global attention and collaboration in applying MCDA to improve decision-making for OPP evaluation and procurement.

Keyword patterns highlight core themes such as decision-making, multicriteria decision analysis, decision support systems, healthcare, and decision support techniques. These reflect the complexity of healthcare decisions, which require balancing multiple competing objectives and stakeholder views.[19,17] MCDA is increasingly used to support pharmaceutical evaluation, HTA, and resource allocation.[11,19,17] Decision Support Systems (DSS) provide a structure for criteria weighting and aggregation to support complex decisions.[11,17]

The scoping review identified seven studies applying MCDA to OPP procurement, with quality criteria emerging as the most important. This aligns with literature calling for comprehensive medicine evaluation beyond cost alone.[19,20] MCDA frameworks were adapted differently across countries: China used a six-stage process emphasizing affordability regulations;[14] Egypt applied a four-stage model excluding price;[21] the USA used two models (eight-stage and six-stage) to balance affordability and quality;[15] Indonesia adopted an eleven-stage model to improve tender transparency;[1] the UAE used a five-stage tool for value-based generic purchasing;[16] and Kuwait created a seven-stage tool prioritizing price and non-price factors.[9] Each country's approach reflects its healthcare priorities, regulations, and procurement needs.

Most tools emphasized quality-related elements, including policy priorities, affordability, selection, standards, pricing, and HTA. This adaptability demonstrates MCDA's usefulness across diverse OPP procurement settings. The strength of this study lies in combining bibliometric and scoping methods to capture both broad trends and detailed applications of MCDA. However, the bibliometric analysis was limited to Scopus-indexed articles, possibly excluding relevant studies from other databases. The scoping review included only English-language articles, which may have excluded additional insights. Future research should expand database coverage and include non-English publications.

CONCLUSION

MCDA is increasingly recognized as a valuable method used for improving healthcare decision-making, especially in evaluating and procuring OPPs. Publication trends show significant growth since 2013. The seven scoping review studies consistently prioritized quality criteria, including medicine selection, standards, pricing, HTA, policy considerations, and affordability. Overall, this study highlights MCDA's growing role in global research and its potential to improve healthcare decision-making for OPP management.

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STATEMENT OF ETHICS

Not required.

REFERENCES

1. Inotai A, Brixner D, Maniadakis N, Dwiprahasto I, Kristin E, Prabowo A, et al. Development of multi-criteria decision analysis (MCDA) framework for off-patent pharmaceuticals: an application on improving tender decision making in Indonesia. BMC Health Serv Res. 2018;18:1003. doi:10.1186/s12913-018-3805-3
2. Baran-Kooiker A, Czech M, Kooiker C. Multi-criteria decision analysis (MCDA) models in health technology assessment of orphan drugs: a systematic literature review—next steps in methodology development? Front Public Health. 2018;6:287. doi:10.3389/fpubh.2018.00287
3. Broekhuizen H, Groothuis-Oudshoorn CGM, van Til JA, Hummel JM, IJzerman MJ. A review and classification of approaches for dealing with uncertainty in multi-criteria decision analysis for healthcare decisions. Pharmacoeconomics. 2015;33(5):445–55. doi:10.1007/s40273-014-0251-x
4. Thokala P, Devlin N, Marsh K, Baltussen R, Boysen M, Kalo Z, et al. Multiple criteria decision analysis for health care decision making: Report 1 of the ISPOR MCDA Emerging Good Practices Task Force. Value Health. 2016;19(1):1–13. doi:10.1016/j.jval.2015.12.003
5. Cinelli M, Kadziński M, Gonzalez M, Słowiński R. How to support the application of multiple criteria decision analysis? Let us start with a comprehensive taxonomy. Omega. 2020;96:102261. doi:10.1016/j.omega.2020.102261
6. Mühlbacher AC, Kaczynski A. Making good decisions in healthcare with multi-criteria decision analysis: the use, current research and future development of MCDA. Appl Health Econ Health Policy. 2016;14(1):29–40. doi:10.1007/s40258-015-0203-4
7. Kolasa K, Zah V, Kowalczyk M. How can multi-criteria decision analysis support value assessment of pharmaceuticals? Findings from a systematic literature review. Expert Rev Pharmacoecon Outcomes Res. 2018;18(4):379–91. doi:10.1080/14737167.2018.1467759
8. Brixner D, Maniadakis N, Kaló Z, Hu S, Shen J, Wijaya K. Applying multi-criteria decision analysis (MCDA) simple scoring as an evidence-based HTA methodology for evaluating off-patent pharmaceuticals in emerging markets. Value Health Reg Issues. 2017;13:1–6. doi:10.1016/j.vhri.2017.02.001
9. Abdullah AH, Holtorf AP, Al-Hussaini M, Lemay J, Alowayesh MK. Stakeholder-driven development of a multi-criteria decision analysis tool for purchasing off-patent pharmaceuticals in Kuwait. J Pharm Policy Pract. 2019;12:17. doi:10.1186/s40545-019-0171-4
10. Gongora-Salazar P, Rocks S, Fahr P, Rivero-Arias O, Tsiachristas A. The use of multicriteria decision analysis to support decision making in healthcare: an updated systematic literature review. Value Health. 2023;26(5):780–90. doi:10.1016/j.jval.2022.11.007
11. Dai Z, Xu S, Wu X, et al. Knowledge mapping of multicriteria decision analysis in healthcare: a bibliometric analysis. Front Public Health. 2022;10:895552. doi:10.3389/fpubh.2022.895552
12. Adunlin G, Diaby V, Xiao H. Application of multicriteria decision analysis in health care: a systematic review and bibliometric analysis. Health Expect. 2015;18(6):1894–905. doi:10.1111/hex.12287
13. Cilmiaty R, Ilyas MF. A bibliometrics and scientometrics study of mineral trioxide aggregate material for irreversible pulpitis. J Med Chem Sci. 2024;7(5):729–43. doi:10.26655/JMCHEMSCI.2024.5.9
14. Hu S, Zhang Y, He J, et al. A case study of pharmaceutical pricing in China: setting the price for off-patent originators. Appl Health Econ Health Policy. 2015;13(1):13–20. doi:10.1007/s40258-014-0150-5
15. Brixner D, Kaló Z, Maniadakis N, Kim K, Wijaya K. An evidence framework for off-patent pharmaceutical review (EFOR) for health technology assessment in emerging markets. Value Health Reg Issues. 2018;16:9–13. doi:10.1016/j.vhri.2018.01.003
16. Farghaly MN, Al Dallal SAM, Fasseeh AN, et al. Recommendation for a pilot MCDA tool to support the value-based purchasing of generic medicines in the UAE. Front Pharmacol. 2021;12:680737. doi:10.3389/fphar.2021.680737

17. Frazão TDC, Camilo DGG, Cabral ELS, Souza RP. Multicriteria decision analysis (MCDA) in health care: a systematic review of the main characteristics and methodological steps. BMC Med Inform Decis Mak. 2018;18(1):90. doi:10.1186/s12911-018-0663-1
18. Holtorf AP, Kristin E, Assamawakin A, Upakdee N, Indrianti R, Apinchonbancha N. Case studies for implementing MCDA for tender and purchasing decisions in hospitals in Indonesia and Thailand. J Pharm Policy Pract. 2021;14(1):1–14. doi:10.1186/s40545-021-00333-8
19. Oliveira MD, Mataloto I, Kanavos P. Multi-criteria decision analysis for health technology assessment: addressing methodological challenges to improve the state of the art. Eur J Health Econ. 2019;20(6):891–918. doi:10.1007/s10198-019-01052-3
20. Pirri S, Lorenzoni V, Turchetti G. Scoping review and bibliometric analysis of Big Data applications for medication adherence. BMC Health Serv Res. 2020;20:688. doi:10.1186/s12913-020-05544-4
21. Elezbawy B, Fasseeh AN, Sedrak A, et al. A multi-criteria decision analysis (MCDA) tool for purchasing off-patent oncology medicines in Egypt. J Pharm Policy Pract. 2022;15(1):1–10. doi:10.1186/s40545-022-00414-2