ISSN 2745-455X (Online)
Indonesian Journal of Pharmacology and Therapy

Improving hospital formulary drug decision making with multi-criteria decision analysis (MCDA): case study from a national government hospital in Indonesia

Erna Kristin[1], Mursyid Bustami[2], Rizaldy Taslim Pinzon[3], Alfi Yasmina[4]*, Agnes Susanto[5], Ratih Puspita Febrinasari[6]

[1]Department of Pharmacology and Therapy, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia, [2]National Brain Center Hospital, Jakarta, Indonesia, [3]Neurology Department, Duta Wacana Christian University, Yogyakarta, Indonesia, [4]Department of Pharmacology, Faculty of Medicine, Universitas Lambung Mangkurat, Banjarmasin, Indonesia, [5]PT Atoma Medical, Jakarta, Indonesia, [6]Department of Pharmacology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

https://doi.org/10.22146/ijpther.7932

Submitted: 03-05-2023
Accepted : 03-11-2023

Keywords:
multi-criteria decision analysis;
drug procurement;
decision-making;
government hospital;
formulary

ABSTRACT

This study aimed to look at the applicability of the multi-criteria decision analysis (MCDA) framework to improve hospital formulary drug decision-making. The case study method was used to investigate MCDA implementation in the National Brain Center Hospital Jakarta, Indonesia. A two stage-workshop was held on October 29th, 2019 and 5 February 5th, 2020, where participants conducted a hands-on experience in applying MCDA for selecting off-patent pharmaceuticals (OPPs) for the hospital formulary. The results of the workshop created awareness of MCDA that can be beneficial in transparently selecting OPP, which is not based only on price while involving multiple stakeholders. As a follow-up, MCDA was used during the drug selection process for the National Brain Center Hospital formulary in 2021 with criteria in accordance with the workshops, namely: 1) equivalence with the reference (originator) product; 2) real-world clinical or economic outcomes; 3) quality assurance; 4) reliability of drug supply; 5) stability and drug formulation; 6) pharmacovigilance, and 7) price advantages. In conclusion, the MCDA method can be implemented with customized criteria and weighting based on hospital needs to help with drug selection for the hospital formularies.

ABSTRAK

Penelitian ini bertujuan untuk melihat penerapan kerangka kerja *multi-criteria decision analysis* (MCDA) dalam proses pengambilan keputusan mengenai formularium obat di rumah sakit. Metode studi kasus digunakan untuk mengkaji implementasi MCDA di Rumah Sakit Pusat Otak Nasional Jakarta, Indonesia. Lokakarya dilaksanakan dalam dua tahap pada tanggal 29 Oktober 2019 dan 5 Februari 2020, di mana para peserta mendapatkan pengalaman langsung dalam menerapkan MCDA guna memilih obat-obatan yang telah habis masa patennya (*off-patent pharmaceuticals*/OPP) untuk formularium rumah sakit. Hasil lokakarya meningkatkan pengetahuan mengenai MCDA yang dapat bermanfaat dalam memilih OPP secara transparan dan tidak hanya berdasarkan kriteria harga dengan melibatkan banyak pemangku kepentingan. Sebagai tindak lanjut, MCDA digunakan pada proses pemilihan obat untuk formularium RS Pusat Otak Nasional tahun 2021 dengan kriteria sesuai hasil lokakarya yaitu: 1) edengan produk pembanding (originator); 2) luaran klinis atau ekonomis berdasarkan data *real-world*; 3) jaminan kualitas; 4) keandalan pasokan obat; 5) stabilitas dan formulasi obat; 6) farmakovigilans, dan 7) keunggulan harga. Kesimpulannya, metode MCDA dapat diimplementasikan dengan kriteria yang disesuaikan dan pembobotan berdasarkan kebutuhan rumah sakit guna membantu pemilihan obat untuk formularium rumah sakit.

*corresponding author: seribumelati@gmail.com

INTRODUCTION

Multi-criteria decision analysis (MCDA) is an umbrella term to describe a collection of formal approaches, which seek to take explicit account of multiple criteria in helping individuals or groups explore decisions that matter.[1] Decision-making problems must be resolved with full accountability, transparency, and using the appropriate methods in discussing various options to reach a value-based decision. Decision-makers whether they are individuals or institutions will need to evaluate priorities and alternatives regarding the decision they have to take. Multi-criteria decision analysis can help incorporate criteria and priorities from stakeholders to provide a consistent and structured framework in the decision-making process.

In recent years, an increase in MCDA applications can be found in healthcare. A systematic review reported that MCDA has been implemented in broad areas of application within the health sector, such as diagnostic and treatment, formulary management, health technology assessment, pain management, professional practice, resource planning, site selection, supply chain, and public health.[2] Another scoping review revealed that MCDA was widely used in public health services.[3] A bibliometric analysis found that there is a steady increase in publications regarding MCDA with a notably higher output in 2016-2021.[4]

An interesting potential of MCDA application in healthcare is as a health technology assessment methodology for evaluating off-patent pharmaceuticals (OPPs). OPPs account for more than 60% of medication access in emerging countries.[5] Several countries have utilized MCDA for OPPs purchase decision-making. Policymakers in the United Arab Emirates have considered MCDA as a tool to improve the transparency and consistency of OPPs purchasing.[6] In Egypt, MCDA tools were developed for the national tender of off-patent oncology medicines.[7] Pharmaceutical policy stakeholders in Kuwait have developed an MCDA model that is locally relevant and could be used as a performance indicator in the purchasing of OPPs.[8] Indonesia has also introduced the MCDA framework in the national drug procurement process.[9]

Multi-criteria decision analysis methodology can be adapted flexibly to smaller environments to improve OPPs evaluation, for instance, a province or a hospital. Experience in a Canadian Provinces drug reimbursement decision-making process emphasizes that MCDA could make better use of all available information while also providing accountability and transparency.[10] A public hospital in China uses the MCDA to assess five dipeptidyl peptidase 4 (DPP-4) inhibitors. The hospital had to determine whether they would purchase new drugs and replace the existing ones.[11]

In Indonesia, government and private hospitals serving the national health insurance are expected to use the e-catalog platform for drug procurement. In the case that the required drug is not available in the e-catalog, hospitals are allowed to process drug procurement manually. Manual drug procurement adds another challenge in decision-making for the hospital procurement officer. Publication from Thailand shows that currently there is no uniform evaluation method applied to pharmaceutical procurement decision-making in hospitals.[12] Multi-criteria decision analysis can be used to assist in manual drug procurement in hospitals. This paper describes a case study of MCDA adaptation in a national government

hospital for OPPs purchasing decision-making.

This paper aimed to look at the applicability of the MCDA framework to improve hospital formulary drug decision-making, by identifying the criteria used for MCDA that can be applied in decision-making related to OPPs, introducing scoring and weighting for criteria used for MCDA in decision-making related to OPPs, and providing recommendations for MCDA implementation at a national government hospital in Indonesia.

MATERIAL AND METHODS

A workshop to introduce MCDA to facilitate selecting OPPs for the hospital formulary was conducted in a national government hospital in Indonesia as a pilot project for assessing the potential of MCDA in OPP selection in a hospital. The workshop had several objectives, namely, to provide knowledge and understanding of the concepts and steps in MCDA, to identify criteria used in MCDA that can be applied in decision-making related to OPP selection in the hospital, to introduce scoring and weighting for criteria used in MCDA in for decision-making related to OPP selection in the hospital, and to recommend the implementation of MCDA for decision-making related to formulary and drug procurement in the hospital.

The workshop was conducted in 2 stages: the pre-workshop and the main workshop. The workshop was conducted on October 29th, 2019 in the hospital. The pre-workshop was attended by a representative from the Drug and Food Control Agency of Republic of Indonesia (DFCA RI), the MCDA trainer team from university, and 16 participants, consisting of the hospital management staff, clinicians, pharmacists, medical record unit staff, internal control unit staff, and quality improvement & patient safety unit staff. The pre-workshop provided a general basic introduction to the concept of MCDA to the stakeholders in formulary development in the hospital. Topics discussed include drug approval and drug quality, an overview of MCDA and how it is used for the selection of OPPs, criteria for MCDA, and data requests for the workshop. A panel discussion was held to brainstorm the criteria that are most relevant to the hospital's needs.

During the period between the pre-workshop and the main workshop, the MCDA trainers kept close contact with the workshop participants, answering questions remained, and collecting data needed for the main workshop, including the list of hospital formulary, drug procurement data (drug names [generic and brand names], drug preparations, dosage strength, manufacturer, price, deadstock information), monthly pharmacist reports, pharmacology data (bioavailability/bioequivalence information, stability/product expiry information, GMP certification of the manufacturer), added service given by drug distributors (supply reliability, return flexibility, technical assistance, continuing medical education opportunities/events, disease awareness events, free laboratory testings, etc.), and the drug pharmacovigilance system available. Data collection was done from various data sources namely, hospital procurement data, hospital pharmacy data, the e-catalog platform, and pharmaceutical brochures from the drug manufacturer. The data would be used to support the drug selection criteria in the exercise and to be used for filling the Excel® MCDA application in the main workshop.

The main workshop was held on February 5th, 2020 in the hospital,

attended by a representative from DFCA RI, the MCDA trainer team from Universitas Gadjah Mada, Yogyakarta and 18 participants consisting of the hospital management staff, clinicians, pharmacists, and the internal control unit staff. The workshop provided a refreshment course on MCDA and a hands-on exercise on how to use MCDA for OPP selection for the hospital formulary. Topics discussed included an overview of MCDA, how to use MCDA to select drugs for the hospital formulary, an introduction to the MCDA Excel® datasheet to assess drugs to be selected for the hospital formulary, and drug quality. The participants of the workshop were then divided into 3 groups to have an experience on how to assess drugs using MCDA Excel® datasheet based on hospital real data. Each group prepared a presentation of the assignment, and this was discussed in the class panel, highlighting the difficulty and ease of using the application. The class panel also discussed how this MCDA method in OPP selection compared with what has been done in their daily routine of formulary development and drug procurement. A summary of what has been done in the workshop was developed, as lessons learned for both the participants and the trainers.

RESULTS

The hospital formulary in the tertiary hospital requires that for each generic drug name in the formulary, there should be 1 originator drug (if available in the market) and 3 OPP drugs. The choice of these 3 OPPs had been based mostly on price and the drug availability in e-catalog, a list of drugs available in the Indonesia market paid by the National Health Insurance. There has been no effort to use other criteria for drug selection.

The pre-workshop discussed the concept of MCDA and the MCDA criteria. After the discussion on the MCDA concept and the importance of using multi-criteria (as opposed to mainly based on price) in decision-making for drug selection, a brainstorming session was conducted, focused on MCDA criteria deemed most important for OPP selection for hospital formulary in the hospital. The various criteria suggested were then classified into main criteria headings that will be used later for the MCDA exercise. These criteria also determined which data needed to be collected for the preparation of the main workshop. The summary of the criteria discussed is presented in TABLE 1.

The data collection and analysis during the period between the pre-workshop and the main workshop resulted in the choice of 3 generic drugs that would be used for the exercise in the main workshop, namely, atorvastatin, flunarizine, and clopidogrel. The choice of the drugs was based on the high utilization, considerable choice of generic/brand names, price variation, and the need to update the formulary for these drugs.

The main workshop provided more technical details on the MCDA

steps for drug selection. The steps are based on the simplified MCDA tool for OPPs. The steps are listed in TABLE 2. The Excel® application used to select drugs based on these MCDA steps was introduced. This Excel® application was based on criteria discussed previously in a workshop on MCDA application for national OPP procurement in Indonesia. A demonstration of the application use was provided, highlighting the possibility of adjusting the criteria and weighting more relevant to the hospital's needs. A discussion was held to stimulate a deeper understanding of the MCDA technique before the exercise began.

The class was grouped into 3, assigned to work on each drug chosen. Each group was provided with the data needed to complete the Excel® application. The participants of each group simulated the MCDA step-by-step using the data provided, discussing the criteria and weighting that they considered most appropriate. The results were presented in the class panel, and the different decisions made by each group on the criteria and weighting used were discussed. TABLE 3 provided an example of the criteria and weighting used on a selected drug discussed.

TABLE 1. Criteria that were considered relevant for OPPs selection for the hospital formulary

Price
Drug quality
Reliability of drug supply & possibility of drug return
Drug efficacy and safety
Drug expiry and stability Patient benefit (added value service) Pharmacovigilance

TABLE 2. MCDA steps for drug selection for hospital formulary

1. Determine the Price Advantage
   - Decides on the weighting and scoring for Price criteria.
2. Determine the non-Price criteria and their scoring
   - Identifies the most relevant criteria for the drug selection and decides on the criteria scoring
3. Determine the ranking and weighting for each non-Price criteria
4. Assess each drug option based on the criteria and weighting
5. Calculate the aggregate score and interpretation

TABLE 3. Criteria and weighting used for selection

Criteria and Scoring	Weight
1. Non-price criteria	
a. Real-world clinical/economic outcomes • No real-world data on equal a) tolerability, b) adherence and persistence, c) non-drug cost • International real-world data on either equal a) tolerability, b) adherence and persistence, c) non-drug cost • Local real-world data on either equal a) tolerability, b) adherence and persistence, c) non-drug cost • International real-world data on improvement in a) tolerability, b) adherence and persistence, c) non-drug cost • Local real-world data on improvement in a) tolerability, b) adherence and persistence, c) non-drug cost	11.88
b. Quality assurance • Limited information on quality assurance • Local/non-GMP quality assurance only for active product ingredient • Local/non-GMP quality assurance for the entire manufacturing process • WHO GMP certification • EU or PIC/s GMP	9.50
c. Reliability of drug supply • Major and multiple problems in the last 5 years • Minor and fairly frequent problems in the last 5 years • Single precedence of supply problems in the last 5 years • No precedence of supply problems in the last 5 years • Manufacturer is financially capable and willing to guarantee supply	9.50
d. Pharmacovigilance • No pharmacovigilance system • Qualified person for pharmacovigilance • Qualified person with a sophisticated system to collect pharmacovigilance data	7.13
e. Equivalence with the reference (original) product • No data on pharmaceutical equivalence • Pharmaceutical equivalence • Interchangeability defined based on local criteria • Bioequivalence proven based on local criteria • Bioequivalence proven based on European EMA or US FDA criteria • Therapeutic equivalence proven in clinical trial • Improvement in efficacy and/or safety based on clinical trial data	4.75
f. Stability and drug formulation • No data on product expiry or stability • Data on non-inferior product expiry or stability in local environment • Data on improved product expiry • Data on improved product stability in local environment • Data on improved product expiry and stability in local environment	4.75
2. Price criteria	52.5

The class panel discussion highlighted several findings. First, this workshop has created awareness of a method that can be beneficial in transparently and rationally selecting OPP drugs from multiple sources for the hospital formulary which is not only based on drug price, but also on other criteria that would ensure drug efficacy, safety, and quality as well as minimize drug supply shortage. Second, this MCDA method can involve many stakeholders in decision-making for OPP selection with their unique objectives, ensuring the satisfaction of the hospital's needs. Third, the Excel® tool used for the MCDA method can be adjusted according to the ever-changing needs of the hospital. This ensures the sustainability and relevance of the MCDA Excel® tool utilization in the hospital. Lastly, the participants agreed to pilot the MCDA method to develop their subsequent hospital formulary and to facilitate OPP purchasing.

The panel discussion also discussed the challenges in applying the MCDA Excel® tool. Technical training for everyone involved in using the tool is needed. Resistance to applying this tool to real-life OPP selection is also discussed since this will add complexity and burden to the process.

DISCUSSION

A workshop on the application of the MCDA method in decision-making for selecting OPP for hospital formulary in a national government hospital in Indonesia has been conducted, and the results showed an increase in awareness and interest in the method. The hospital organizers have agreed to test the MCDA Excel® tool for their OPP selection and purchasing. Evaluation of ranking and weighting of the MCDA criteria and the MCDA utilization will be conducted after the pilot testing.

In this workshop, the price criterion is the criterion with the highest weight. On the other hand, a publication from a hospital in China regarding the application of MCDA for antidiabetic agents reported the most important criterion was the quality of evidence.[11] Meanwhile, the MCDA workshop in Egypt to develop tools for purchasing off-patent oncology medicines stated that price or cost-related criteria were excluded to abide by the national regulations of the tender process and the first ranked criteria with the highest weight is "use in reference country".[7] This shows that each MCDA tool can be developed based on local settings and needs, so there may not be two identical MCDA tools. The criteria and weights differ between MCDA tools and each tool is developed for different decision-making purposes.

Hospital formulary development is a complicated process, involving multiple stakeholders with their demands and criteria,[13] and the decision-making in drug selection for hospital formulary often leads to time-inefficient discussion and is sometimes prone to subjectivity with a lack of scientific evidence utilization. Eventually, price is often used as the main driver in drug selection. This may result in reduced quality of health service, particularly in pharmacological treatment, reduced safety for patients, and eventually an increased burden on hospital resource budgeting. Furthermore, the ability to maintain adequate drug supply with appropriate product stability and expiry also cannot be ensured since these are not considered in the decision-making process. The use of the MCDA method in decision-making needed for hospital formulary development will ensure that the process is transparent, accountable, consistent, (more) objective, comprehensive, and collaborative.

There are several successful applications of the MCDA tool in the decision-making process for drug procurement. A workshop was coordinated in Thailand in 2018 with participants from drug purchasing units from hospitals, academic pharmacy education leaders, the ministry of health, pharmaceutical associations, industry

associations, and regulatory agencies, to develop an MCDA tool appropriate for decision-making in multi-source drug bidding in Thailand hospitals. The participants agreed that the MCDA approach would improve the consistency, transparency, and documentation of decisions made by multiple stakeholders, while also considering criteria and weighting relevant to local settings.[12] A case study in a large general hospital in China combined MCDA with a mini-health technology assessment (mini-HTA) tool to facilitate medical device procurement and showed that it is an efficient, rapid, objective, flexible, robust, and user-friendly tool for procurement decision-making.[14]

This MCDA workshop conducted in a national hospital showed that MCDA is a potential tool to aid in selecting OPPs, with benefits and limitations identified through the workshop. The most important benefit of the workshop is the awareness and comprehension achieved by the participants of this MCDA tool to simplify the complex tasks in drug selection, while keep considering other multiple important factors or criteria other than price.

Another advantage of the MCDA tool is that it is conducted in a way that multiple stakeholders can collaborate to propose their ideas for selection criteria. This process aggregates the various perspectives in one single tool and usually can accommodate the needs and concerns of the stakeholders.

Meanwhile, challenges identified by the discussion panel were the need for specific training in using the MCDA Excel® tool and the potential resistance in applying this tool to real-life OPP selection. Based on the workshop held, one-day training will be adequate to familiarize the stakeholders with this tool. The MCDA Excel® tool is also flexible for changes in criteria or weighting, therefore it will be more relevant to the hospital's needs. The application of this new tool in drug formulary development and drug procurement needs leadership support and routine dissemination of the benefit of MCDA methodology to reduce the resistance to using the tool. Testing this tool for OPP selection will also provide more insight into the tool and the benefit it potentially provides. The tool can be revised based on the evaluation to ensure easier use and relevance to the local hospital setting.

CONCLUSION

A workshop to introduce MCDA to facilitate selecting OPPs for the hospital has been conducted and it identified criteria, scoring, and weighting relevant to the local hospital setting. An MCDA Excel® tool was used to combine multiple criteria into an aggregate score to select OPPs for hospital formulary and drug procurement. The workshop has created awareness, interest, and understanding of the MCDA application in decision-making for OPP selection and procurement.

ACKNOWLEDGEMENTS

We would like to send our gratitude to all the staff at the National Brain Center Hospital (Rumah Sakit Pusat Otak Nasional) for participating in the workshop and PT. Abbott Indonesia for funding and facilitating the workshop.

REFERENCES

1. Thokala P, Devlin N, Marsh K, Baltussen R, Boysen M, Kalo Z, *et al.* Multiple criteria decision analysis for health care decision making - an introduction: Report 1 of the ISPOR MCDA Emerging Good Practices Task Force. Value Heal 2016; 19(1):1-13. https://doi.org/10.1016/j.jval.2015.12.003
2. Adunlin G, Diaby V, Xiao H. Application of multicriteria decision analysis in health care: A systematic review and bibliometric analysis. Heal Expect 2015; 18(6):1894-905.
3. Glaize A, Duenas A, Di Martinelly C, Fagnot I. Healthcare decision-making

applications using multicriteria decision analysis: a scoping review. J Multi-Criteria Decis Anal 2019; 26(1-2):62–83.
4. Dai Z, Xu S, Wu X, Hu R, Li H, He H, *et al.* Knowledge mapping of multicriteria decision analysis in healthcare: a bibliometric analysis. Front Public Health 2022; 10:895552. https://doi.org/10.3389/fpubh.2022.895552.
5. Brixner D, Maniadakis N, Kaló Z, Hu S, Shen J, Wijaya K. Considering multicriteria decision analysis (MCDA) simple scoring as an evidence-based HTA methodology for evaluating off-patent pharmaceuticals (OPPs) in emerging markets. Value Heal Reg Issues 2017; 13:1-6. https://doi.org/10.1016/j.vhri.2017.02.001
6. Farghaly MN, Al Dallal SAM, Fasseeh AN, Monsef NAK, Suliman EAMA, Tahoun MA, *et al.* Recommendation for a pilot MCDA tool to support the value-based purchasing of generic medicines in the UAE. Front Pharmacol 2021; 12:1–5. https://doi.org/10.3389/fphar.2021.680737
7. Elezbawy B, Fasseeh AN, Sedrak A, Eldessouki R, Gamal M, Eldebeiky M, *et al.* A multi-criteria decision analysis (MCDA) tool for purchasing off-patent oncology medicines in Egypt. J Pharm Policy Pract 2022; 15(1):4-11. https://doi.org/10.1186/s40545-022-00414-2
8. Abdullah AH, Holtorf AP, Al-Hussaini M, Lemay J, Alowayesh M, Kaló Z. Stakeholder driven development of a multi-criteria decision analysis tool for purchasing off-patent pharmaceuticals in Kuwait. J Pharm Policy Pract 2019; 12(1):1–7. https://doi.org/10.1186/s40545-019-0171-4
9. 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(1):1-12. https://doi.org/10.1186/s12913-018-3805-3
10. Laba TL, Jiwani B, Crossland R, Mitton C. Can multi-criteria decision analysis (MCDA) be implemented into real-world drug decision-making processes? A Canadian provincial experience. Int J Technol Assess Health Care 2020; 36(4):434-9. https://doi.org/10.1017/S0266462320000525
11. Bao Y, Gao B, Meng M, Ge B, Yang Y, Ding C, *et al.* Impact on decision making framework for medicine purchasing in Chinese public hospital decision-making: determining the value of five dipeptidyl peptidase 4 (DPP-4) inhibitors. BMC Health Serv Res 2021; 21(1):1-7. https://doi.org/10.1186/s12913-021-06827-0
12. Assawamakin A, Holtorf AP, Maniadakis N. Weighing price and performance for decisions for multisource pharmaceutical bidding in public hospitals in Thailand. In: Evaluation of Health Services. London: IntechOpen; 2020. https://doi.org/10.5772/intechopen.83823
13. Management Sciences for Health. Managing medicine selection. MDS-3: managing access to medicines and health technologies. Arlington, VA: Management Sciences for Health; 2012.
14. Yang C, Wang Y, Hu X, Chen Y, Qian L, Li F, *et al.* Improving hospital based medical procurement decisions with health technology assessment and multi-criteria decision analysis. Inq (United States). 2021;58. https://doi.org/10.1177/00469580211022911