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DEVELOPMENTAL FACTORS FOR DIGITALIZATION OF QUALITY MANAGEMENT IN HEALTH CARE

In the current era, the effective application of high-tech in all spheres goes hand in hand with the Internet of Things (IoT), 5G, robotization, supercomputers, artificial intelligence, etc. The high-tech sector must also be developed at an accelerated pace. Technological innovation and digital technologies are penetrating all areas of activity, including healthcare. Digitalization of healthcare processes increases the availability of medical services to a large number of people, as well as the ability to control their health status. The digital transformation of healthcare processes not only affects the quality of life, but also increases process capacity and the quality of medical services provided.

Keywords: *digital transformation, digital health, quality in health, quality management, digitalization of quality management.*

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ФАКТОРИ РОЗВИТКУЦИФРОВІЗАЦІЇ УПРАВЛІННЯ ЯКІСТЮ В ОХОРОНІ ЗДОРОВ'Я

У сучасну епоху ефективне застосування високих технологій у всіх сферах йде рука об руку з Інтернетом речей (IoT), 5G, роботизацією, суперкомп'ютерами, штучним інтелектом тощо. Сектор високих технологій також має розвиватися прискореними темпами. Технологічні інновації та цифрові технології проникають у всі сфери діяльності, включно з охороною здоров'я. Цифровізація процесів охорони здоров'я підвищує доступність медичних послуг для великої кількості людей, а також можливість контролювати стан свого здоров'я. Цифрова трансформація процесів охорони здоров'я не лише впливає на якість життя, а й підвищує пропускну здатність процесів та якість наданих медичних послуг.

Ключові слова: *цифрова трансформація, цифрове здоров'я, якість в охороні здоров'я, управління якістю, цифровізація управління якістю.*

Introduction. The use of the concept of quality in healthcare is associated with two very influential experts, Nurse Nightingale and Dr. Codman. Florence Nightingale's evidence-based academic work, including strict adherence to basic sanitation and requirements to reduce the spread of infectious organisms, graphic description of causes of death, and statistical analysis, has taken an important place in improving the quality of health care. At the same time that Nightingale's work in nursing and health care quality was beginning to peak, Ernest A. Codman, MD, put forward the idea of using recent findings to improve the quality of health care. A physician and distinguished surgeon on staff at Massachusetts General Hospital, Codman sought to create an "end results system" for monitoring patient care. At this time, patient outcomes should be monitored, analyzed, and taken into account by physicians and the medical establishment, and final outcomes should be communi-

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cated to the public so that patients are informed about the medical service so they can make choices. In the early 20th century, Codman attempted to bring this system into the mainstream of health care. To this end, he advocated hospital standardization as the primary goal of the American College of Surgeons (ACS), founded in 1912. Codman chaired a committee on hospital standardization and developed a program for hospital standardization. This program eventually led to the creation of the Joint Commission on Accreditation of Healthcare Organizations. By 1918, the ACS was surveying large hospitals for the "minimum standard" used in its standardization program. By 1922, the survey program began to include medium-sized hospitals. In the following decades, the demand for the program grew considerably, and in 1946 the United States Hospital Construction Funding Act was passed. Although not supported by their contemporaries, Nightingale and Codman's work left a mark on history and ignited the fight for quality in health care.

In a situation where it has become increasingly important for organizations to improve the quality of their work and thereby increase their competitiveness in today's global and competitive marketplace, it is no longer a question of whether quality should be embedded in the health care sector, but what is the most effective way to do so. Therefore, it has become well established why quality is deeply embedded in the healthcare system and why it is of utmost importance to the delivery of healthcare services to each individual patient/client (A.G.Zunac et al., 2019).

Literature review. Quality management (QM) is a service and control process in which the quality of products and services is carefully checked for compliance with specified requirements. K.Zgodadova, B.Tosich, J.Russo, A.Aleksandrova, A.Kolesnik, M.Yasin, A.Birch-Jensen, I.Gremir, R.Ibrahim, S.Dodwad and others conducted a scientific study of the concept of quality, QM in health care, and the main features of QM through digital health. It should be noted that international organizations such as the OECD, the WHO and the World Bank Group have supported the expansion of research in this area. As examples we can cite the documents "Provision of quality health services: the global imperative of universal health coverage", "Improving the quality of health care in Europe: characteristics, effectiveness and implementation of various strategies". These studies considered the main directions of QM in the context of the digital transformation of the modern health care sphere. In addition to this, it is regrettable that the existing literature lacks definitive conclusions emphasizing the benefits and challenges of digital quality management system (QMS) in health care.

Problem statement and Research Objective.

Quality management in health care. The concept of quality in health care refers to the extent to which services are more likely to produce desired outcomes for the population. This means that quality of care can be measured. Quality in health care is not just about expanding services or improving the system, but also about improving the health of the population and reflecting the wishes of service users and other stakeholders. "Quality is about doing the right thing for the right people at the right time and always right" (S. S. Dodwad, 2013). The concept of quality in health care refers to the level of health care services that increase the likelihood of achieving desired population health outcomes and are consistent with current professional knowledge. This approach assumes that quality of care can be measured not only by

increasing the number of services or improving systemic processes, but also reflects the desire of stakeholders to improve population health. This definition of quality of health care services includes both curative and preventive care. In general, the importance of quality health services, which must be effective, safe, and people-centered, is globally recognized. In addition, health services must be timely, equitable, comprehensive, and effective in order to enjoy the benefits of quality health care (WHO et al., 2018).

Currently, there is no single definition of quality of health care services. A World Health Organization (WHO) Research Group has proposed a systematic approach to assessing quality, in which quality of care is assessed in terms of:

- Adequacy, which characterizes the compliance of the applied medical technologies with the needs and expectations of the population (adequacy can be assessed in terms of the impact of the applied technique on the patient's health and the quality of the patient's subsequent life);
- Economic efficiency;
- Scientific and technical level, indicating the up-to-date methods of prevention, diagnosis and treatment (A.L.Alexandrova et al., 2005).

Over the past 20 years, many frameworks have been developed that contribute to a better understanding of health care systems and a better understanding of the effectiveness of health care systems. Most of these frameworks, explicitly or implicitly, consider quality to be an important health system goal, but they differ in how they define quality and how it describes its contribution to overall health system goals. The framework presented by the WHO has a special meaning, the "component elements" as the basis for health systems strengthening. This structure represents the health system in terms of its building blocks, including service delivery, health personnel, information, health products, financing, and leadership. In addition, this framework defines quality and safety, as well as accessibility and coverage, as intermediate goals of the health system. Achieving these intermediate goals will ultimately contribute to the health system's overarching goals: improving health, responding to need, financial protection, and improving efficiency (WHO, 2022). It should be noted that this concept refers to quality and safety separately, whereas most of the definitions of quality discussed above include safety as the main indicator of quality.

Thus, QM is an aspect of the overall management function that defines and implements quality strategy and policy. It includes strategic planning, resource allocation, and other systematic quality assurance activities such as quality planning, operations, and evaluations (S.S.Dodwad, 2013). A QMS provides a strategic framework that meets the requirements of quality, efficiency, and effectiveness. This can be achieved by performing the following functions:

a) providing quality patient care;

b) Creating an environment of continuous process improvement;

c) performing these functions at minimal cost (K.Zgodavova, S.E.Koleska, 2007).

The most important model used to conceptualize approaches to quality improvement – not only in healthcare, but in many industries – is the Plan-Do-Check-Act (PDCA) cycle, also known as the Plan-Do-Study-Act. (PDSA) cycle. The PDCA cycle is a four-step model for implementing change that is used by many

health agencies and public health programs (WHO, 2022). The planning phase identifies the problem, gathers relevant information to address the problem, and identifies the root cause of the problem; the solution developed in the implementation phase is implemented and methods are decided on to measure its effectiveness; results are prepared by comparing first and recent data collected in the validation phase; in the action phase, results are documented, process changes are communicated to others, and recommendations for addressing the problem are made for the next PDCA cycle.

Currently, most studies consider three aspects of the quality of medical care:

- quality of structure - organization of staff, qualifications of medical workers, material, technical and drug provision of the treatment process;

- quality of the process - compliance with standards of medical care and the correct choice of medical equipment;

- quality of the end result - economic and social efficiency, medical and demographic indicators, patient satisfaction with the services received, quality of life (A.L.Alexandrova et al., 2005).

These aspects are also known as the Donabedian triad. In his famous 1966 article "Assessing the Quality of Medical Care," Donabedian, based on the "investment-process-result" concept used in industrial production, proposed a triad of structure, process and outcome to assess the quality of medical care (WHO, 2022).

All existing approaches to QM in health care identify 3 main activities - standard setting, continuous improvement, and monitoring. Standardization in health care refers to activities aimed at achieving optimal order by developing and establishing requirements, norms, works, services used in health care. Continuous improvement includes developing and implementing strategies to improve patient satisfaction, funding, and accountability for quality improvement. Monitoring activities include auditing, accreditation, and certification (WHO, 2022).

Recently, both public and private sector organizations working in health care have been focusing more on organizing processes according to the current version of ISO-9000 and ISO-9001 standards. Because the ISO concept is largely based on experience, ideas, and theory proven in practice, over time these concepts have become necessary elements in the structure of a quality system. This pragmatic approach proved to be correct, making these standards the most widely accepted and used in the history of the International Organization for Standardization, ISO (B.Tosic, et al., 2018). The European standard EN 15224 is mainly used for quality management in healthcare. The standard builds on the requirements of ISO 9001 and transfers them to specific quality requirements in healthcare. It also contains additional requirements, specifications and interpretations as well as aspects of clinical risk management (K.Zgodavova, S.E.Koleska, 2007).

The growing interest in quality measurement has been accompanied and supported by a growing ability to measure and analyze the quality of health care, due in part to significant changes in information technology and related advances in measurement methodology. Most quality measurement initiatives involve the development and evaluation of quality indicators. Obviously, the quality of health care is difficult to measure directly, as it is a theoretical concept that can cover different aspects depending on the exact definition and context of the measurement. According to the definition of quality, quality indicators are defined as quantitative indicators that pro-

vide information about the effectiveness, safety, and human-centeredness of care. Quality indicators should provide:

- a quality goal, i.e., a clear statement of the intended goal or objective, e.g., hospital mortality of patients admitted with pneumonia should be as low as possible;

- a measurement concept, i.e., a specific methodology for collecting data and calculating an indicator, e.g., the proportion of patients with a primary diagnosis of pneumonia who die during their hospital stay;

- the concept of measurement, i.e., a description of how the measure would be used to assess quality, e.g., if hospital mortality is below 10%, this is considered a good level of quality (WHO, 2022).

Thus, QM in health care requires planning and must be a priority to achieve universal health coverage. Quality assurance and sustainability in health systems consists of a series of steps based on principles such as transparency, people-centeredness, information measurement, workforce investment:

1) creating an enabling environment;
2) patient (service) orientation;
3) marketing changes in the enterprise;
4) staff motivation;
5) team building: review;
6) data collection and analysis;
7) problem solving cycle - problem definition, problem description, strategy development, solution planning, definition of standards, solution implementation, solution evaluation, and monitoring;
8) control (Dodwad S.S., 2013).

Thus, a healthcare organization must establish an integrated management system consisting of a QMS, an occupational health and safety management system, and an environmental management system. With such an integrated management system, a health care institution can meet increasing environmental requirements and use technological innovation and digitalization to improve the quality of services provided (A.G. Zunak et al., 2019)

Digital transformation of quality management in health care. The healthcare industry is entering an era of digital innovation, with patients seeking services that can directly respond to their needs as they are limited by their daily activities. Consumers search the Internet for medical information, looking for information about doctors, and booking appointments for medical checkups. Recognizing the benefits of digital transformation, more and more companies in the healthcare sector, including hospitals, are taking the initiative to implement digital transformation in their management systems to produce better healthcare services. Not all healthcare facilities are ready to embrace the Disruption 4.0 era, which is full of digital technology. Various obstacles related to human resources, funding sources, business processes, government regulations and rules, and the lack of a data integration system often get in the way (M. Jasin, 2022). It is necessary to emphasize the fact that digital transformation permeates the entire organization as well as the quality management system. The digital transformation of the QMS is particularly important in relation to the concept of Quality 4.0, which is based on innovations arising from Industry 4.0 (A.G.Zunac et al., 2019).

The main purpose of digitizing QM is to reduce costs, provide easy and quick access, implement certain procedures and interpret rules to improve quality. A digital QMS can help businesses obtain relevant and timely information by facilitating decision-making, information flow, and communication capabilities (A.G.Zunak et al., 2019; R.Ibrahim, 2019). Digital QMS includes systems such as ISO certifications that dictate how organizations follow to secure internal operating procedures, eliminate unnecessary traditional approaches to improve business performance and gain competitive advantage. While digital QMS is primarily for internal processes, the system implicitly mandates that organizations follow multiple business standards when selecting business partners, such as suppliers, employees and other stakeholders. The presence of different stakeholders can create challenges for traditional QMS. However, a collaborative digital QMS can create business value in three sections:

- Business-2-business value creation - this means creating business value for partners, such as suppliers.

- Creating value in the business-2-others domain - this means creating value for joint venture partners, alliance partners, offshore partners, etc.

- Creating value in the business-2-customers domain - this refers to creating value for customers (R.Ibrahim, 2019).

Digital transformation in the healthcare organization is shaping the role of QM for the following reasons: 1) digital solutions that improve the technical quality of products and services appropriately influence the focus of QM; 2) digital technology is opening up new forms of interaction with customers in search of better ways to use and deliver services in real time; 3) QM advancement in improving internal processes is supported by more digital solutions; 4) all activities related to digitization and QM are not limited to one function and apply to the entire organization. From the above, it is clear that digitization potentially affects all aspects of operations management (M.Elg et al., 2021).

As we know, one of the main characteristics of digitalization is its ability to change and transform processes, organizations and even ecosystems. This means that roles and relationships are changing both within and between organizations. The result is lower costs and greater efficiency, effectiveness and quality of service delivered. With a digital QMS, organizations can manage and benefit from important up-to-date QM documents. This eliminates the need for physical copies, making business information available to everyone, anywhere, anytime. A digital QMS can easily be analyzed whenever an organization requires any changes. Electronic QMS is a dynamic management system; it provides speed, adds flexibility, and even allows you to analyze changes in the company. The traditional QMS is characterized by "having redundancy," while the digital QMS works in the opposite direction, as it aims to reduce redundancy. This encourages businesses to invest in a digital QMS because it is easy to maintain, it also makes data available for internal and external audits, and new changes can be implemented quickly by everyone in the organization (M.Elg, et al., 2021; R. Ibrahim, 2019).

Thus, we can note that the digitalization of health services has also led to changes in the understanding of measurement and indicators of its quality. The development and application of technologies such as e-health, mobile health, and the general development of the information system, which allows communication and exchange of

information, allow for faster diagnosis. In addition, the ability to communicate remotely with medical personnel reduces the need to visit a doctor, which has the effect of reducing waiting times and, therefore, getting the care you need more quickly. This also leads to fewer health risks that need to be treated in a shorter period of time. The possibilities offered by the use of robotics and automated systems can lead to a reduction in the cost of providing qualified medical personnel, as well as a solution to the problem of staffing shortages in general. With artificial intelligence, procedures that require high precision can be performed much more reliably, and with expert systems, diagnosis and therapy can be more efficient and effective (A.G. Zunac et al., 2019).

Digitalization of health care processes makes it possible to enjoy quality health care where it is not available. Similarly, health care users can find answers to simple questions themselves, thereby avoiding queues, which ultimately lead to a deterioration in the quality of life of other health care users. However, the benefits of digitalization and the use of digital technologies in health care require the modernization of existing infrastructure, as well as the provision of adequate education for both health care users and health care providers. Infrastructure security is often understood as high value, adapting the existing business model of a healthcare organization to the digital environment. This means providing competent personnel to maintain application systems, as well as educating and training health care users about the opportunities and benefits of using digital technology.

Conclusions. Along with the emergence of the industrial revolution and its associated technologies, a revolution is also taking place in health services. The concept of Health 4.0 has emerged, involving the use of technologies developed within Industry 4.0. The digitalization of healthcare processes involves the use of telemedicine, big data, sensors, IoT, IoMT, automated and robotic systems, which requires building new infrastructure to enable their use, as well as additional training for existing medical professionals. Given the evolution of Industry 4.0 to Industry 5.0, in the future we can expect the development of Health 5.0, which includes the open collaboration of medical professionals with automated systems and artificial intelligence, which means additional opportunities to improve the quality of service.

The digital transformation of processes in healthcare is not only related to the introduction of new technologies, but organizations also have the opportunity to improve existing processes, which will affect the improvement of the quality of medical services. A high quality of medical services leads to an improvement in the quality of life of their users. In order to ensure quality, it is advisable to provide for the effective use of the possibilities of digital health:

- harmonization of standards to improve the quality and comparability of data, in particular standardized terminology for the classification, analysis and prevention of adverse events;
- development of national legislation that protects privacy and allows the use of personal health data for research and quality improvement, as well as transparency;
- establishing reliable birth and death registration systems to ensure quality control at all stages of care and developing a national system of unique patient identifiers based on them;
- incorporating the measurement of patient outcomes and experiences as a standard element in facility quality assessment;

- collecting and analyzing information about quality improvement services and informing the public about how this information is used;

- transition from paper documentation to a unique electronic medical record, etc.

Regardless of how far the health care system must go to achieve universal health care coverage, quality must be at the core of the health care system. A quality-oriented approach to health care providers, health care facilities, drugs, devices and other technologies, information systems and financing is vital at all stages of development. The focus should be on laying the foundations, planning, and developing quality health systems. However, more action is needed to build quality health systems. Health systems must move away from top-down hierarchies and toward collaborative and cooperative networks in which primary care is primary and person-centered. This transformation of attitudes must be accompanied by new mechanisms for holding governments and health system leaders accountable and building citizen trust.

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