

Technical Factors Influencing the Health Information System in Kosovo

Ardita Baraku¹, Naser
Ramadani^{1,2}, Roland Bal³

¹National Institute of Public Health,
Prishtina, Kosovo

²Medical Faculty, University of Prishtina
"Hasan Prishtina", Prishtina, Kosovo

³Erasmus School of Health Policy and
Management, Erasmus University
Rotterdam, Rotterdam, The Netherlands

Corresponding author: Ardita Baraku, MScPH,
MHCM, National Institute of Public Health,
Prishtina, Kosovo. E-mail: arditabaraku@yahoo.
com, ORCID ID: <http://www.orcid.org/0000-0003-4954-0086>.

doi: 10.5455/aim.2023.31.265-269

ACTA INFORM MED. 2023, 31(4): 265-269

Received: NOV 15, 2023

Accepted: DEC 18, 2023

ABSTRACT

Background: Health information systems (HIS) are considered a vital tool to strengthen Low- and Middle-Income Countries' (LMIC) health systems. Unfortunately, little is known about the technical factors of HIS in LMIC. **Objective:** This study aimed to make an empirical contribution, using the case of Kosovo to find out about HIS development, trying to identify dysfunctional areas and opportunities for improvement. **Methods:** Technical factors of the PRISM framework were analyzed via document analysis, and semi-structured interviews were held with 15 respondents from the Ministry of Health, the National Institute of Public Health of Kosovo, and the Hospital Clinical University Services of Kosovo. Interviews were transcribed and coded deductively, using the defined theoretical framework to guide the content analysis. **Results:** The results indicate that MoH considered technical factors while developing HIS in Kosovo. Nevertheless, HIS fulfills only some of the essential functions. Barriers to efficient HIS among technical factors are lengthy, time-consuming manual HIS forms, inadequate data from HIS forms for NIPHK analysis, difficulties when changing software and HIS economic operators, and the complexity of HIS functioning. **Conclusion:** Kosovo still faces technical difficulties with an efficient and sustainable HIS system. Complex processes of extensive efforts have yet to produce the desired results, which prevent evidence-based health analysis and informed decision-making in Kosovar healthcare. More research is needed into organizational and behavioral factors influencing HIS efficiency in LMIC.

Keywords: Health information systems, technical factors, developing countries, Kosovo.

1. BACKGROUND

HIS is an organized arrangement of people (health professionals and data operators), tools (technological equipment and report forms), and routine procedures (for data collection, processing, reporting, and usage) to provide and use routine health information (1, 2). Unfortunately, in low and middle-income countries (LMIC), HIS did not give the expected transparency and accountability in healthcare, disabling the calculation of health indicators and evidence-based policymaking (3). Such a situation led researchers to establish guidelines for HIS structure and components for LMIC (4). The Performance of Routine Information System Management – PRISM framework, designed for developing countries – helps define HIS determinants,

their strengths, and weaknesses in a causal pathway and enables analysis of interventions to strengthen HIS.

The updated PRISM framework, built upon the framework by Lafond and Field (5), suggests that a routine HIS contains inputs (HIS determinants), processes, and outputs, aiming at improved health system performance as an outcome and improved health status as an impact. In inputs, we find technical, organizational, and behavioral factors. In processes, we deal with the data flow. In outputs, we see data quality and meaningful information usage in decision-making (4). Technical factors involve special skills and technology to design, maintain and improve HIS process and performance, including the complexity of the reporting form, procedures, HIS design,

© 2023 Ardita Baraku, Naser Ramadani, Roland Bal

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

computer software, and IT complexity. Technical factors affect HIS performance directly or through behavioral factors (6,7). For example, if data collection forms are too complicated, indicators are irrelevant, or computer software is not user-friendly, the confidence and motivation of HIS workers will be negatively affected. Conversely, if HIS software supports proper and timely data processing and provides meaningful information for decision-making, information use will be optimal (4).

2. OBJECTIVE

This research aims to make an empirical contribution, to HIS development in LMIC. Existing research shows that these countries face difficulties with HIS due to the complex structure of their health organizations (8), fragmented and disconnected HIS parts (9), impractical goals (10), and the uncertainty of social, economic, and political environments (11), therefore each developing country needs to establish its HIS design based on its government, population and health system surroundings (12). Taking this perspective, it is imperative to analyze how the HIS is developed within the country context. More specifically, the study seeks to apply the updated PRISM framework to investigate technical factors of HIS development in Kosovo and explore the ability of the system to provide valuable and meaningful healthcare information by: a) describing the HIS development, b) describing the barriers related to HIS data collection and reporting, and c) evaluating the HIS design and providing recommendations for further improvement.

The research will: 1) expand the relatively limited body of knowledge on HIS development in LMIC; 2) inform future policy-making regarding HIS design in Kosovo; and 3) indirectly, by specifying HIS limitations and improvement options, the research will enhance healthcare monitoring and quality in the country.

3. MATERIAL AND METHODS

Study design

This qualitative research uses the case of Kosovo to describe HIS development in LMIC. Document analysis and interviews with purposefully selected participants and knowledgeable actors of HIS in Kosovo enabled an insider perspective on HIS functioning and difficulties with producing relevant information for healthcare decision-making.

Organization and respondents

The research was conducted in the Ministry of Health of Kosovo (MoH), the National Institute of Public Health of Kosovo (NIPHK), and the University Hospital and Clinical Services of Kosovo (UHCSK). MoH and NIPHK are central-level governmental organizations, while UHCSK is a tertiary-level institution (see below), the biggest provider of public healthcare services. Fifteen respondents were selected based on one or more of the following characteristics: direct experience with HIS development, management working position requiring data usage, and/or working position requiring HIS use. Written permissions were obtained from the organizations to interview their staff, and informed consent from each participant. The interviews aimed to understand the challenges in HIS development in providing data and supporting the central policy-making level.

Data collection methods

Data were attained through document analysis of legislation, strategies, reports, and other writing found online from open sources or provided by the respondents in Albanian and English. Further, semi-structured individual interviews occurred between June – August 2020, online via Zoom's platform in the respondents' native language, and were audio-recorded. Respondents were provided electronically with the consent form, and all confirmed their willingness to cooperate at the beginning of the interview. Each interview involved previously prepared open-ended questions to allow discussion with the respondents and obtain their perception of the research questions; HIS development and design, data collection and analysis barriers, and to clarify their view of the opportunities to improve HIS in Kosovo, with a focus on pediatric and gynecological services. In addition to the interviews, and only when substantially relevant to the research results, the authors used personal experience and knowledge gained through many years of serving in the Kosovar healthcare system.

Data analysis

All interviews were transcribed and translated into English. Further, they were analyzed to extract noteworthy statements and formulate meaning. A deductive coding system guided data analysis and answered research questions based on the defined framework.

Validity and reliability

Precise and verifiable record-keeping and data triangulation ensured the internal validity of the research. The external validity was ensured by discussing the findings with sample participants to ensure they understood and accepted them. Reliability was ensured by preserving all the documents, the main field notes, audio recordings, and transcripts. Confidentiality requirements were addressed by protecting the identity of the respondents. Risk to the validity and reliability involved accurate translation and interpretation from the native language into English, which was addressed by checking back the interview records while translating and using a professional interpreter service (13). In addition, sample member checks were made to verify if the respondents could recognize themselves in the analysis.

4. RESULTS

Health services in Kosovo are organized at primary, secondary, and tertiary levels. The public healthcare sector consists of 449 facilities providing primary healthcare at the municipal level, while secondary and tertiary services are provided by the Hospital University Clinical Services of Kosovo (HUCSK), spread over seven central geographical regions of the country. The private sector has 1,657 licensed outpatient clinics and 28 hospitals (14). Because of political reasons, medical facilities in 10 municipalities with Kosovar-Serbs minority by large do not participate in the Kosovar Health System (15).

Analysis of technical factors of HIS in Kosovo

After the war, healthcare in the Kosovo system faced numerous difficulties where "a lack of necessary and sufficient data from HIS was vital, as it hindered serious analysis and planning in public health" (respondent#1). Furthermore, rapid technological developments required the moderniza-

tion of services, increasing health personnel skills to work with data, and improving legal and technical infrastructure of fragmented data “as many healthcare organizations gave themselves a right to develop their systems” (respondent#2). Two decades later, HIS functions in public healthcare institutions, it is fragmented, not integrated, and does not follow the patient pathway in the healthcare system

a) HIS design

This part will describe the involvement of foreign experts in designing HIS, the extent of inputs by national professionals and their consideration by MoH, and the most recent HIS design.

Several times, MoH created working groups to define HIS design. The groups, especially in the past, often included international experts. “NIPHK was always a part of those groups. Sometimes our voice was heard, sometimes not – as happens in other issues too” (respondent#2). For example, in March 2000, a two-week pilot of a new HIS aimed to test the data collection system in Kosovo by taking a snapshot of morbidity, drug use, doctors’ workload, and health facilities. The study was designed by WHO/UNMIK experts Leticia Fernandez and Ileana Castaneda, collaborating with the national expert Prof. Dr. Enver Baraku, Chief of the Social Medicine Department at NIPHK (16). While there is no information on the level of input by the national expert, this shows the joint work of international and national experts for HIS design in Kosovo. Another example comes a year later when a recommendation from a German expert resulted in a decision to initiate a semi-computerized HIS. The national experts agreed with the proposal: “We did not have enough trained staff to use computers, and the internet network was unavailable as it is now” (respondent#3).

A different experience emerged in 2012, when 15 working groups of mainly national experts worked on designing a new HIS software component, aiming to define the patient flow in the healthcare system. This pilot design was planned to be implemented in the Gynecology and Pediatrics Clinics of the HCUSK, among others (respondent#11). The proposal went to the supporting international agency LuxDev. “While watching the design presentation, it appeared to be very good, too good to be true” (respondent#6). However, this design was not put to life, nor were the working group members informed that the software had changed. “Only due to private interaction with health professionals did I realize that what we had worked on was not presented in that software, and I cannot tell why” (respondent#11).

As of 2018, the new Basic HIS (BHIS) system was designed for primary care. The decision-making team examined practices and mishaps from Finland, Estonia, and Lithuania, and countries of the region – Serbia, Montenegro, North Macedonia, and Albania – while designing HIS. This system has addressed patients’ follow-up within the health system, enabling the doctor to automatically identify previous patient visits for primary and ambulatory healthcare. In addition, the system identifies the patient by citizen number. Unfortunately, “this system is still being installed throughout primary healthcare organizations and is not available for inpatient care, while the Covid-19 pandemic has seriously influenced the speed of the process” (respondent#4).

b) Computer software

Changes in HIS design also caused changes in the HIS software over the years. Initially, Access software was being used, and later, Avicenna software. A new web-based application for primary healthcare, Basic HIS, is being distributed (respondent#4). “It is simple, only 14 indicators, and not so costly” (respondent#13). These changes are perceived to be caused by a lack of understanding among high-level decision-makers in healthcare. “Every time a high-level manager would change, we would waste 5-6 months until they would understand the issue. As a result, it was always easier for them to spend money to develop a new HIS instead of maintaining, updating or customizing the current one” (respondent#15).

The additional problem presented the end of contracts with the economic operator providing software design, installation, and maintenance services. Issues, such as inadequate budget planning, delay of procurement procedures, and non-transferability of HIS software source codes from one operator to another, would arise. In addition, once contracted, the new operator would start designing a new software from the beginning, causing data loss or poor data transfer from the previous software. “Working with data was always temporary; as soon as the contract ended, the data couldn’t be used anymore” (respondent#2), which caused severe breaks in data and thus the possibility to analyze data over time.

c) IT complexity

This part presents the IT network, personnel needed and trained, institutions involved, functional domains of HIS, and the current changes in the HIS system.

The HIS system in Kosovo consists of the hardware infrastructure (HIS workstations, LAN, WAN connection, and Data center infrastructure) and related software (and its integration with external registries). All HIS workstations for health personnel consist of 1 zero-client connected to the Data Centre through LAN infrastructure destined for HIS and managed by the Network Operating Centre, a part of the HIS Department at MoH. In addition, all HIS workstations have access to a nearby printer. There is one workstation for each category, every two doctors, every five nurses, and every six administrative staff. Despite all of the network, in 2017, not all public healthcare organizations had the necessary IT supplies, software, and HIS system installed (17,18), and the situation hasn’t changed so much since, because of the diminished activities during the years of the COVID-19 pandemic

Three other institutions are involved with HIS implementation: the Ministry of Public Administration manages and oversees the implementation of IT projects in public institutions; the Agency of Civil Registration is the owner and administrator of civilian data; while the National Agency for Personal Data Protection is an independent state institution responsible for overseeing the legitimacy of the processing of personal data. These institutions signed an agreement with MoH in 2015 and 2019 to create operating procedures and harmonize activities enabling health data analysis and reporting (19).

There are 16 HIS domains: none is fully implemented, and six are partially implemented (Admission, release, and transfer of patients; Inpatient, outpatient, and emergency care; Electronic medical record; Identity and access management; Medicine Registry, and Catalogue of procedures and laboratory) and ten are uncompleted (Patient relation-

ship management; Medical treatment and planning; Health professionals Registry; Healthcare organizations Registry; Patients Registry; Diagnostic catalog; Billing support; Personnel scheduling and planning; Acceptance/approval management; and Medical statistics and public health reporting system). Based on these domains, there are 120 different sub-functional operations listed. The access to these various operations is not clearly defined – the same person in other clinics may have access to multiple functions. Responsibility to backup data is given to the contracted company, but the HIS department in MoH does not know if this was being done (19). Current HIS design is functional in most primary healthcare organizations and some outpatient specialistic services in hospital care. It uses virtual technology, meaning there are no computer boards, only keyboards, mice, and monitors, while everything else is taken from the central server. In addition, the system is based on a hierarchy of users, meaning that health professionals can access their patient data while health managers can derive data only based on their access rights and job description (respondent#4).

d) The complexity of the reporting form and procedures

There are eight mandatory forms for data collection in HIS: Health Sheet (HS-001), Birth Sheet (HS-002), Infant sheet (HS-003), Malign disease sheet, Massive contagious disease sheet, Massive non-contagious disease sheet, Dental sheet, and Pharmaceutical sheet (20). The first three forms were of interest for our research, focused on gynecology and pediatrics: HS-001 registers any medical service/consultation for mother and child health; HS-002 records the data of a mother that has given birth, while HS-003 records the data of a newborn. Health personnel completes all three forms manually. However, health personnel must also fill out other documents requested by the Agency of Statistics in Kosovo (ASK): DEM-1 and DEM-2 forms. DEM-1 form has four sheets: Medical report for birth (for healthcare organization), Statistical Sheet for Birth (for ASK), Medical Certificate of Birth (for a municipality), and Medical Certificate of Birth (for parents of a newborn). DEM-2 form also has four sheets, named similarly and destined for the same organizations, but these forms register a death instead of birth. Instructions on the sheets require that both documents are completed manually and in capital letters (17). To illustrate the burden of health personnel with these forms, when a baby is born, forms HS-002, HS-003, and four sheets of DEM-1 are the minimal possible forms that need to be completed manually.

Manually registered health data are sent to the HIS unit of the healthcare organization to be entered into the computer software. Since the NIPHK often has no access to the software (respondent#3), monthly, the data follow the hierarchy of healthcare organizations, from the lowest to the highest level, to get to the NIPHK, usually employing Excel sheets saved in memory sticks or sent via e-mail. NIPHK requires data for five areas: healthcare organizations' network, human resources, morbidity, in-hospital mortality, and activities of healthcare organizations. "A part of the data gets exported to ASK while demographic data is imported from them to publish yearly population health analyses" (respondent#2).

Reporting forms and procedures do not enable data analysis. For example, DEM-2 forms do not include specifics for maternal deaths; therefore, NIPHK cannot analyze maternal

mortality (respondent#5). Also, "incidence or specific morbidity cannot be calculated from the "midnight statistics" – a document prepared daily by each ward and clinic to show the inpatient numbers and some morbidity-related information – because the data are not associated with the patient's name" (respondent#2). Furthermore, this reporting form and procedures result in reporting delays of six months or longer; problems with data coverage, relevance, and validity, while aggregations of the same data provide varying results (respondent#2).

5. DISCUSSION

This qualitative research focused on HIS development and functioning in Kosovo, as a case study for LMIC, to discover if the current HIS design responds to the needs of the healthcare system by concentrating on technical factors, as listed in the PRISM framework, and asking about HIS development, barriers to HIS data collection/reporting, and evaluating the HIS design to provide recommendations for further improvement.

The results indicate that MoH gave importance to technical factors in HIS development in Kosovo. MoH had an understanding that electronic HIS is necessary. Therefore, it regulated the HIS forms and reporting procedures, acquired international expertise to support HIS development, cooperated with national stakeholders, and developed several software systems in searching for the best fit. Despite the time and investments, HIS does not fulfill its essential functions, and numerous issues heavily influence HIS sustainability. Barriers facing HIS efficiency, among technical factors, are lengthy and time-consuming manual HIS forms, inadequate data from HIS forms for NIPHK analysis, fragmented HIS unavailable in all levels of healthcare, and opting out for new software instead of improving existing one, without weighting the impact or consequences of such decision, changes of software systems, and the mere complexity of HIS functioning.

Other researchers in developing countries have also found that technical barriers can limit HIS use (21) and hinder rapid access to relevant healthcare information (22). At the same time, software upgrades can improve the system quality (23), increase HIS utilization, provide better healthcare outcomes (24) and enhance health decision-making based on valid quality data (25). In addition, national context, collaboration with national experts, and locally meaningful health data were considered important for successful HIS (21).

The PRISM framework provided the theoretical structure guiding this research and helping sort out the gathered data. The framework also points out that providing technical resources is only a precondition to HIS efficiency, as technical factors directly or through behavioral factors impact HIS processes. Further, the framework helps identify relevant barriers among technical factors that affect HIS efficiency. Finally, the framework identifies the necessary actions to strengthen HIS in Kosovo.

However, the framework was not suitable for describing events retrospectively. Instead, it appears to be more convenient for taking a snapshot of the situation. It is undoubtedly not the ideal framework for an unstable environment with frequent changes in strategic directions. Other study limitations include personnel fluctuation, causing the loss of institutional

memory, and the COVID-19 pandemic, which limited the physical search of the archives for more detailed information.

The recommendations for further research would be to research organizational and behavioral factors of the framework to gain more detailed insight into people and culture's roles in HIS development. Developing a HIS framework for unstable outer environments would also be recommended. The practice recommendations are to develop a long-term HIS governmental strategy together with people knowledgeable of the functioning of the healthcare system and link it with several short-term strategies which should minimize and simplify the technical HIS requirements: simple forms with useful data, with the most suitable procedure for data collection, reporting, and analyzing.

6. CONCLUSION

More than two decades after the war, Kosova faces technical difficulties with an efficient and sustainable HIS system. So far, complex processes of extensive efforts have not produced the desired results nor met the expectations, which prevents evidence-based health analysis and informed decision-making in Kosovar healthcare.

- **Declaration of patient consent:** The authors certify that they have obtained all appropriate participant consent forms.
- **Author's contribution:** A.B. and R.B. contributed substantially to the conception and design of the work or in the acquisition, analysis, or interpretation of data for the work. A.B., N.R. and R.B. had a part in the article preparing for drafting or revising it critically for important intellectual content. A.B., N.R. and R.B. gave final approval of the version to be published and agreed to be 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.
- **Conflicts of interest:** There are no conflicts of interest.
- **Financial support and sponsorship:** None.

REFERENCES

1. AbouZahr C, Boerma T. Health information systems: the foundations of public health. *Bull World Health Organ.* 2005;83(8):578–83. PMID: 16184276.
2. Kimaro HC, Mengiste SA, Aanestad M. Redesigning health information systems in developing countries: The need for local flexibility and distributed control. *Public Administration and Development: Int J Manag Res Pract.* 2008;28(1):18–29. <https://doi.org/10.1002/pad.473>.
3. Berisha M, Miftari-Basholli F, Ramadani N, Gashi S, Hoxha R, Kocinaj D. Impact of the national population register in improving the Health Information System of malignant diseases in Kosova. *Acta Inform Med.* 2018;26(1):62–66. doi: 10.5455/aim.2018.26.62-66.
4. Aqil A, Lippeveld T, Hozumi D. PRISM framework: A paradigm shift for designing, strengthening and evaluating routine health information systems. *Health Policy Plan.* 2009;24(3):217–28. doi: 10.1093/heapol/czp010.
5. Lafond A, Field R. The PRISM. Introducing an analytical framework for understanding performance of routine health information system. RHINO Second International Workshop, September 20–October 4, Eastern Cape, South Africa; 2003.
6. Nsubuga P, Eseko N, Wuhib T, Ndayimirije N, Chungong S, McNabb S. Structure and performance of infectious disease surveillance and response, United Republic of Tanzania, 1998. *Bull World Health Organ.* 2002;80(3):196–203. PMID: PMC2567741.
7. Rotich JK, Hannan TJ, Smith FE, Bii J, Odera WW, Vu N, et al. Installing and implementing a computer-based patient record system in sub-saharan Africa: The Mosoriot Medical Record System. *J Am Med Inform Assoc.* 2003;10(4):295–303. doi: 10.1197/jamia.M1301.
8. Littlejohns P, Wyatt JC, Garvican L. Evaluating computerised health information systems: Hard lessons still to be learnt. *BMJ.* 2003 Apr 19;326(7394):860–3. doi: 10.1136/bmj.326.7394.860.
9. Chilundo B, Aanestad M. Negotiating Multiple Rationalities in the Process of Integrating the Information Systems of Disease-Specific Health Programmes. *Electron J Inform Sys Dev Countries.* 2004; 20(2): 1–28. <https://doi.org/10.1002/j.1681-4835.2004.tb00129.x>.
10. Heeks R. Failure, Success and Improvisation of Information Systems Projects in Developing Countries. SSRN Electronic Journal. 2002, Development Informatics Working Paper no. 11. <http://dx.doi.org/10.2139/ssrn.3477762>.
11. Braa J, Hedberg C. Developing District-based Health Care Information Systems: The South African Experience. *The Information Society: An International Journal.* 2001;18(2):113–27.
12. Lippeveld T, Sauerborn R, Bodart C. Design and Implementation of Health Information systems. 2000 [cited 2020 Feb 29]. <https://apps.who.int/iris/handle/10665/42289>
13. van Nes F, Abma T, Jonsson H, Deeg D. Language differences in qualitative research: Is meaning lost in translation? *Eur J Ageing.* 2010;7(4):313–316. doi: 10.1007/s10433-010-0168-y.
14. National Institute of Public Health of Kosova. Analysis of population health status and healthcare system 2020 [In Albanian]. Prishtina, Kosova; 2022.
15. Gashi F. Parallel health care system continues to operate in northern Kosova. *Prishtina Insight [Internet].* 2019 [cited 2023 Apr 7]. Available from: <https://prishtinainsight.com/parallel-health-care-system-continues-to-operate-in-northern-Kosova-mag/>
16. Ministry of Health Kosova. Administrative Instruction 11/2013 on Health Information System and reporting health data. 2013. Official Gazette of the Republic of Kosova. Available from: <https://gzk.rks-gov.net/ActDetail.aspx?ActID=9888>
17. Ministry of Health Kosova. Monitoring and evaluation manual of the Health Sector Strategy 2017-2021 [In Albanian]. 2017. Prishtina, Kosova.
18. Kosova Health Talks 22 [Internet]. 2000 [cited 2023 April 25]. Available from: <https://reliefweb.int/report/serbia/Kosova-health-talks-22>
19. Ministry of Health Kosova. Health Sector Strategy 2017-2021. 2016. Available from https://kryeministri.rks-gov.net/wp-content/uploads/2022/07/Strategjia_sektoriale_e_shendetesise_final-mentor_2016_ENG.pdf
20. National Audit Office. Efficiency and effectiveness in implementing unified and integrated health information system, Performance audit. 2017. Prishtina, Kosova. Available from: <http://zka-rks.org>
21. Bagherian H, Sattari M. Health information system in developing countries: A review on the challenges and causes of success and failure. *Med J Islam Repub Iran.* 2022;36(1). doi: 10.47176/mjiri.36.111.
22. Mohamadali NA, Faizah N, Aziz A. Technology factors are barriers to sustainable health information systems (HIS)-a review. *Procedia Computer Science [Internet].* 2017;124:370–378. <https://doi.org/10.1016/j.procs.2017.12.167>.
23. Abbasi Moghadam MA, Fayaz Bakhsh A. Hospital information system utilization in Iran: a qualitative study. *Acta Med Iran.* 2014;52(11):855-9. PMID: 25415820.
24. Mohd Salleh MI, Zakaria N, Abdullah R. The influence of system quality characteristics on health care providers' performance: empirical evidence from Malaysia. *J Infect Public Health.* 2016;9(6):698–707. doi: 10.1016/j.jiph.2016.09.002.
25. Masic I. Medical decision making - an overview. *Acta Inform Med.* 2022;30(3):230. doi: 10.5455/aim.2022.30.230-235.