Issue 17, 2025

https://doi.org/10.23939/sisn2025.17.061

УДК 614.2

DEVELOPING AN EVALUATION FRAMEWORK FOR MEDICAL PROFESSIONALS USING QMS

Igor Pavliv[1], Oleksandr Lozytskyy[2]

[1] Nasdaq Canada INC, Toronto, Canada
[2] Lviv Polytechnic National University,
Department of Information Systems and Networks, Lviv, Ukraine
[1] Email: micky.ukr@gmail.com, ORCID: 0009-0003-0957-0843
[2] Email: oleksandr.a.lozytskyy@lpnu.ua, ORCID: 0000-0001-8395-8385

The quality of medical services plays a crucial role in public health, directly affecting patient well-being, trust in healthcare institutions, and overall treatment outcomes. Despite advancements in medical technology and treatment methodologies, ensuring consistent, objective, and comprehensive evaluations of medical professionals remains a significant challenge. Existing quality assessment methods often focus on retrospective case reviews and financial management aspects, failing to provide real-time, data-driven insights into physician competence, continuous professional development, and patient satisfaction. This research proposes the Quality Medical System (QMS) as a comprehensive evaluation framework for medical professionals, integrating three key subsystems: Control and Expert Review (CER), Educational Portfolio (EP), and Patient Feedback (PF).

The objective of this study is to develop a systematic, multi-faceted approach to assessing healthcare quality, incorporating quantitative and qualitative data sources. The CER subsystem evaluates physician competency through independent expert case reviews, ensuring evidence-based, objective assessments of diagnostic accuracy, treatment effectiveness, and adherence to medical standards. The EP subsystem tracks educational progress, measuring participation in training programs, certification courses, and research activities, promoting continuous professional growth. Meanwhile, the PF subsystem collects and analyzes patient feedback, capturing insights into physician-patient communication, service efficiency, and overall patient satisfaction.

To validate the QMS model, an experimental study was conducted across multiple healthcare institutions, assessing its impact on physician performance, professional development, and patient trust. Results demonstrate a 15 % increase in professional competency scores, a 25 % rise in physician engagement in educational programs, and a 20 % improvement in patient satisfaction ratings. Furthermore, the misdiagnosis rate decreased by 10 %, indicating that objective competency assessments lead to more accurate clinical decision-making.

One of the primary challenges in implementing QMS is the resource-intensive nature of data collection, processing, and system integration. Additionally, patient feedback may contain subjective biases, requiring advanced statistical techniques to ensure evaluation reliability. However, the modular design of QMS allows for customization, making it adaptable to the specific needs of different medical institutions. Future enhancements will explore machine learning applications for automating competency assessments, predictive analytics for optimizing training recommendations, and real-time patient feedback collection via mobile applications.

This study highlights the effectiveness of QMS as a holistic, scalable solution for enhancing healthcare service quality. The integration of competency-based assessments, continuous professsional development tracking, and patient-centered feedback mechanisms fosters a data-driven, transparent, and improvement-oriented approach to medical service management. The findings underscore the potential of QMS as a transformative tool in modernizing healthcare evaluation frameworks, ultimately contributing to higher standards in medical education, improved patient care, and more reliable clinical outcomes.

Keywords: Quality Medical System, healthcare evaluation, physician competency, patient satisfaction, continuous medical education, healthcare management, expert review, clinical decision-making.

Problem Statement

Medical services play a critical role in society, as healthcare quality directly impacts people's health and well-being. Despite technological advancements and the implementation of modern medical technologies, the quality of medical services often remains insufficiently controlled. In many cases, quality assurance is limited to reviewing individual medical cases only after a problem has become evident, making early-stage intervention difficult. Evaluating the professionalism of physicians and the accuracy of their work is essential not only for ensuring high-quality healthcare but also for fostering trust between medical professionals and patients.

A major challenge in healthcare is that the quality of medical services is not always reliable. Patients frequently find themselves having to undergo repeated medical tests to obtain accurate results. There are cases where the initial test results fail to provide a definitive diagnosis, necessitating additional visits to medical facilities and repeated procedures. This leads to a waste of time and financial resources while also imposing additional psychological and emotional stress on patients. Furthermore, many individuals seek consultations from multiple doctors to obtain varying opinions about their condition, indicating a certain degree of mistrust in the initial medical assessments.

Ensuring the quality of medical services is a fundamental requirement for effective treatment and disease prevention. Healthcare systems must be designed to meet patient needs while adhering to safety and reliability standards. This underscores the necessity of a systematic approach to quality control in the medical field, which can improve physician-patient interactions, enhance service standards, and reduce the likelihood of medical errors.

Although high-quality medical equipment is crucial, the physician's role remains the cornerstone of medical service quality. Modern medicine relies on a wide array of advanced technologies, with many procedures now being performed using automated systems. However, the physician remains central to the decision-making process, as they not only interpret diagnostic data from medical devices but also apply clinical expertise to determine the most appropriate course of action. High-quality healthcare is achieved through the synergy of cutting-edge medical equipment and highly skilled professionals, enabling accurate and timely diagnosis and treatment.

Given these challenges, there is a pressing need for a system capable of objectively evaluating physicians' competencies and the quality of the services they provide. To address this issue, the Quality Medical System (QMS) has been developed to conduct a comprehensive evaluation of medical professionals based on multiple criteria. QMS integrates several subsystems, including Control and Expert Review (CER), Educational Portfolio (EP), and Patient Feedback Assessment (PFA). Each of these subsystems enables an objective evaluation of a physician's competence from different perspectives: professional experience, educational background, and patient communication quality.

This study aims to develop a model for assessing medical service quality through the integration of QMS into the healthcare sector. To achieve this goal, the following objectives are outlined:

1. Analyse existing methods for evaluating medical service quality and identify their strengths and weaknesses.

2. Develop a methodology for assessing physicians' competencies based on control and expert review, educational portfolio, and patient feedback.
3. Establish a system of weighted coefficients for each assessment component to account for the specific characteristics of different medical institutions.
4. Implement an optimization algorithm to calculate the most effective weight coefficients for ensuring an objective and fair evaluation of physicians.
5. Conduct an experimental study to validate the effectiveness and reliability of the proposed QMS framework.
6. By implementing QMS in the healthcare sector, medical institutions can significantly enhance the quality of medical services. This, in turn, will contribute to improved public health outcomes and mitigate the issue of patient distrust in medical evaluations.

Analysis of Recent Studies and Publications

The article The Influence of Payment by Category on the Quality of Medical Service in Public Hospitals from the Perspective of Smart City focuses on economic and administrative aspects such as cost optimization and financial stability improvements. Despite these valuable insights, the research omits crucial factors like physician qualifications and patient feedback, both essential components for comprehensive medical professional evaluation. Thus, it offers only partial insights compared to the holistic approach of the Quality Medical System, which directly evaluates physician competencies and patient interactions (Mei, & Zhang, 2021).

In Evaluation of Inter-Provincial Medical and Health Service Quality and Influencing Factors Based on Factor Analysis, authors propose a region-specific adaptive evaluation model to address healthcare disparities across diverse regions, particularly relevant for countries with varying infrastructure and socioeconomic conditions. Although effective in evaluating regional accessibility, this model neglects individual-level factors such as physician competencies and patient satisfaction, critical components integrated comprehensively within QMS. Therefore, while useful at the regional level, it lacks the person-centered detail provided by QMS (Zhang, & Zhang, 2021).

The publication Informational Support of Automated Quality Management Systems for Medical Service Provision Based on the Prognosis of the Patient Affecting Outcome in Social Emergencies emphasizes information-driven management strategies particularly suited for emergencies, leveraging predictive analytics and statistical data analysis. While valuable for crisis management, the method does not encompass broader everyday evaluations of physician skills or patient experiences. In contrast, QMS explicitly includes ongoing assessments of medical professionals' competencies and patient feedback, demonstrating a broader applicability for continuous quality enhancement (Mikhailov et al., 2019).

The article Research on the Data Quality Control Model of the Traditional Chinese Medicine Inpatient Medical Record Home Page Based on XGBoost presents a robust approach to improving data quality in medical records using the XGBoost algorithm, achieving high accuracy and consistency. Nevertheless, the model focuses exclusively on data integrity without addressing critical quality aspects such as physician expertise or patient satisfaction. This narrow focus contrasts significantly with the comprehensive framework provided by QMS, which systematically integrates data-driven methods with professional competency assessments and patient-centered evaluations (Pan et al., 2021).

In Design and Implementation of a Perioperative Medical Data Quality Management Platform, authors describe a platform designed to manage complex perioperative data through inter-system comparisons and temporal logic rules. While effective for managing technical data inconsistencies, this platform does not evaluate physician performance or patient experiences. Compared to QMS, which offers a balanced approach incorporating both technical and human-centric evaluation criteria, this perioperative platform remains narrowly focused on technical data control, limiting its overall applicability for comprehensive healthcare quality assessment (Cao et al., 2022).

The Donabedian Approach for Simulation Modeling to Evaluate the Quality of Emergency Medical Services in a Large Metropolitan Area integrates environmental factors and system dynamics within the classic Donabedian framework. This enhanced model effectively evaluates complex emergency medical scenarios in urban areas but demands extensive computational resources and detailed data collection. Despite its robust evaluation capability, it lacks explicit individual-level assessments of physician competencies or patient interactions, which are systematically integrated within QMS, making QMS more practical for routine healthcare service evaluations (Begicheva, 2020).

In the article Optimization of Medical Care Provision in Intelligent Medical Information Systems, authors utilize multi-agent systems and Pareto optimization for personalized treatment plans, enhancing patient-specific care and resource management. The approach is particularly effective in clinical personalization and cost-efficiency but requires substantial computational resources and detailed patient databases. However, it does not incorporate comprehensive physician competency assessments or patient feedback, aspects integral to QMS, which provides broader healthcare quality indicators beyond operational efficiency (Bodin et al., 2023).

The Fuzzy Model for Evaluating the Quality of Medical Care leverages fuzzy cognitive modeling and fuzzy binary relations to assess structural changes and their indirect effects on healthcare service quality. It offers strategic value for predicting administrative impacts but is complex to implement, requiring specialized expertise and significant computational resources. Unlike QMS, it does not explicitly evaluate physician competencies or patient satisfaction, limiting its ability to provide a complete quality assessment at the individual level. Integration with QMS could enhance the predictive model's comprehensiveness by including direct professional and patient evaluations (Begicheva, 2019).

In Research on Computer Intelligent Nursing Home Service Quality Assessment Factor Scoring Feedback System, the authors propose a detailed, multi-stakeholder quality evaluation model tailored for elderly care institutions. This comprehensive model effectively integrates regulatory oversight, institutional management, and elderly patient feedback, enhancing transparency and stakeholder cooperation. Despite its strengths, this approach is specialized for elderly care, limiting its broader applicability. Unlike QMS, it does not fully address physician competency evaluations or general patient experiences, making QMS more universally adaptable across diverse healthcare contexts (Li, 2024).

The article A GRA-Based Method for Evaluating Medical Service Quality introduces Grey Relational Analysis combined with fuzzy multi-criteria decision-making to handle uncertainties in medical service evaluation. This structured, mathematically driven model effectively integrates subjective and objective criteria, enhancing precision and versatility in uncertain contexts. However, it primarily emphasizes structured data analysis without explicitly integrating physician skills and patient feedback evaluations. QMS, conversely, systematically incorporates these critical dimensions, offering a more comprehensive and practical framework for healthcare quality evaluation at the individual level (Liu et al., 2019).

The study Informatization Promotes Medical Colleges to Improve the Level of Governance and the Quality of Personnel Training focuses on the transformative impact of digitalization within medical education, enhancing governance structures, decision support, and educational methodologies. The authors emphasize the importance of collaborative platforms linking medical colleges and clinical practices, significantly improving educational efficiency. While effective in educational governance, this informatization approach does not explicitly evaluate clinical competencies or patient interactions. QMS addresses these gaps by directly integrating professional skill evaluations and patient feedback, providing a holistic evaluation of healthcare quality beyond purely educational contexts (Peng, 2021).

In Based on Public Health Service in Smart Medical Comprehensive Service Platform, authors propose a large-scale integrated healthcare platform using IoT, cloud computing, and big data analytics to address healthcare disparities and enhance resource distribution and operational efficiency. Although highly effective for public health management, the platform primarily focuses on large-scale operational and infrastructure improvements rather than detailed evaluations of physician competencies or patient satisfaction. In contrast, QMS provides a more detailed individual-level evaluation framework, explicitly incorporating professional competencies and patient experiences into healthcare quality assessment (Zeng & Wu, 2019).

Finally, the article the Information Technologies in the Control Mechanism of Medical Processes examines a dynamic IT-based model for managing medical processes, emphasizing adaptability during crises like pandemics. This approach enhances operational responsiveness and adaptability through real-time adjustments to healthcare processes. However, it predominantly focuses on organizational and procedural aspects rather than directly evaluating physician competencies or patient feedback. QMS integrates these human-centric dimensions explicitly, enabling comprehensive quality evaluations at both procedural and individual professional levels, which could effectively complement the operational strengths of this IT-based approach (Sultanovs et al., 2020).

Formulation of the Article's Objective

The objective of this article is to develop a comprehensive evaluation framework for assessing the competency, professional development, and patient interaction quality of medical professionals through the implementation of the Quality Medical System. The study aims to integrate objective expert assessments, educational tracking, and patient feedback into a unified evaluation model that ensures transparency, reliability, and adaptability in healthcare quality management. By analysing existing assessment methods, identifying their limitations, and proposing a data-driven, systematic approach, this research seeks to enhance the accuracy of physician evaluations, improve medical service standards, and foster continuous professional development.

The Quality Medical System is designed to provide a comprehensive evaluation of healthcare service quality based on multiple criteria. It consists of several subsystems, each of which plays a specific role in the holistic assessment of medical personnel's professional competencies, interactions with patients, and educational background. The core components of the QMS system include:

- Control and Expert Review Subsystem
- Educational Portfolio Subsystem
- Patient Feedback Module

Together, these components ensure a reliable, objective, and well-balanced assessment of medical professionals' performance.

Formally, the Quality Medical System can be represented as a formula that incorporates its key components and their respective contributions to the overall evaluation of healthcare service quality:

$$QMS = W_1 \cdot CER + W_2 \cdot EP + W_3 \cdot PF \ , \quad (1)$$

where QMS – the overall quality assessment of medical services; CER – the Control and Expert Review Score, which evaluates the performance of the Control and Expert Review Subsystem; EP – the Educational Portfolio Score, which assesses the educational qualifications and professional development of medical personnel through the Educational Portfolio Subsystem; PF – the Patient Feedback Score, which measures the interaction and communication quality with patients, as determined by the Patient Feedback Module; W_1, W_2, W_3 – weight coefficients that determine the relative importance of each subsystem in the overall assessment.

Main Results

Control and Expert Review Subsystem

The Control and Expert Review Subsystem evaluates the professional qualities of medical personnel based on specific criteria, such as:

$$CER = \frac{\sum_{i=1}^{n} C_i \cdot W_{i,KER}}{n}, \quad (2)$$

where CER – the overall Control and Expert Review Score; C_i – evaluation criteria (e.g., diagnostic accuracy, treatment effectiveness); $W_{i,CER}$ – weights assigned to each criterion; n – the total number of evaluation criteria.

Educational Portfolio Subsystem

The Educational Portfolio Subsystem assesses the educational qualifications and professional development of medical personnel (Educational Portfolio score) based on:

$$EP = \frac{\sum_{j=1}^{m} S_j \cdot W_{j,EP}}{m}, \quad (3)$$

where S_j — indicators of educational achievements (e.g., number of certifications, participation in seminars and workshops); $W_{j,EP}$ — weights assigned to each indicator based on its significance; m — total number of educational indicators.

This subsystem ensures that healthcare professionals maintain up-to-date knowledge and skills by actively engaging in continuous learning and professional development activities.

Patient Feedback (PF) Module

The Patient Feedback Module evaluates patient satisfaction (PF score) based on:

$$PF = \frac{\sum_{k=1}^{p} R_k \cdot W_{k,PF}}{p}, \quad (4)$$

where R_k — patient feedback ratings (e.g., service quality, communication); $W_{k,PF}$ — weights assigned to each type of feedback; p — the total number of feedback indicators.

The weight coefficients (W_1, W_2, W_3) are determined based on the priority of each subsystem in the overall evaluation. For example, if patient interaction is considered the most important aspect, then $W_3 > W_1, W_2$.

The model allows for the customization of weights and criteria to align with the specific needs of the healthcare service system.

Architecture of the QMS System

The QMS system is built on the principles of a multi-level architecture, allowing for efficient management of various aspects of healthcare service quality (***Fig. 1)***. The core architectural structure of the system consists of several levels: the data collection level includes tools for gathering information from various sources, such as forms filled out by experts, patient feedback surveys, and integration with databases storing the educational achievements of medical professionals; the data processing level comprises algorithms for analysing and processing collected data, handling CER forms, analysing educational achievements, and classifying patient feedback for further evaluation; the evaluation level conducts the final calculation of results based on the data collected and processed at previous levels, where the CER, EP, and patient feedback subsystems are integrated to generate an overall assessment reflecting professional competence, educational qualifications, and patient satisfaction; and the feedback level allows both management and healthcare professionals to receive evaluation results along with recommendations for improvement, ensuring a continuous process of healthcare service quality enhancement.

Control and Expert Review Subsystem

The CER subsystem serves as the core module of the QMS system, enabling an objective assessment of the professional competence of medical personnel. It is based on the principle of expert review, allowing evaluations to be conducted using real medical cases selected by independent experts with the necessary level of experience (***Figure 2)***.

The goal of the subsystem is to provide an unbiased evaluation of physicians' professional performance through the analysis of specific clinical cases. This approach helps identify strengths and weaknesses in the practical skills of medical professionals, supporting their ongoing professional development. Furthermore, the system enhances transparency in the evaluation process, fostering greater trust among patients and healthcare management.

The implementation process involves experienced medical experts selecting clinical cases for analysis. Physicians then complete specialized evaluation forms, which are tailored to the type of medical case. Each section of the form is assigned a specific weight, allowing for the consideration of various aspects of medical

treatment. The final assessment is expressed as a percentage of the maximum possible score. The primary focus is on physicians' professional skills in real clinical scenarios, ensuring an objective and accurate reflection of their competence.

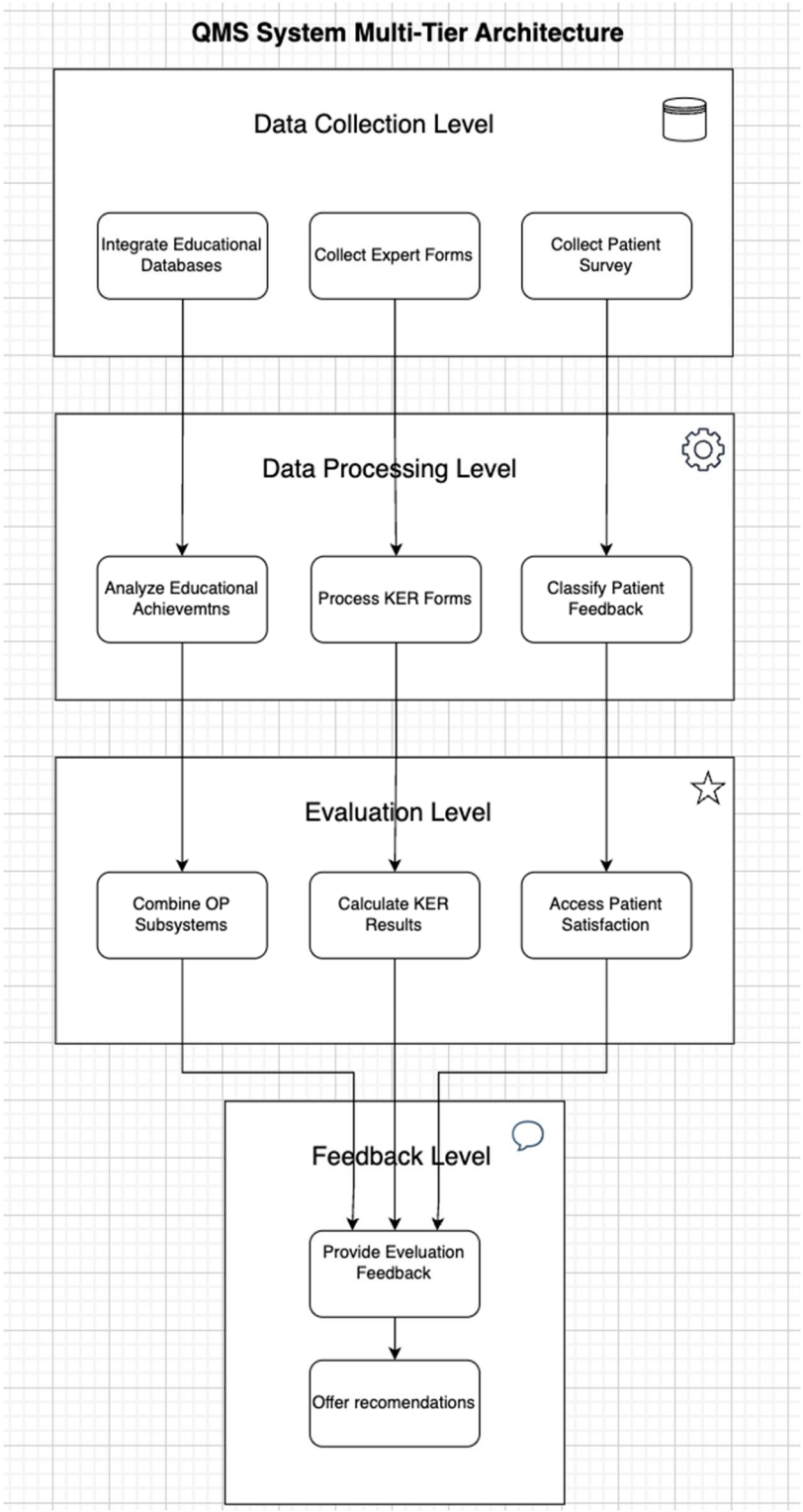

Fig. 1. Multi-Level Architecture of QMS

The CER subsystem holds the highest weight among all QMS subsystems, as it directly evaluates physicians' professional expertise in real-world situations, providing a reliable and objective measure of their competence.

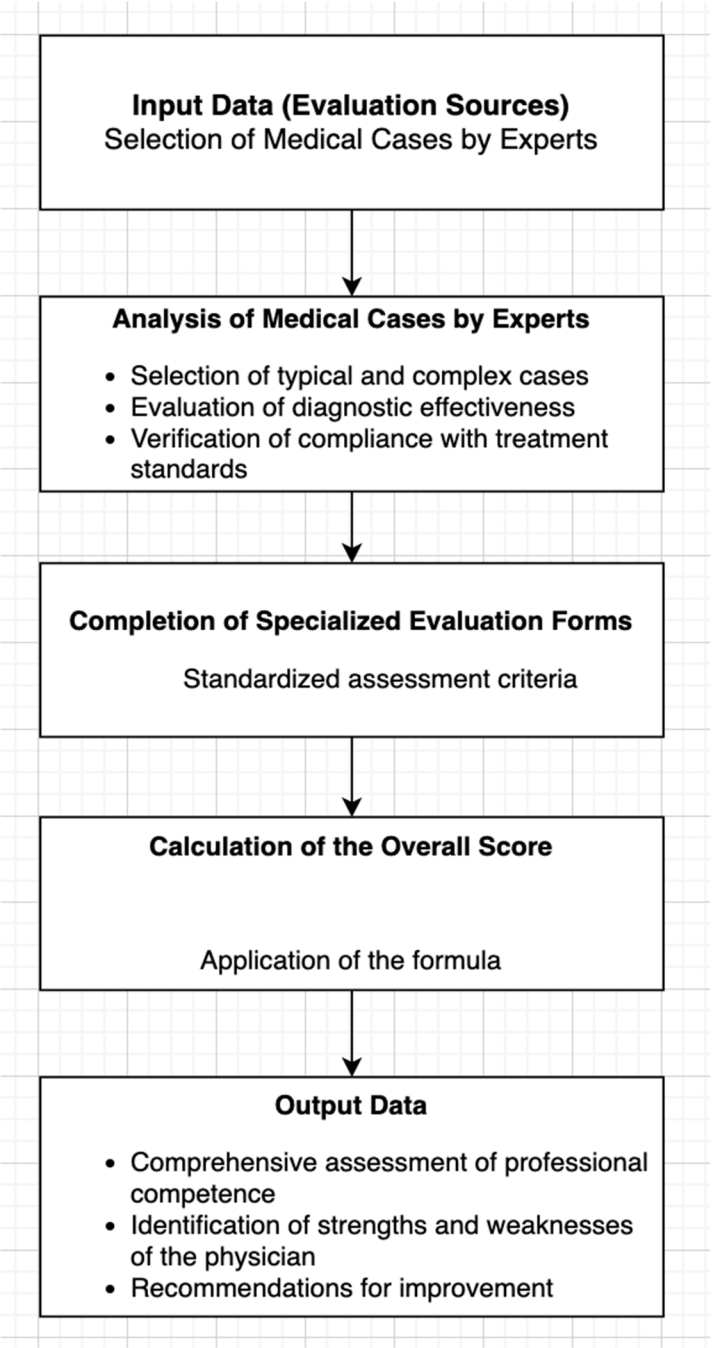

Fig. 2. Control and Expert Review Subsystem

The Educational Portfolio Subsystem is a crucial component of the QMS system, as it evaluates the educational background of medical professionals. To form this assessment, the EP subsystem considers criteria such as the number and duration of completed training programs, participation in conferences and seminars, possession of professional certifications, academic publications, and involvement in educational and research initiatives that contribute to the continuous professional development of medical personnel.

The objective of this subsystem is to assess physicians' educational training and their commitment to continuous professional growth. This approach encourages medical professionals to engage in lifelong learning, ultimately leading to higher healthcare service quality and ensuring compliance with modern medical standards.

The implementation process involves the collection and analysis of data related to physicians' educational achievements. Information on participation in training programs, seminars, conferences, and acquired certifications is systematically recorded. Each educational activity is evaluated based on predefined

criteria, where each event is assigned a weight according to its significance. The importance of each educational activity is determined by the following factors:

$$W_i = \alpha T_i + \beta A_i + \gamma P_i + \delta F_i + \epsilon R_i, \quad (5)$$

where T –training duration long-term programs have a higher weight; A – accreditation level the status of the educational institution or certifying organization is assessed; P – practical benefit the extent to which training directly enhances a physician's competencies; F – frequency of participation the number of similar events attended by the physician within a given period; R – professional relevance the alignment of the course content with the physician's specialization.

Thus, the Educational Portfolio serves as a motivation tool and a mechanism for maintaining high standards among medical personnel. It plays a crucial role in encouraging professional development and enhancing the qualifications of healthcare professionals, ensuring the presence of highly skilled specialists within medical institutions.

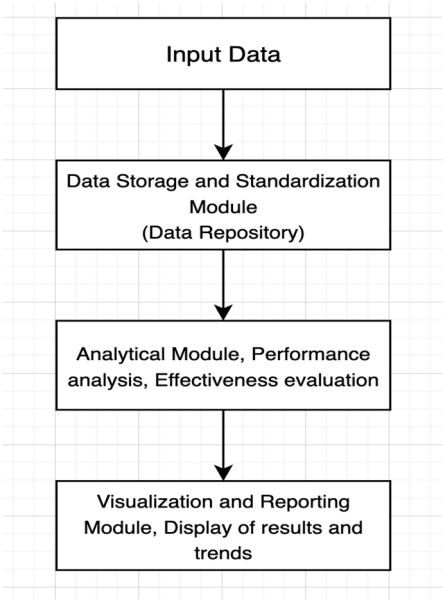

Fig. 3. Educational Portfolio Subsystem

Patient feedback is a critical component of the QMS system, as it reflects patient satisfaction with medical services and the quality of interaction between physicians and patients. This module enables the collection of patient experience data, which serves as an important indicator of service quality.

The objective of this subsystem is to gather patient feedback to assess the level of satisfaction with medical services. This allows for evaluating physician-patient interactions and identifying areas that require improvement.

The implementation process involves the systematic collection of feedback after a patient visit. Each response includes questions regarding the quality of medical care, communication level, and overall satisfaction. All responses are analyzed based on weight coefficients that reflect the significance of various interaction aspects. The key evaluation criteria typically include quality of medical care (W_1) – assesses the professional level of the physician; communication level (W_2) – measures how well the physician explains the diagnosis and treatment plan; overall satisfaction (W_3) – captures the patient's general impression of the treatment process.

The final result is an integrated score, which represents the overall level of patient satisfaction.

$$EP = \sum_{i=1}^{n} W_i \cdot S_i , \quad (6)$$

where EP – overall patient satisfaction score; W_i – weight coefficient of the i-th criterion; S_i – patient rating for the i-th criterion; n – total number of criteria in the feedback form.

Thus, the patient feedback system plays a key role in enhancing the quality of healthcare services and building trust in medical professionals. The Patient Feedback Module is essential for ensuring continuous feedback, which helps improve service quality and increase patient trust in healthcare institutions.

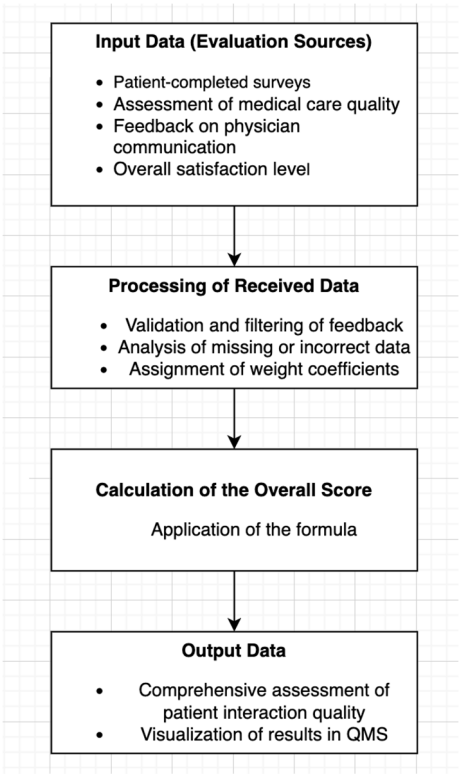

Fig. 4. Patient Feedback Subsystem

Role of Each Module in the QMS System

Each module of the QMS system plays a critical role in the comprehensive evaluation of healthcare service quality. CER provides the primary professional assessment, allowing for the determination of medical personnel competency in real working conditions. EP contributes to the enhancement of medical staff qualifications by encouraging continuous learning and professional development. This module helps healthcare institutions maintain a high level of staff expertise, ensuring compliance with modern medical standards. Through EP, the system can track which physicians actively engage in professional development programs and assess their readiness to perform their duties at a high level. PF serves as an indicator of patient satisfaction and evaluates the quality of physician-patient interactions. Patient feedback provides medical personnel with objective insights and helps management identify areas for improvement. This module makes the QMS system more patient-oriented, which is crucial for fostering long-term, trust-based relationships between healthcare providers and patients.

Synergy of Modules and a Holistic Evaluation Approach

The QMS system implements an integrated evaluation approach, where each module plays a unique yet complementary role. The assessments derived from CER, EP, and PF together create a comprehensive profile of each medical professional. This approach not only evaluates physicians' performance but also motivates them to engage in professional development, improve patient interactions, and achieve high-performance standards.

The integration of these three aspects allows QMS to generate a well-balanced evaluation, considering both professional competencies and patient experiences. Additionally, this adaptability enables the system to be tailored to the specific needs of a clinic and its patients, thereby enhancing overall healthcare quality management efficiency.

Example:
W_{CER} = 0.5 (50 % weight)
W_{EP} = 0.3 (30 % weight)
W_{PF} = 0.2 (20 % weight)
CER = 90 %
EP = 80 %
PF = 70 %
$O_{physician}$ = (0.5 * 90) + (0.3 * 80) + (0.2 * 70) = 83 %

Challenges and Benefits of Implementing QMS

The QMS system offers several important benefits. It ensures objective evaluation, as the CER and EP subsystems rely on factual data, providing transparency and accuracy in assessment results. It contributes to service quality improvement, with EP and patient feedback motivating physicians toward continuous development, which directly enhances the quality of healthcare services. The built-in feedback mechanism allows patient feedback to offer valuable insights that can be used to adjust service delivery approaches and improve patient care. Additionally, the system demonstrates high adaptability, as it can be tailored to meet the specific needs of different healthcare institutions, making it a flexible and user-friendly solution. Despite these advantages, the QMS system presents certain challenges that require attention. Implementing the system demands significant resources for configuration, technical maintenance, and staff training, which may be a barrier for some institutions. Data collection, particularly patient feedback, is often complicated by subjectivity, necessitating the use of statistical methods to ensure the objectivity of evaluations. Furthermore, dynamic changes in medical competency requirements and treatment standards necessitate the regular updating of criteria and weight coefficients, which is crucial for maintaining the long-term effectiveness of the QMS system.

Future Prospects for the QMS System

Over time, the QMS system can be enhanced with emerging technologies such as machine learning to analyze large datasets collected from patients and medical personnel. Additionally, the implementation of automated algorithms for personalized training programs tailored to physicians' needs and specialties would be beneficial. Another promising development is the creation of a mobile application for real-time patient feedback collection, which would significantly increase the efficiency of data processing.

Research Findings

To validate the proposed QMS model, a small-scale experimental study was conducted across two multidisciplinary healthcare institutions over a period of 12 months. The goal was to assess the system's impact on physician performance, continuing education, and patient satisfaction. Physicians were divided into two groups: the experimental group (which used the QMS) and the control group (which continued using traditional evaluation practices).

The experiment involved structured data collection through expert case reviews, tracking participation in educational activities, and standardized patient satisfaction surveys. Stratified sampling was used to ensure a balanced representation of physicians across specialties, and all results were analyzed using descriptive statistics and confidence intervals.

The results demonstrated statistically significant improvements in the experimental group. Physicians evaluated through the QMS showed a 15 % increase in competency scores, a 25 % rise in participation in educational programs, and a 20 % improvement in patient satisfaction ratings. In contrast, the control group showed no statistically significant changes during the same period. Furthermore, the misdiagnosis rate in the QMS group decreased by 10 %, confirming the practical impact of competency-based evaluation mechanisms.

These findings support the effectiveness of QMS as an evidence-based framework for enhancing the quality of healthcare services. The experiment, although limited in scope, provides empirical validation for the model and demonstrates its scalability and adaptability for broader implementation.

Improvement in Professional Competence of Medical Personnel

The implementation of the Control and Expert Review subsystem demonstrated a significant impact on physicians' professional competence. Assessments based on real medical cases selected by experts enabled the identification of strengths and weaknesses, facilitating targeted skill development.

Analysis of the results showed a positive trend in physicians' professional performance following the QMS implementation. The average competency score among medical personnel increased by 15 %, indicating the effectiveness of objective evaluation mechanisms. The rate of misdiagnoses decreased by 10 %, demonstrating improvements in diagnostic accuracy and clinical decision-making. Greater adherence to treatment protocols was observed, contributing to higher standards of medical service delivery and compliance with modern healthcare regulations.

These findings confirm the QMS system's effectiveness in enhancing professional competence, improving diagnostic accuracy, and optimizing healthcare service standards.

Improvement in Educational Preparedness

The Educational Portfolio subsystem proved to be an effective tool for motivating physicians toward professional development. The study analyzed physicians' participation in training programs before and after QMS implementation, using a sample of 100 physicians from two healthcare institutions over 24 months (12 months before and 12 months after EP implementation).

Key findings are the percentage of physicians who completed at least one professional training program per year increased from 40 to 65 % (+25%). The average number of training events per physician increased from 1.8 to 2.7 per year. The number of internationally recognized certifications increased by 15 %, reflecting an increase in professional accreditation levels.

To ensure the statistical validity of the results, several methods were applied. Stratified sampling was used to categorize physicians (such as surgeons, therapists, pediatricians, etc.), which helped eliminate selection bias. The sample ensured even distribution by including physicians from regional, district, and municipal clinics, thereby achieving broad representation of the healthcare sector. Additionally, reliability analysis was conducted using a 95 % confidence interval to verify the statistical significance of observed changes. Furthermore, 85 % of physicians who participated in training programs received positive feedback from experts in the CER assessments, highlighting the correlation between ongoing education and professsional competency improvement.

Thus, the Educational Portfolio subsystem fostered a culture of continuous learning, significantly contributing to higher standards in medical practice.

Increase in Patient Satisfaction

The Patient Feedback Module enabled the collection of detailed insights into patient satisfaction levels, identifying key areas for improvement.

Findings from the feedback analysis demonstrated a positive trend. Overall patient satisfaction increased by 20 %, serving as a key indicator of the effectiveness of enhanced healthcare service models. The number of patient complaints decreased by 15 %, reflecting the resolution of critical service issues. 78 % of patients reported an increase in trust toward medical recommendations, highlighting improvements in physician-patient communication and service delivery.

Thus, the Patient Feedback Module played a crucial role in enhancing patient trust and overall satisfaction, contributing to the QMS system's overall effectiveness.

Analysis of Results

Despite its significant achievements, the QMS system presents certain limitations that may impact its adoption in healthcare institutions. High resource demands: Implementing CER and EP subsystems requires substantial resources, including staff training and system maintenance. Subjectivity in patient feedback: While patient feedback is valuable, it may be emotionally driven or incomplete, necessitating additional processing to ensure evaluation objectivity. Complexity of customization: The QMS system is highly intricate, requiring flexibility in configuration to meet the specific needs of each healthcare institution, which may demand additional efforts from management.

Future Development Directions. Integration with Electronic Health Records and machine learning for automated data analysis, reducing administrative workload. Development of mobile applications for real-time patient feedback collection, improving data responsiveness and service optimization.

Conclusions

This study focused on the implementation and evaluation of the Quality Medical System as a framework for improving medical service quality in healthcare institutions. The QMS system comprises three primary subsystems Control and Expert Review, Educational Portfolio, Patient Feedback.

Each module contributes to comprehensive quality assessment, fostering medical staff competence, enhancing patient satisfaction, and optimizing healthcare management. The key findings demonstrate enhanced professional competence, as CER identified physician strengths and weaknesses, improving clinical proficiency and diagnostic accuracy. The EP module increased motivation for learning by incentivizing continuous professional development, leading to higher qualification levels. Higher patient satisfaction was achieved through PF, which improved patient trust and reduced service complaints. Additionally, QMS optimized healthcare management by streamlining staff evaluation and ensuring transparent decision-making.

The implementation of the Quality Medical System demonstrated measurable improvements across key performance indicators. Specifically, physician competency scores increased by 15 %, participation in professional training programs rose by 25 %, and patient satisfaction improved by 20 %. Additionally, diagnostic errors were reduced by 10 %. These quantitative outcomes confirm the effectiveness of QMS as an objective, comprehensive, and scalable solution for healthcare quality management, capable of significantly enhancing both clinical outcomes and patient trust.

The QMS system proved to be an effective tool for enhancing medical service quality and optimizing healthcare management processes. Future enhancements in technology integration and automation could further expand the system's capabilities, providing an even higher level of medical service quality across various healthcare institutions.

REFERENCES

1. Begicheva, S. V. (2019). IEEE 21st Conference on Business Informatics (CBI). doi: 10.1109/CBI.2019.10088
2. Begicheva, S. V. (2020). IEEE 14th International Conference on Application of Information and Communication Technologies (AICT). doi: 10.1109/AICT50176.2020.9368653
3. Bodin, O. N., Bezborodova, O. E., Mitroshin, A. N., Chuvykin, B. V., Martinov, D. V., & Edemsky, M. V. (2023). Systems and Technologies of the Digital HealthCare (STDH). doi: 10.1109/STDH59314.2023.10491005
4. Cao, J., Zhang, J., Lin, X. G., & Sun, A. L. (2022). IEEE 2nd International Conference on Information Communication and Software Engineering (ICICSE). doi: 10.1109/ICICSE55337.2022.9828956
5. Li, Z. (2024). IEEE 3rd International Conference on Electrical Engineering, Big Data and Algorithms (EEBDA). doi: 10.1109/EEBDA60612.2024.10485925
6. Liu, A., Guo, X., Liu, T., Zhang, Y., Tsai, S.-B., & Zhu, Q. (2019). IEEE Access, 7. doi: 10.1109/ACCESS.2019.2903684
7. Mei, Y., & Zhang, J. (2021). International Conference on Public Management and Intelligent Society (PMIS). doi: 10.1109/PMIS52742.2021.00064
8. Mikhailov, Y. I., Budrin, A. G., Budrina, E. V., Kovalchuk, S. V., Soldatova, A. V., & Lemeshkin, R. N. (2019). International Conference "Quality Management, Transport and Information Security, Information Technologies" (IT&QM&IS). doi: 10.1109/ITQMIS.2019.8928385
9. Pan, W., Xie, J., Zhao, Y., Liu, B., & Hu, K. (2021). IEEE International Conference on Bioinformatics and Biomedicine (BIBM). doi: 10.1109/BIBM52615.2021.9669614
10. Peng, K. (2021). 11th International Conference on Information Technology in Medicine and Education (ITME). doi: 10.1109/ITME53901.2021.00133
11. Sultanovs, E., Strebko, J., Romanovs, A., & Lektauers, A. (2020). 61st International Scientific Conference on Information Technology and Management Science of Riga Technical University (ITMS). doi: 10.1109/ITMS51158.2020.9259298
12. Zeng, S., & Wu, M. (2019). IEEE International Conference on Computation, Communication and Engineering (ICCCE). doi: 10.1109/ICCCE48422.2019.9010766
13. Zhang, Z., & Zhang, Y. (2021). International Conference on Public Management and Intelligent Society (PMIS). doi: 10.1109/PMIS52742.2021.00019

СИСТЕМА ОЦІНЮВАННЯ МЕДИЧНИХ ФАХІВЦІВ НА ОСНОВІ QMS

Ігор Павлів[1], Олександр Лозицький[2]

[1] Nasdaq Canada INC, Торонто , Канада
[2] Національний університет "Львівська політехніка",
кафедра інформаційних систем та мереж, Львів, Україна
[1] Email: micky.ukr@gmail.com, ORCID: 0009-0003-0957-0843
[2] Email: oleksandr.a.lozytskyy@lpnu.ua, ORCID: 0000-0001-8395-8385

Якість медичних послуг відіграє ключову роль у сфері охорони здоров'я, безпосередньо впливаючи на добробут пацієнтів, рівень довіри до медичних установ та загальні результати лікування. Незважаючи на розвиток медичних технологій і вдосконалення методів лікування, забезпечення послідовного, об'єктивного та комплексного оцінювання медичних фахівців залишається серйозною проблемою. Існуючі методи оцінки якості часто орієнтовані на ретроспективний аналіз випадків та фінансовий менеджмент, що не дає можливості отримати оперативні, засновані на даних висновки про кваліфікацію лікарів, їх безперервний професійний розвиток і рівень задоволеності пацієнтів. У цьому дослідженні пропонується система Quality Medical System (QMS) як комплексна модель оцінювання медичних працівників, що інтегрує три основні підсистеми: Контрольно-експертну роботу (КЕР), Освітнє портфоліо (ОП) та Відгуки пацієнтів (ВП).

Мета цього дослідження – розробка системного, багатофакторного підходу до оцінювання якості медичних послуг, який поєднує кількісні та якісні джерела даних. Підсистема КЕР оцінює компетенцію лікарів на основі незалежного експертного аналізу клінічних випадків, що забезпечує доказову, об'єктивну оцінку точності діагностики, ефективності лікування та відповідності медичним стандартам. Підсистема ОП відстежує освітній прогрес медичних фахівців, оцінюючи участь у навчальних програмах, сертифікаційних курсах і наукових дослідженнях, що сприяє постійній професійній еволюції. Водночас ВП аналізує зворотний зв'язок пацієнтів, забезпечуючи дані про якість комунікації між лікарем і пацієнтом, ефективність надання медичних послуг та загальний рівень задоволеності пацієнтів.

Для перевірки ефективності моделі QMS було проведено експериментальне дослідження у кількох медичних установах, метою якого було оцінити її вплив на результати роботи лікарів, професійний розвиток і довіру пацієнтів. Отримані результати показали зростання рівня професійної компетенції лікарів на 15 %, збільшення на 25 % залученості медиків до освітніх програм та покращення на 20 % рівня задоволеності пацієнтів. Крім того, частота помилкових діагнозів знизилася на 10 %, що свідчить про позитивний вплив об'єктивних оцінювань компетентності лікарів на клінічне прийняття рішень.

Одним із ключових викликів у впровадженні QMS є ресурсоємність збору, обробки та інтеграції даних. Додатково, відгуки пацієнтів можуть містити суб'єктивні упередження, що потребує застосування просунутих статистичних методів для забезпечення надійності оцінки. Проте модульна структура QMS дозволяє гнучко адаптувати систему під потреби різних медичних установ. Перспективні напрями розвитку QMS включають впровадження алгоритмів машинного навчання для автоматизації оцінювання компетентності, предиктивної аналітики для оптимізації навчальних програм і мобільних додатків для отримання зворотного зв'язку пацієнтів у реальному часі.

Це дослідження демонструє ефективність QMS як комплексного, масштабованого рішення для вдосконалення якості медичних послуг. Інтеграція оцінки компетенції лікарів, відстеження професійного розвитку та аналізу відгуків пацієнтів формує прозорий, заснований на даних підхід до управління якістю медичних послуг. Отримані результати підкреслюють потенціал QMS як інноваційного інструменту для модернізації систем оцінювання в медицині, що в перспективі сприятиме вищим стандартам медичної освіти, покращенню лікування пацієнтів та підвищенню достовірності клінічних рішень.

Ключові слова: система оцінювання якості медичних послуг (QMS), оцінка системи охорони здоров'я, компетентність лікарів, задоволеність пацієнтів, безперервна медична освіта, управління охороною здоров'я, експертна оцінка, клінічне прийняття рішень.