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ASSESSMENT OF THE IMPLEMENTATION STATUS OF MEDICAL INFORMATION SYSTEMS IN PHARMACY INSTITUTIONS OF UKRAINE BASED ON THE RESULTS OF A QUESTIONNAIRE SURVEY

Alla Kotvitska, Iuliia Korzh, Serhii Smerechuk, Alina Volkova, Liubov Tereshchenko

Digital transformation of the healthcare system is one of the key areas of reforming the sector in Ukraine and involves the active implementation of an electronic healthcare system and medical information systems in the activities of pharmacy institutions. However, along with the regulatory technical requirements for the functioning of medical information systems, the issue of their practical effectiveness from the perspective of direct users – pharmaceutical workers – remains insufficiently researched.

The aim of the work. T*o assess the status of the implementation and functioning of MIS in pharmacy institutions in Ukraine based on the results of a questionnaire survey of specialists involved in their use in practical activities.*

Methods. *A descriptive cross-sectional questionnaire survey was applied with a combination of normative and user-oriented approaches. The survey was conducted among 76 pharmacy specialists. The results were processed using descriptive statistics, comparative analysis, and qualitative interpretation.*

Results. *It was established that the implementation of medical information systems in pharmacies in Ukraine is at the stage of formed basic integration with the electronic health care system and ensures the implementation of key digital processes, in particular work with electronic prescriptions. The uneven implementation of individual functional modules, the fragmentation of administrative and accounting functionality, as well as the heterogeneity of the level of technical support were revealed. Most respondents supported the need for further expansion of the functionality of medical information systems and the implementation of a comprehensive multi-criteria approach to assessing their effectiveness.*

Conclusions. *The results obtained justify the feasibility of further unification and standardization of the functionality of medical information systems, as well as the development of a single methodology for assessing their effectiveness for pharmacies in Ukraine, considering technical, organizational, information and communication, social and economic criteria*

Keywords: *electronic health care system, medical information systems, pharmacy, electronic prescription, medicinal product, pharmaceutical care, reimbursement, technical requirements, questionnaire survey, assessment of the effectiveness of systems*

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1. Introduction

In the context of modern global challenges, the digital transformation of healthcare systems is considered at the international and national levels as a strategic direction of development, focused on increasing the level of accessibility, efficiency and quality of medical and pharmaceutical care to the population. The leading role in shaping these approaches is played by strategic documents of the World Health Organization (WHO), in particular the Global Strategy on Digital Health 2020–2025, which defines priorities for the development of digital health, including the formation of a sustainable digital infrastructure, ensuring the interoperability of information systems and the integration of digital tools into the processes of management and provision of medical and pharmaceutical care to the population. WHO emphasizes that the implementation of digital solutions should be based not only on technological innovations, but also on effective governance, human resource development and systematic evaluation of the results of their practical application [1]. In pharmacy, digital transformation is seen as a long-term trend that changes the organization of services and strengthens the role of digital tools in increasing the accessibility and efficiency of pharmaceutical care [2].

In Ukraine, a two-component electronic health care system (EHS) has been formed, within which interaction with the central database (CDB) is carried out through medical information systems (MIS), which act as an intermediate link between users and the central component of the system. Such an architecture ensures continuous information interaction between the doctor (health care institution), the patient, and the pharmacist (pharmacy, PH) through a tool such as the electronic prescription (eRx) [2, 3].

The results of the generalization of international experience emphasize that the effectiveness of the electronic prescription is determined not only by the availability of a digital channel, but also by the combination of functional and technical requirements, data interoperability, and support for key stakeholder workflows [4].

A practical implementation of this interaction is the activity of pharmacies integrated into the eHealth system via medical information systems (MIS), through which contracts are concluded with the National Health Service of Ukraine (NHSU) under the "Affordable Medicines" program, and medicines and medical devices are dispensed based on eRx [5]. According to NHSU data, in 2024 more than 1.5 million electronic prescriptions were dispensed, indicating the active implementation of digital services in pharmaceutical practice [6].

At the same time, official sources mainly focus on the legal and technological aspects of the functioning of the eHealth system, leaving aside a comprehensive assessment of the quality and efficiency of pharmacy MIS from the perspective of end users, in particular pharmaceutical professionals.

The experience of countries with advanced healthcare systems, including the United Kingdom, the United States, and Australia, confirms the need for deeper integration of MIS into pharmacy practice as part of the digital transformation of healthcare [7–10]. Within the concept of the "connected community pharmacy," it has been demonstrated that integrated pharmacy MIS, connected to electronic health records and national digital health infrastructure, contribute to improving the continuity and quality of pharmaceutical care. Pilot projects implemented in the United Kingdom, in which pharmacies (PH) were granted full read–write access to shared electronic medical records, demonstrate an increase in the level of coordination between physicians and pharmacists, as well as in the quality of pharmaceutical care provided [9]. Similar results were obtained in Australia, where the integration of electronic health records and electronic prescriptions (eRx) into pharmacy practice changes the role of pharmacists in pharmacotherapy management, while also revealing both benefits and organizational and technical challenges [10].

Systematic reviews also show that, for the successful implementation of eRx in pharmacies, critical factors include information quality, interoperability, workflow design/support, and the availability of technical support [11].

At the same time, recent studies indicate a limited number of works devoted to analyzing the impact of MIS on pharmacy activities and the work of pharmaceutical professionals, as well as a lack of empirical data on the consequences of implementing electronic prescriptions (eRx) and other digital services [12]. For Ukraine, this issue is particularly relevant, as existing publications mainly address general aspects of pharmacy digitalization or the organization of the eHealth system [13, 14], while a systematic assessment of the implementation and functioning of pharmacy MIS, taking into account the experience of end users, is presented only in a limited number of studies.

Publications analyzing pharmacists' experience in the context of eRx implementation emphasize the need to combine technological readiness, user training, and organizational support as prerequisites for the sustainable implementation of the eHealth system [15].

Given the active development of the eHealth system in Ukraine, the implementation of electronic prescribing and dispensing of medicines and medical devices, as well as adaptation to international practices, a systematic assessment of the quality of MIS functioning in pharmacies becomes particularly relevant.

The aim. To assess the state of implementation and functioning of MIS in pharmacies of Ukraine based on the results of a questionnaire survey of specialists directly involved in their implementation and use in practical activities.

2. Research planning (methodology)

The study was conducted as a descriptive cross-sectional questionnaire survey. The methodological approach combined a normative-oriented perspective (compliance with technical requirements (TR) within the eHealth system) and a user-oriented perspective (professional assessments of specialists), which made it possible to evaluate both formal compliance and the practical applicability of pharmacy MIS. This approach is consistent with international reviews that consider eRx as a system requiring the simultaneous consideration of functional requirements, technical characteristics, and support for real-world workflows [4, 16].

The questionnaire was developed based on an analysis of current regulatory and legal acts (RLA) and technical requirements for MIS, considering practical scenarios of pharmaceutical professionals' work during eRx dispensing. Prior to the main data collection phase, the questionnaire was piloted in a group of specialists in order to refine the wording of the questions and improve the content validity of the instrument.

A purposive sampling method was used to form the study sample. Pharmacy specialists with experience in direct participation in the implementation, support, or organization of MIS operations were invited to participate in the survey. The survey was conducted online using the Google Forms service. The questionnaire included single-choice and multiple-choice questions, as well as rating scales based on a 5-point Likert scale. Participation in the survey was voluntary; respondents provided informed consent, and no personal data were collected, ensuring the anonymity and confidentiality of the responses.

During the study, the organizational conditions for the implementation of pharmacy MIS were assessed, including compliance of the main modules with technical requirements (TR), the level of quality and technical support, the status of regulatory support, and directions for further functional development. The structure and main stages of the study on the effectiveness of MIS functioning in pharmacies in Ukraine are presented in Fig. 1.

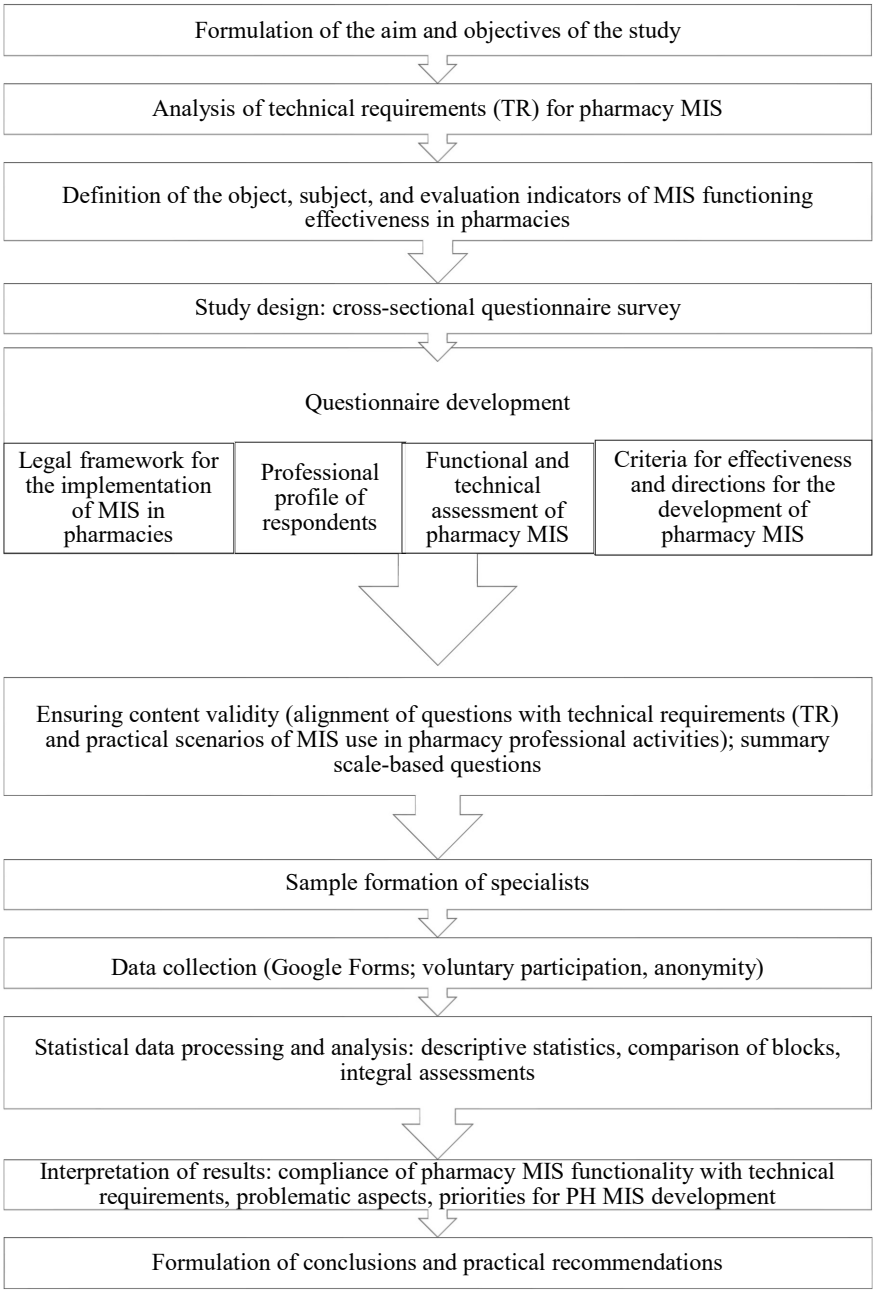

Fig. 1. Structure and main stages of the study on the assessment of the effectiveness of pharmacy MIS functioning in Ukraine

3. Materials and methods

The study materials included scientific publications devoted to the implementation and functioning of pharmacy MIS in pharmaceutical practice, current regulatory and legal acts (RLA) governing the operation of MIS in pharmacies, as well as the results of the authors' own survey.

Selection of survey participants was carried out using a purposive (targeted) sampling method, considering their professional competence and practical experience in the implementation and operation of MIS in pharmacies, which ensured the validity of the obtained results.

The survey was conducted in September 2025 in an electronic format using the Google Forms service. The questionnaire consisted of 26 questions and was aimed at assessing organizational, technical, regulatory, and service aspects of MIS functioning. In total, 76 completed questionnaires were obtained. The largest share of responses was provided by pharmaceutical staff of the "Med-Service" pharmacy chain – 18 respondents (24% of the total number of respondents) and the "Bazhaiemo Zdorovia" pharmacy chain – 11 respondents (14%) (Fig. 2).

The sample structure by position showed that pharmacy managers accounted for 51.9% of respondents, IT department representatives / MIS specialists – 23.4%, pharmacists – 15.6%, pharmacy assistants – 5.2%, and other positions – 3.9%. It was found that 71.8% of respondents had more than five years of professional experience, which allows the formed sample to be considered sufficient for generating well-grounded professional judgments.

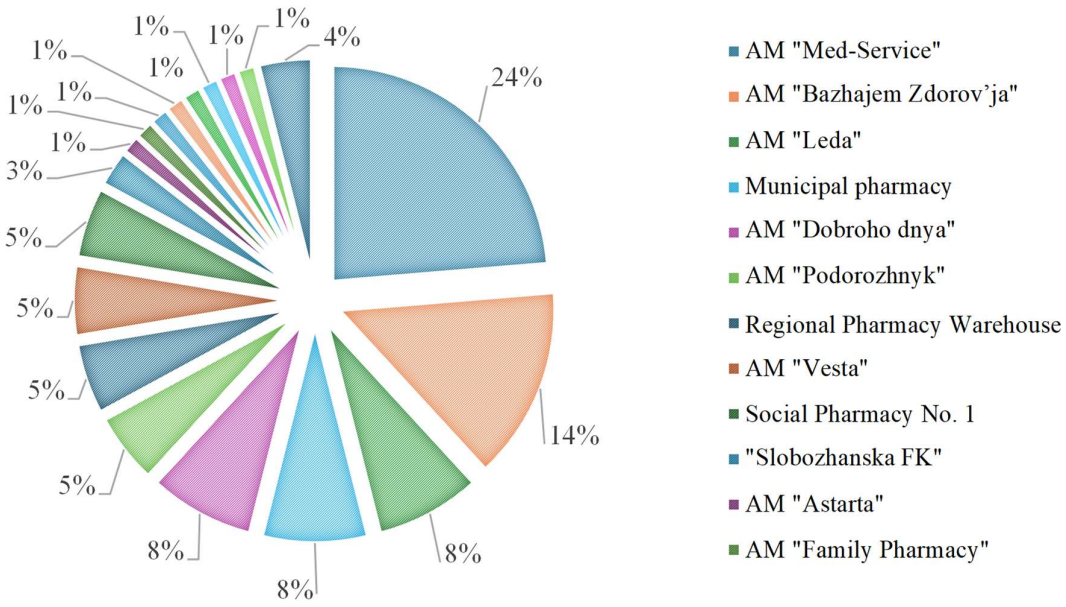

Fig. 2. Distribution of respondents by pharmacy chain

During the preparation and execution of the study, a set of methods was used, including general scientific methods (analysis, synthesis, generalization), theoretical methods (structural and system analysis), as well as practical empirical methods (questionnaire survey as the main empirical data collection tool). Data processing was carried out using descriptive statistics and comparative analysis methods.

Participation in the study was voluntary. Before completing the questionnaire, all respondents were informed about the aim of the study, participation conditions, and the assurance of anonymity and confidentiality of the obtained data, and provided informed consent to participate in the survey. No personal data were collected.

4. Research results

In the process of processing the survey results, one of the objectives was to determine whether pharmacies have a designated responsible person for the implementation and further functioning of MIS, since this specialist ensures proper organizational coordination and continuity of digitalization processes. The results showed that in 80.8% of pharmacies, management has officially appointed a responsible person for the functioning of pharmacy MIS, whereas in 19.2% such a position is formally absent.

Analysis of respondents' answers showed that among the appointed responsible persons, specialists with a pharmaceutical education prevail (85.9%), while 10.9% have IT or technical education, 1.6% have medical education, and 1.6% have economic education.

At the next stage of the study, the criteria that, according to specialists, should be considered when selecting pharmacy MIS were systematized and defined (Fig. 3).

Analysis of responses to the question regarding the priority characteristics of pharmacy MIS showed that respondents prefer a comprehensive approach. Thus, 71.8% selected the option "all of the above," meaning they consider it necessary to simultaneously take into account key criteria such as a convenient and user-friendly interface, absence of system failures (system reliability), compliance of PH MIS technical characteristics with current regulatory and legal acts requirements, integration with the pharmacy accounting system, as well as the cost of using the software product.

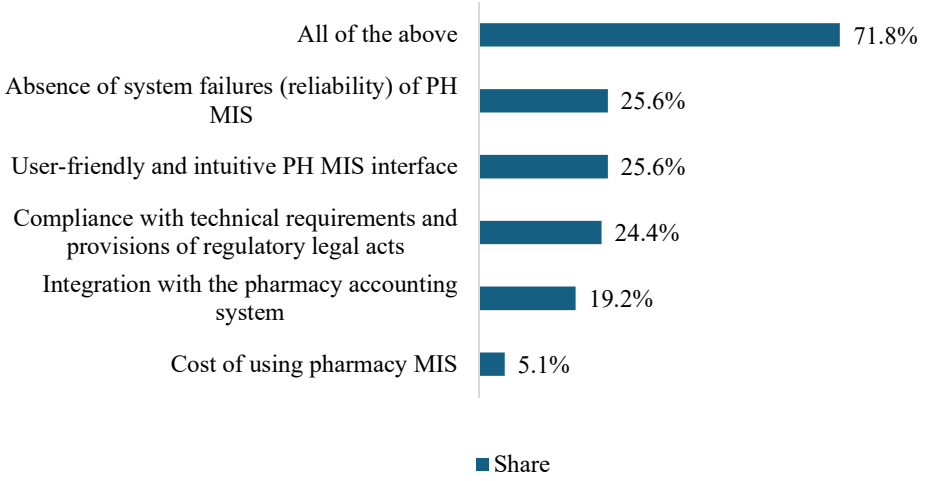

Fig. 3. Distribution of respondents' answers to the question: "Which criteria, in your opinion, are important when selecting pharmacy MIS?"

The subsequent stage of the study involved determining the extent to which MIS used in pharmacies comply with specific provisions of the technical requirements as set out in the order of the National Health Service of Ukraine (NHSU) No. 307 dated 17.04.2025 [17]. Initially, questions concerned the "Pharmacy Administrative Module" section.

To the question "Does the MIS allow adding/editing information about licenses, including the designation of primary (retail sale of medicinal products) / secondary (activities involving controlled substances or others) status?", only 59.0% of respondents answered "Yes", while in 41.0% of pharmacies this functionality is absent.

A more favourable situation was observed regarding the maintenance and updating of information on structural

units within pharmacy MIS. To this question, 71.8% of respondents indicated that their MIS allows creating and editing units with specification of pharmacy information (address, GPS coordinates, contact phone number, and working hours), however in 28.2% of pharmacies this functionality has not yet been fully implemented.

At the same time, in response to the question "Does the pharmacy MIS (PH MIS) provide the function of registering pharmaceutical professionals with subsequent assignment to the corresponding structural units?", the vast majority (88.5%) responded positively, while 11.5% gave negative responses.

Regarding the possibility of verifying pharmacists' data through state registers (State Tax Service (STS), Civil Status Registration Office (CSRO)), 85.9% indicated such a possibility, which reflects an overall high level of compliance with requirements for personnel identification and authorization.

In response to the next question, 87.2% of respondents reported the availability in pharmacy MIS of a function for viewing and monitoring the status of submitted applications for concluding contracts with the National Health Service of Ukraine (NHSU), whereas 12.8% do not have access to such a tool.

The most problematic function proved to be the control of compliance with obligations of individual pharmacies (under reimbursement agreements for medicines and medical devices. Thus, 65.4% of respondents indicated that this function is fully implemented, 24.3% reported partial implementation, and 10.3% noted a complete absence of the corresponding functionality.

Next, an analysis was conducted of the compliance of pharmacy MIS (PH MIS) with the technical requirements section "Requirements for accounting of electronic prescriptions for medicinal products (MP) in pharmacies (PH)". The aim was to determine whether PH MIS ensure the full representation of the key electronic prescription (eRx) attributes necessary for proper dispensing of medicinal products, prescription monitoring, and participation of pharmacies in reimbursement programs. The obtained results demonstrated that the implementation of these requirements varies significantly across different PH MIS. Thus, 64.1% of respondents selected the option "all of the above," indicating that the majority of pharmacies assess their MIS as fully compliant with the stated requirements (Fig. 4). It was found that data reflecting prescriptions (signature text, daily and single dose, start and end dates of treatment course, and the program under which the prescription was issued) are in many systems either absent or presented only partially.

In the context of e-prescribing, the completeness and standardization of prescription attributes are of crucial importance: a review of pharmacists' reports on incidents related to e-prescriptions demonstrates typical data quality issues, particularly regarding instructions and the quantity of prescribed medicinal products [18].

The results of the assessment of pharmacy MIS compliance with technical requirements regarding the display of the list of prescription medicinal products during eRx dispensing are presented in Fig. 5. The majority of respondents indicated that their PH MIS support the key requirements of this section, which overall reflects a positive development of system functionality. At the same time, uneven implementation of individual components was identified. In particular, the most important elements for practical use are the display of trade names of MP for eRx redemption and reimbursement data (reimbursement amount and patient co-payment), whereas less consistently supported features include extended packaging characteristics, minimum dispensing quantity of MP, and reimbursement register attributes (registration number and validity period).

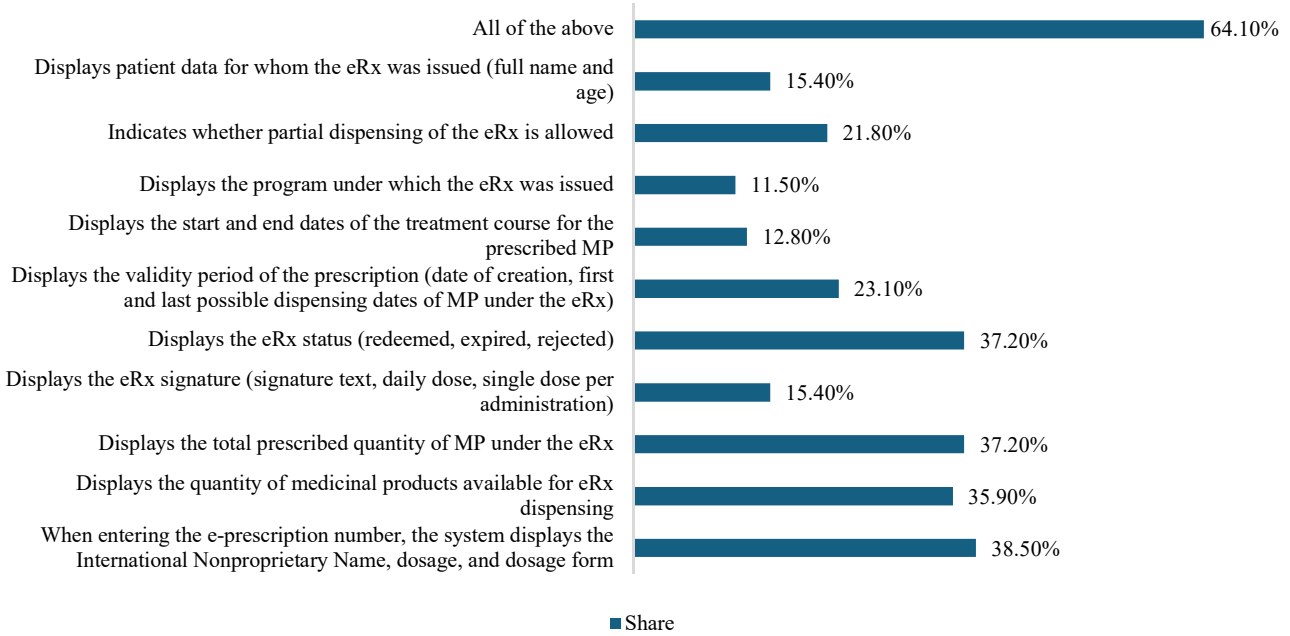

Fig. 4. Distribution of respondents' answers to the question:
"Indicate which technical requirements for eRx your MIS complies with"

At the same time, it should be noted that the need for a standardized and sufficiently comprehensive dataset for e-dispensing is also reflected in European guidelines on ePrescription/eDispensation, which emphasize the importance of data standardization and harmonization of standards to avoid fragmentation [19].

In order to generalize the results regarding MIS compliance with technical requirements, respondents were asked an integrated question: "Assess the compliance of your MIS functionality with TR using a 5-point scale (1 – does not comply, 5 – fully complies)". The results are presented in Fig. 6.

The obtained responses indicate a predominance of high ratings (4–5) across all parameters (completeness, relevance, clarity, flexibility/adaptability, and personal data protection), which overall confirms a sufficient level of compliance of MIS functionality with established TR. At the same time, the presence of isolated medium and low ratings (3 and 1–2) indicates local shortcomings and uneven implementation, which necessitates further standardization and harmonization of MIS functionality across different pharmacy networks.

Given that partial non-compliance of MIS functionality with technical requirements may potentially lead to more frequent user requests to technical support services, the questionnaire included the following question: "How would you rate the quality of technical support of your MIS on a 5-point scale? (1 – very low; 2 – low; 3 – average; 4 – high; 5 – very high)".

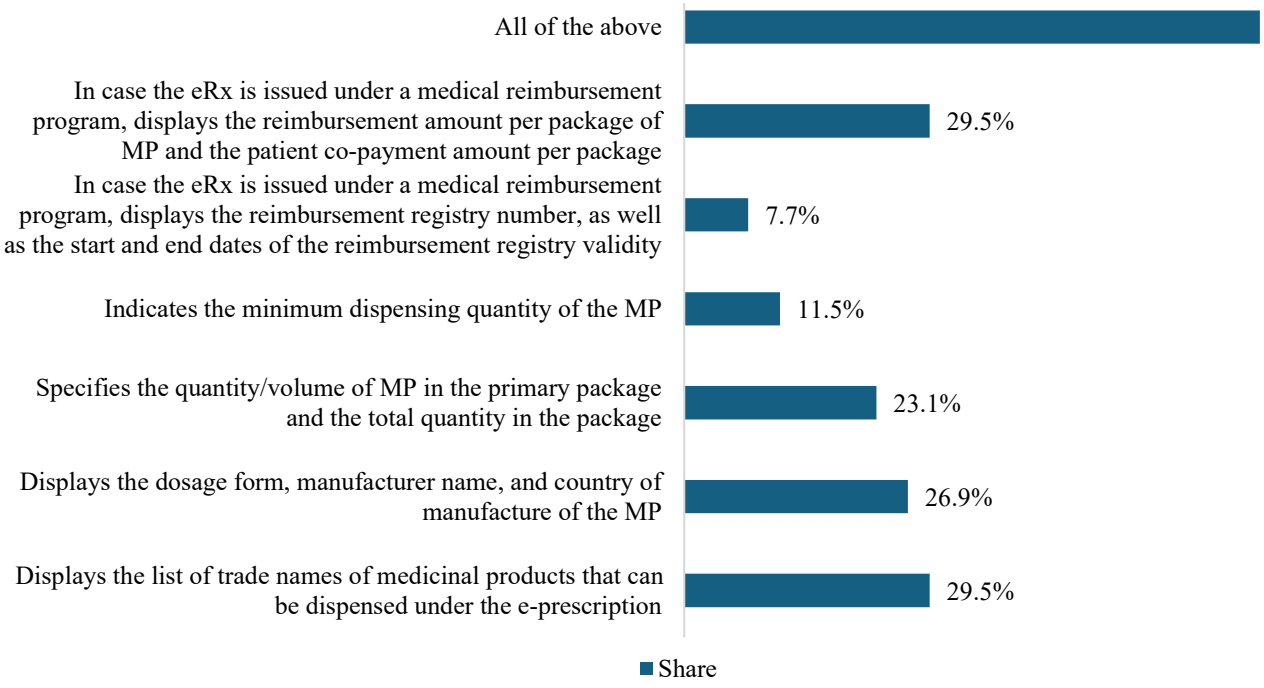

Fig. 5. Distribution of respondents' answers to the question: "Indicate which technical requirements for the list of prescription medicinal products your MIS complies with"

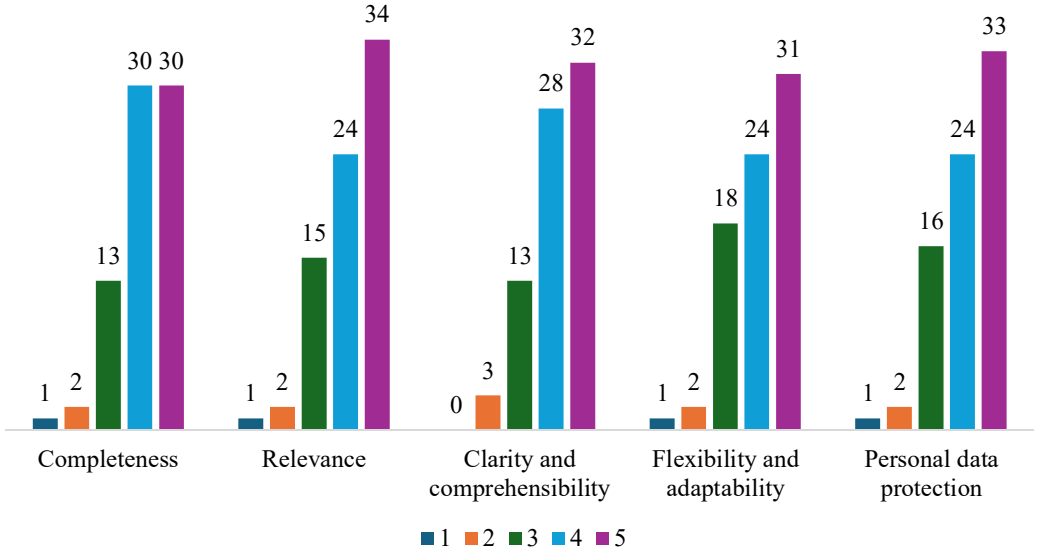

Fig. 6. Distribution of respondents' answers to the question: "Assess the compliance of your MIS functionality with technical requirements using a 5-point scale: 1 – does not comply, 5 – fully complies"

The survey results showed that technical support was generally rated positively. Thus, 46.2% of respondents rated it at 4 points (high level), while 35.9% rated it at 5 points (very high level). At the same time, 17.9% of respondents assessed the quality of technical support at 3 points (average level), which may indicate the presence of certain operational difficulties, including delays in response, inconsistency in the quality of consultations, or limited availability of support during peak workload periods.

This is consistent with findings from a systematic review, where the availability and quality of technical support are identified as key factors for the successful implementation of electronic prescriptions in pharmacy practice [11].

To determine the overall attitude of respondents toward the need for further development of pharmacy MIS, the following question was included: "Do you consider it necessary to expand the capabilities and functionality of the MIS you use in your professional practice?". It was found that 89.7% of respondents supported the need for functional expansion, while only 10.3% did not see such a need. Therefore, the obtained data indicate that the existing functionality of PH MIS, despite meeting basic requirements, requires further development and adaptation to the needs of professional practice.

To clarify the directions of such development, respondents were asked the question: "If 'YES', what functionality would you add to the MIS to improve the level of pharmaceutical care?". The results showed that the greatest support was given to solutions aimed at optimizing work with electronic prescriptions (eRx), in particular automated transmission of the prescription number or barcode via pharmacy MIS or communication applications, as well as the possibility of dispensing multiple medicinal products under a single eRx (Fig. 7).

The final block of the survey was aimed at identifying the components of effectiveness of the implementation and functioning of pharmacy MIS. It was found that 87.2% of respondents support the need to develop effectiveness criteria and a methodology for evaluating PH MIS, while 12.8% do not share this position.

To specify the content of such a methodology, respondents were asked a follow-up question: "If 'YES', which components of effectiveness criteria are necessary, in your opinion?" (Fig. 8). The majority of respondents (61.5%) supported the need to consider all groups of PH MIS effectiveness criteria simultaneously, which confirms the preference for a comprehensive approach. This substantiates the feasibility of developing a unified multi-criteria methodology for evaluating the effectiveness of PH MIS.

As part of detailing the components of pharmacy MIS effectiveness, it was considered appropriate to assess the significance of criteria separately for each group, namely information and communication, organizational, technical, social, and economic. The first question concerned information and communication criteria, as they reflect the level of patient-centeredness and the quality of data exchange between key participants in pharmaceutical care. These criteria included the availability of information for the patient, access to the history of medicinal product purchases, the presence of brief instructions for MP use, the possibility of creating an individual patient profile, and the implementation of feedback between physician-patient-pharmacist.

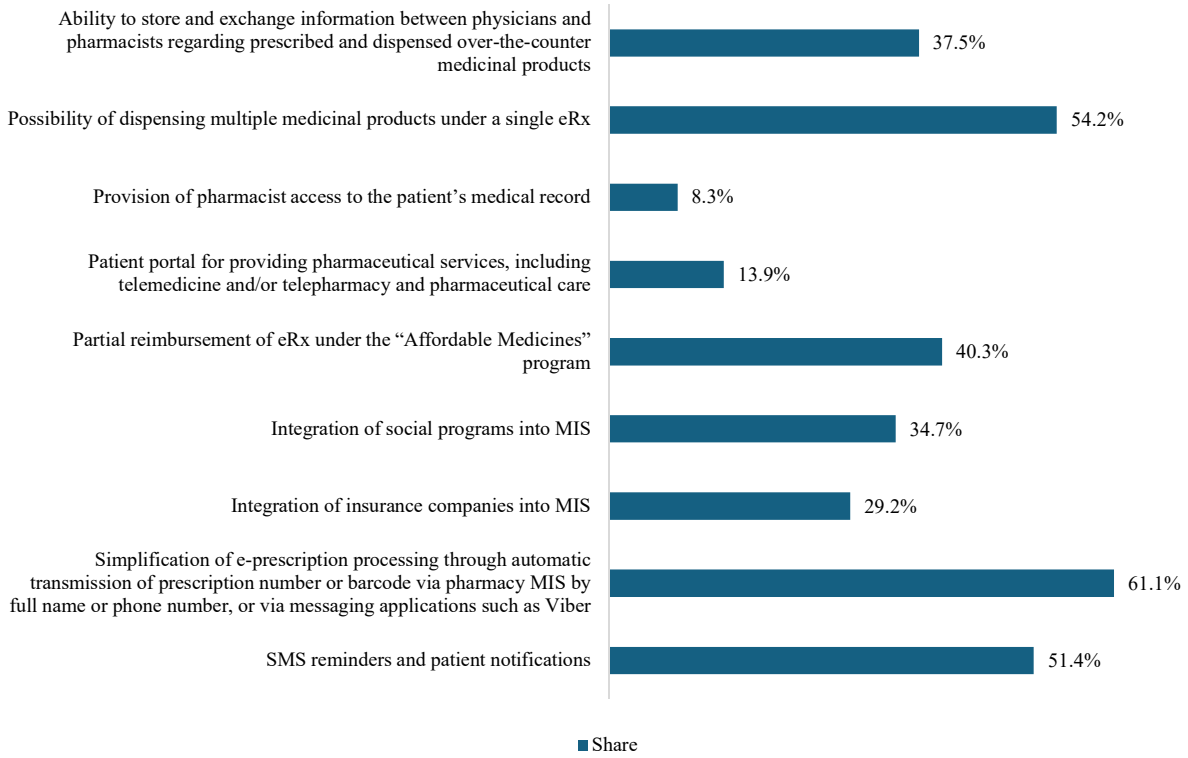

Fig. 7. Distribution of respondents' answers to the question: "If 'YES', what functionality would you add to the MIS to improve the level of pharmaceutical care?"

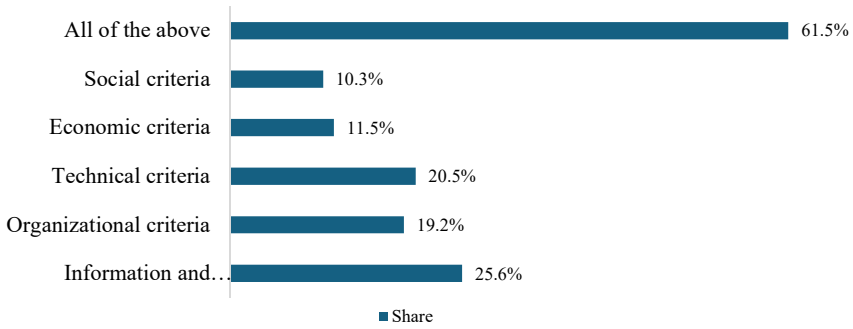

Fig. 8. Distribution of respondents' answers regarding the necessary criteria for evaluating the effectiveness of pharmacy MIS

For this purpose, respondents were asked: "Assess the importance of information and communication criteria on a 5-point scale (1 – not important at all; 5 – very important)". The obtained distribution of responses (Fig. 9) indicates a consistent predominance of high ratings across all the specified criteria.

The next question concerned the evaluation of the organizational block of pharmacy MIS effectiveness criteria, as organizational conditions determine the sustainability of digital solution implementation and their practical effectiveness in daily pharmacy operations. Organizational criteria include the presence of a responsible person or team, clear planning of PH MIS implementation stages, the existence of internal regulations and standards for its use, as well as the functioning of technical support services. For this purpose, respondents were asked: "Assess the importance of organizational criteria on a 5-point scale (1 – not important at all; 5 – very important)".

The distribution of responses showed a predominance of high ratings across all items, highlighting the importance of managerial and process-related components for effective digitalization of pharmacy practice. The most significant criteria identified by respondents were the availability of technical support services, the presence of a responsible person/team, clear planning of implementation stages, and the regulation (standards) of MIS use, indicating the need for process standardization and reduction of operational errors.

The next question was aimed at evaluating the technical block of pharmacy MIS effectiveness criteria. The technical criteria included system stability, personal data protection, automation of key operations (eRx, electronic signature), interface usability, availability of analytical tools, integration with the eHealth system, and scalability. Respondents were asked: "Assess the importance of technical criteria on a 5-point scale (1 – not important at all; 5 – very important)".

The distribution of responses (Fig. 11) showed a predominance of high ratings across all components, confirming the perception of the technical dimension as a foundation for the effective functioning of pharmacy MIS (PH MIS). Respondents identified system stability and data protection as the most significant criteria, along with automation of key operations (eRx/e-signature), interface usability, analytical tools, system integration, and scalability. Isolated lower ratings may reflect differences in the digital maturity of pharmacy networks and the level of experience in using specific software solutions.

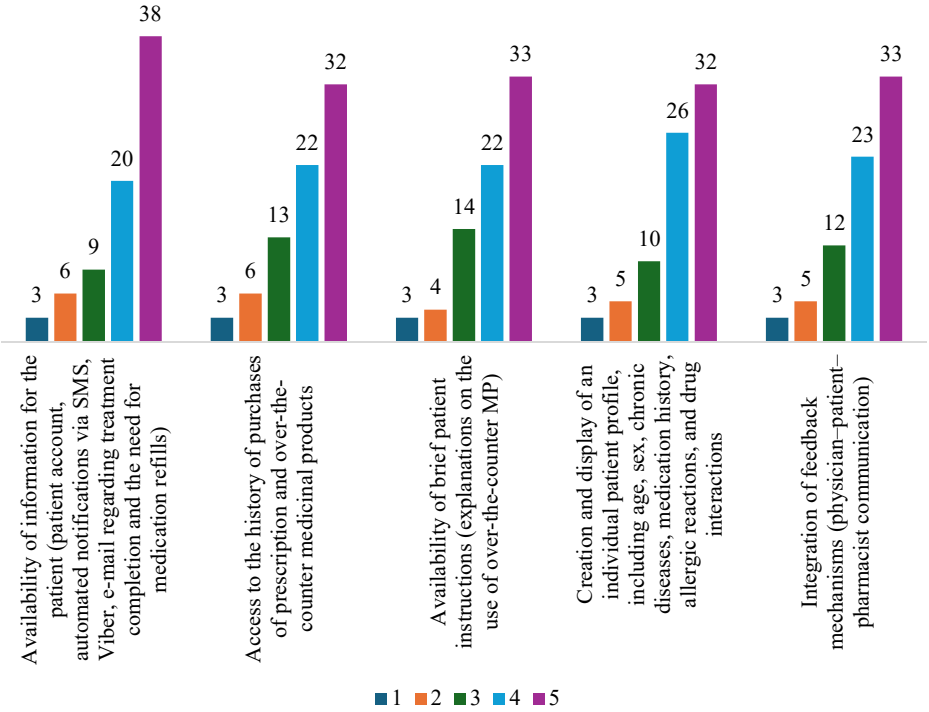

Fig. 9. Distribution of respondents' answers to the question: "Assess the importance of information and communication criteria for the effectiveness of pharmacy MIS functioning on a 5-point scale:
1 – not important at all; 2 – of low importance; 3 – partially important; 4 – important; 5 – very important"

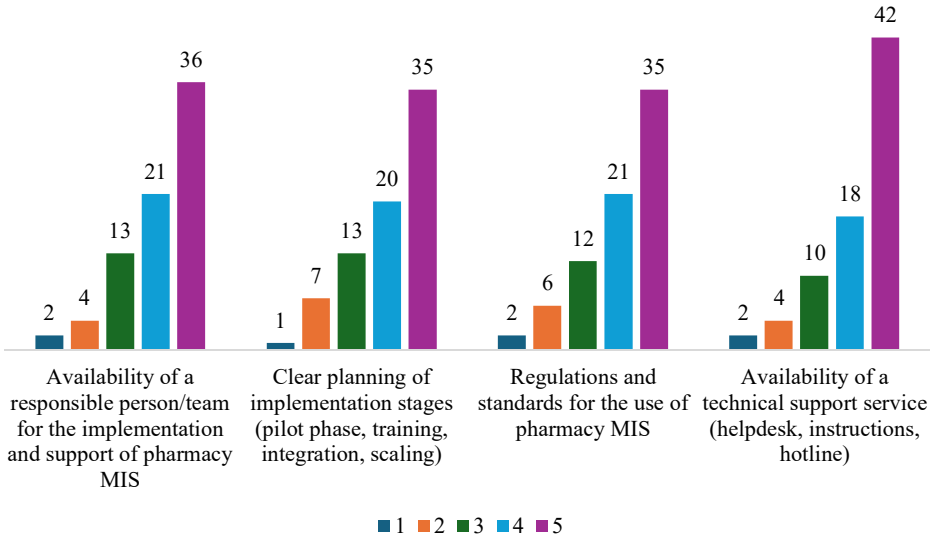

Fig. 10. Distribution of respondents' answers to the question: "Assess the importance of organizational criteria for the effectiveness of pharmacy MIS functioning on a 5-point scale: 1 – not important at all; 2 – of low importance; 3 – partially important; 4 – important; 5 – very important"

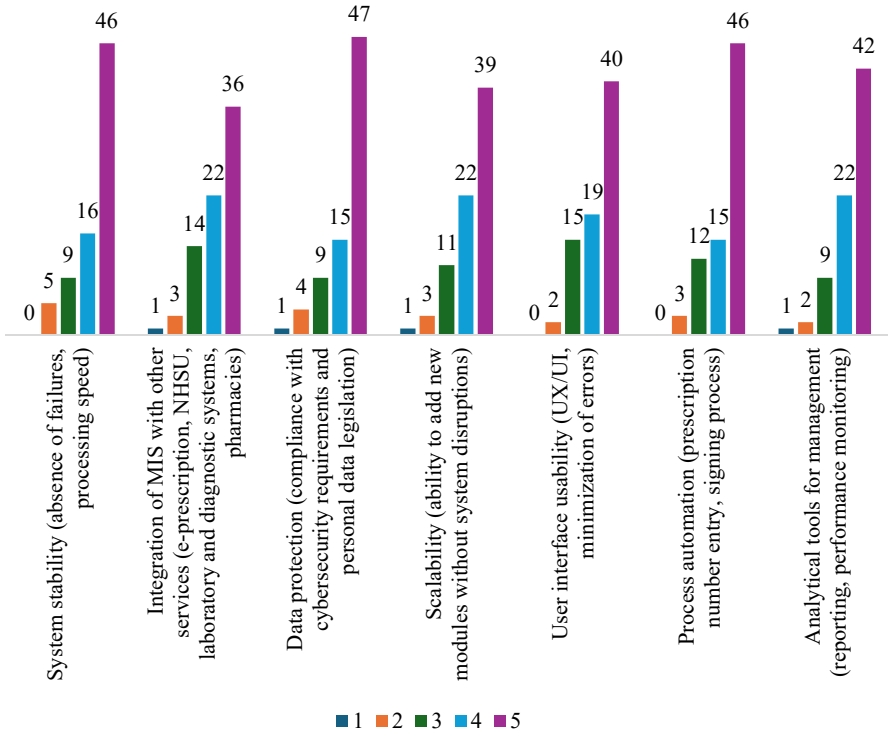

Fig. 11. Distribution of respondents' answers to the question: "Assess the importance of technical criteria for the effectiveness of pharmacy MIS (PH MIS) functioning on a 5-point scale: 1 – not important at all; 2 – of low importance; 3 – partially important; 4 – important; 5 – very important"

The social block of pharmacy MIS effectiveness criteria reflects the system's ability to support socially oriented mechanisms for ensuring the accessibility of pharmaceutical care to the population. The social criteria included the availability of up-to-date information on the "Affordable Medicines" reimbursement program, correct representation of preferential conditions for medicinal product dispensing, and support of patient-oriented services. Respondents were asked to assess the significance of these criteria on a 5-point scale.

The distribution of responses (Fig. 12) demonstrated a clear predominance of high ratings across all three items. Respondents identified the availability of up-to-date information on the "Affordable Medicines" reimbursement program and the correct representation of preferential dispensing conditions as significant, as these are critical for the continuity of pharmacotherapy, transparency of reimbursement calculations, and accurate communication with patients.

Social criteria are considered by respondents as an essential component of pharmacy MIS effectiveness,

and the corresponding functionality should be consistently implemented and standardized across different software products. This highlights the need to prioritize socially oriented modules in the further development of PH MIS, particularly in terms of the timely updating of information on reimbursement and benefit schemes, as well as the standardized representation of conditions for different categories of patients.

The final question assessing the components of pharmacy MIS effectiveness concerned the economic block of criteria, which reflects the managerial and financial-operational value of PH MIS. The economic criteria included the ratio between the cost of using PH MIS and its functional capabilities, availability of sales analytics, the possibility of automated reporting to the National Health Service of Ukraine (NHSU), and flexibility of pricing models. The distribution of responses showed a predominance of high ratings across all items, indicating the significant role of economic parameters in the comprehensive understanding of PH MIS effectiveness (Fig. 13). The most important aspects for respondents were sales analytics capabilities, which provide an evidence base for inventory management, as well as the cost-to-functionality ratio of PH MIS, indicating that pharmacies are oriented not so much toward minimizing costs as toward achieving optimal system value. High importance was also attributed to the possibility of automated transmission of reports to the National Health Service of Ukraine (NHSU), which reflects the practical need to reduce administrative workload and minimize the risk of errors in processes related to reimbursement. The flexibility of pricing models remains significant as well, as it allows adaptation of MIS use to the scale of the pharmacy network, the intensity of digital processes, and the specific needs of individual pharmacies.

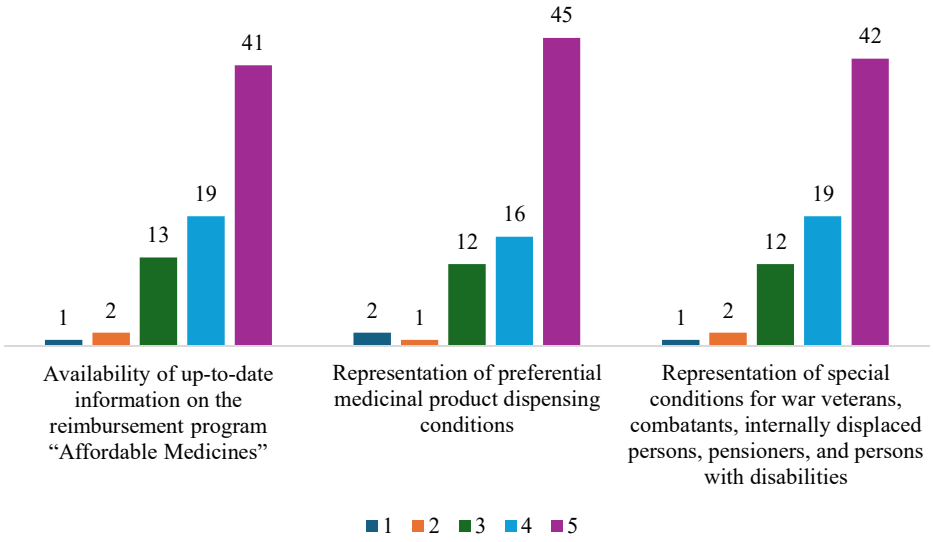

Fig. 12. Distribution of respondents' answers to the question: "Assess the importance of social criteria for the effectiveness of pharmacy MIS (PH MIS) functioning on a 5-point scale: 1 – not important at all; 2 – of low importance; 3 – partially important; 4 – important; 5 – very important"

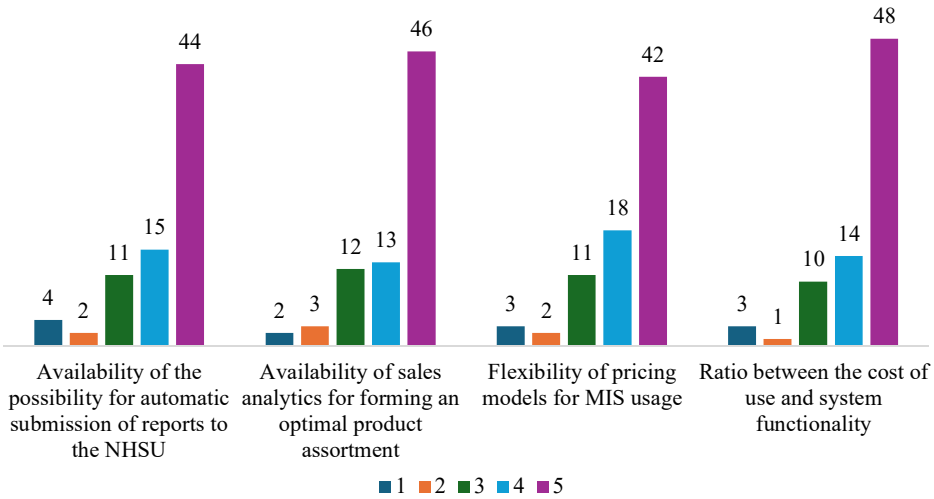

Fig. 13. Distribution of respondents' answers to the question: "Assess the importance of economic criteria for the effectiveness of pharmacy MIS functioning on a 5-point scale: 1 – not important at all; 2 – of low importance; 3 – partially important; 4 – important; 5 – very important"

The synthesis of the results from the final block of the survey demonstrated that respondents consider the effectiveness of pharmacy MIS as a multidimensional system that cannot be assessed solely through technical parameters or compliance with formal requirements. This position is supported by the analysis of respondents' answers regarding a comprehensive approach to the development and functioning of PH MIS: the majority of respondents supported the need to develop a system of effectiveness components and an evaluation methodology, as well as selected the option implying simultaneous consideration of information-communication, organizational, technical, economic, and social groups of criteria. Thus, the obtained data indicate a demand from the professional community for a unified standardized approach to MIS evaluation in the context of real pharmacy workflows and its impact on the quality of pharmaceutical care.

5. Discussion

The results of the conducted study allow for characterizing the organizational and functional level of maturity of pharmacy MIS used in Ukraine and for comparing the obtained data with modern approaches to the digital transformation of pharmaceutical practice.

It was established that in most pharmacies, the practice of appointing a responsible person for the implementation and functioning of MIS is consistent with international research recommendations, which emphasize the role of managerial coordination in ensuring the sustainable implementation of digital solutions in healthcare. At the same time, the absence of such a position in nearly one-fifth of pharmacies may complicate coordination with MIS providers and affect the continuity of digital processes. International evidence also highlights that the sustainability of e-prescription (eRx) implementation depends on a combination of organizational support and user training within the eHealth system [15].

The analysis of the sample structure showed that pharmaceutical specialists with a pharmacy education predominate among respondents, while the share of IT specialists is relatively low. In our view, such a disproportion may limit the quality of technical support for pharmacy MIS and highlights the need to expand the interdisciplinary competence of personnel or strengthen cooperation with IT specialists to ensure the effective functioning of PH MIS.

A systematic review of MIS implementation in pharmaceutical practice identifies digital literacy and training, infrastructure, privacy, and availability of support as key determinants of pharmacists' readiness for digital transformation and system interoperability. Accordingly, the development of staff competencies and standardized training programs may be as important as technical improvements of MIS [16].

An important direction for improving organizational support is the introduction of clear regulatory requirements defining the functional responsibilities and accountability of employees involved in the implementation and maintenance of pharmacy MIS. The implementation of such approaches may contribute to the standardization of digital procedures, increase their transparency, and ensure the sustainable functioning of MIS within pharmacies.

The analysis of criteria for selecting PH MIS suggests that, despite the commercial nature of most MIS solutions and their predominantly paid usage model, the economic component is not considered a decisive factor by respondents. Instead, functional, regulatory, and organizational characteristics of the system play a significantly more important role.

Reviews of digital innovations in community pharmacy emphasize that technologies are often implemented without sufficient assessment from the perspective of pharmacists' needs, which complicates decisions regarding optimization and scaling. This reinforces the importance of using user-centered criteria (usability, support, process integration) when selecting pharmacy MIS [20, 21].

The obtained data on compliance of the administrative module with the technical requirements of the National Health Service of Ukraine indicate an overall sufficient level of implementation of basic functions. At the same time, fragmentation of certain components was identified, particularly in relation to licensing information management and monitoring of compliance with reimbursement agreement obligations. Such uneven functional implementation may affect the quality of digital process management and highlights the need for further standardization of requirements for PH MIS.

The predominance of high integral ratings of MIS functionality compliance with technical requirements and positive assessments of technical support quality indicate an overall acceptable level of service provision. At the same time, the presence of a persistent share of medium ratings may reflect heterogeneity in the digital maturity of pharmacies and the need for further improvement of support standards, particularly in terms of response time and standardization of consultation protocols.

Strong support for expanding pharmacy MIS functionality and the prioritization of solutions aimed at optimizing electronic prescription (eRx) workflows indicate a well-formed demand from professionals for further development of digital healthcare services. At the same time, limited support for extended pharmacist access to clinical data may reflect existing regulatory and ethical constraints regarding professional responsibility boundaries and personal data protection.

The results of the assessment of the components of pharmacy MIS effectiveness confirm the feasibility of a multi-criteria approach to its determination. The predominance of a comprehensive approach combining technical, organizational, social, economic, and information-communication criteria is consistent with current WHO recommendations on the evaluation of digital interventions in healthcare.

The proposed approach aligns with frameworks for evaluating technological solutions for pharmacies,

which suggest assessing them not only based on technical parameters but also on practical applicability and support for everyday workflows [22].

Overall, the obtained results indicate a basic level of integration of pharmacies into the digital eHealth ecosystem, while also revealing the need for further harmonization of functionality, standardization of key modules, and development of a unified methodology for evaluating the effectiveness of MIS. The implementation of these directions may contribute to improved manageability of digital processes, transparency of reimbursement of medicines and medical devices, and the quality of pharmaceutical care for the population.

Practical significance. The obtained research results may be used in the practical activities of pharmacy organizations and MIS developers to improve the processes of digitalization of pharmaceutical care. In particular, the results make it possible to:

– substantiate the need for unification and standardization of pharmacy MIS functional modules in accordance with technical requirements and actual user needs;

– apply the defined criteria (technical, organizational, information-communication, social, and economic) for the development of a comprehensive methodology for assessing the effectiveness of MIS in pharmacies;

– optimize the functionality of PH MIS in terms of electronic prescription (eRx) processing, which will contribute to improving the quality of pharmaceutical care and reducing operational errors.

Thus, the research results have applied value for improving the efficiency of pharmacy operations under conditions of digital transformation of the healthcare system in Ukraine.

Study limitations. Study limitations include a relatively small sample size and the use of a purposive sampling method, which may limit the generalizability of the results to all pharmacies in Ukraine.

Prospects for further research. Future studies should focus on the development of a unified multi-criteria methodology for assessing the effectiveness of pharmacy MIS.

6. Conclusions

It was established that the implementation of pharmacy MIS in Ukraine is at the stage of a well-established basic integration with the eHealth system and ensures the implementation of key digital processes, in particular the management of electronic prescriptions (eRx).

It was found that in 80.8% of pharmacies responsible persons for the implementation and functioning of MIS have been appointed; however, in 19.2% such a position is absent. The personnel structure is characterized by the predominance of specialists with pharmaceutical education and limited involvement of IT specialists.

It was determined that when selecting pharmacy MIS, respondents prioritize a comprehensive assessment of functional, regulatory, and organizational characteristics of the system, while the cost of use is not considered a determining factor.

It was generally established that there is a sufficient level of compliance of pharmacy MIS functionality with the technical requirements of the National Health Service of Ukraine. At the same time, fragmentation of certain components of the administrative module and electronic prescription (eRx) accounting modules was identified, particularly in terms of licensing information management, monitoring of compliance with reimbursement agreement obligations, and completeness of eRx attribute representation.

Integral assessments of MIS functionality compliance with technical requirements and evaluations of technical support quality indicate an overall acceptable level of service support; however, the presence of a stable proportion of medium ratings points to heterogeneity in the level of functionality implementation across different pharmacies.

A high level of support for further expansion of pharmacy MIS functionality was identified, particularly regarding optimization of eRx processing, which indicates a clear demand from end users for the development of digital services.

The survey results confirmed the feasibility of developing criteria for evaluating the effectiveness of pharmacy MIS based on a multi-criteria approach, simultaneously considering technical, organizational, information and communication, social, and economic parameters.

The obtained data substantiate the need for further harmonization of MIS functionality, standardization of key modules, and development of a unified methodology for evaluating the effectiveness of MIS for pharmacies in Ukraine.

Conflict of interests

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this article.

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Data availability

Manuscript has no associated data.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies in creating the submitted work.

Authors' contributions

Alla Kotvitska: Conceptualization, Methodology, Project administration, Supervision; **Iuliia Korzh:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Supervision; **Serhii Smerechuk:** Project administration, Investigation, Writing – original draft, Formal analysis; **Alina Volkova:** Methodology, Writing – review & editing, Formal analysis; **Lubov Tereshchenko:** Investigation, Formal analysis, Validation.

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