



Research Article

The Role of eHealth in the Management of Patient Safety

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Abstract

The aim of the article is to present the essence of patient safety and the role, goals, benefits and areas of application of eHealth in the process of patient safety management. The development of information and communication technologies creates opportunities to support innovation in the health services sector in the field of e-health services and tools. However, the implementation of digital technologies in the field of health has a significant impact on patient safety. Therefore, the question of the possibility of using e-health services and tools in supporting patient safety management becomes a key issue. The article is conceptual in nature and was developed using research methods such as: review and in-depth analysis of literature and documents on health policy, reports and legal acts. eHealth services and tools can be used in a variety of activities in the patient safety management process, but require consistent, complex interaction at all levels of the healthcare system, as well as cross-sectoral and international cooperation. This applies to both cooperation in the field of technology and the legal framework for using the potential of e-health. Particularly important in the implementation of digital technologies is ensuring data security and active participation of patients and medical staff in developing health awareness, their involvement in communication and educational processes.

Keywords: E-health, Patient Safety Management, Health Care, Digital Health Interventions.

Introduction

The basic assumption of the article is the issue of ensuring patient safety in the era of progressive development of digital health. With the advancement of information and communication technologies, the possibilities of supporting the development of innovation in the medical services sector are expanding. Real benefits resulting from the implementation of digital technologies in the processes of providing health services, strengthening the role of the patient, involvement of patients and the community in health-related activities are recognised. The institutions of the European Union point out that thanks to the significant use of digital innovations it is possible to promote health, prevent and combat illnesses, help meet patients' needs and facilitate equal access to high quality care for citizens, and therefore recommend the implementation of priority actions in three main areas such as: citizens' secure access to and sharing of health data across borders; better data to advance research, disease prevention and personalised health and care and digital tools for citizen empowerment and person-centred care (Commission to the European Parliament, 2018).

Progress of digital technologies contributes to the dynamic development of eHealth, including services and tools for mobile health (mHealth) and telemedicine. According to Eurostat data, in 2019 already 55% of individuals aged 16 to 74 (citizens of 28 EU countries) used the Internet to search for health-related information (injury, disease, nutrition, improving health, etc. within the last three months before the survey) (Eurostat, 2020).

Digital innovations used in the health sphere can be a source of benefits in increasing the availability of health services, improving communication between participants of the health care system, providing high quality health services that significantly influence the patient safety. At the same time, digital technologies can generate safety risks,

especially in the area of data management, quality and reliability of the data collected and provided to patients. The key challenge for health care systems is to ensure health safety, including safe data management in the field of digital health interventions. This applies both to the recipients of health services (current and potential patients), health care providers (in the institutional dimension and at the level of employees) as well as national and local decision makers responsible for the functioning of the health system and organisations related to the information sphere.

Research Approach

The starting point in the research process was the assumption that the use of eHealth services and tools is important for the management of patient safety. The author tried to answer the following key questions:

1. What is the essence and what factors determine the management of patient safety?
2. What functions are the tools and services of eHealth in the health care system?
3. How and in what areas digital health interventions can support patient safety management?

The main aim of the article is to present the essence and determinants of patient safety and to identify the possibilities of using eHealth tools and services (digital health interventions) in the process of patient safety management. The article is conceptual and based on the analysis of literature as well as documents. The following research methods were used: a) study of literature - review and in-depth analysis of literature in the field of management, related to the patient safety management and digital health, and b) analysis of documents - review and in-depth analysis of international strategic documents on health policy, reports and legal acts.

The Essence and Determinants of Patient Safety Management

The issue of safety in the field of health is multidimensional. The complexity of the problem stems from the very definition of health, which is considered as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2020). In a broader sense health means a "dynamic state of physical, mental, social and spiritual well-being" (Chuengsatiansup, 2003). In the considerations of the essence of health safety, the specific features of health services are important, in particular their professional character, which is usually a source of disproportions in the knowledge resources, occurring in the relations between a medical worker (a professional) and a patient (not possessing specialist knowledge). The main features of health services include: intangibility and lack of guarantee of the effectiveness of the health service, psychological complexity of the process (stress accompanying patients), constant interaction between the doctor and the patient, professional knowledge of the service provider, which enables professional performance of the service and implies the need for good communication between the doctor and the patient to build trust (Bukowska-Piestrzynska, 2009).

The concept of safety in the area of health is associated with such issues as safe health care, health safety, patient safety and concerns both the system level (health care system and society), as well as the patient's level (relations between the individual patient and the organisation providing health services).

Safety is an indispensable and desirable feature of health services. According to the World Health Organisation (WHO, 2018a), a good health system should deliver quality services to all people, when and where they need them. Ensuring security is the domain of the state that is responsible for shaping such a health care system that will provide good health services to citizens. In this context, health safety is the process of continuous efforts of the state and

individuals to meet their health needs and manifests itself in the certainty of action of government administration bodies, local government administration and subordinate services in the field of protection of life and health (Paplicki, (2016). These activities should lead to achieving health safety, i.e. a state guaranteeing no threats that may cause a deterioration or loss of citizens' health (Ameljańczyk and Ameljańczyk, 2012). In the general dimension, health safety concerns the formal and organisational determinants of the health care system and is related to the activities of decision-makers (at the national and local level) and health care providers responsible for shaping and efficient functioning of the health system. According to B. Bober (2016), the level of health safety is determined by the health care system (including public hospitals) and is closely related to the availability of health services.

The concept of patient safety is closely related to health safety. Patient safety, as a feature of health care systems, means the discipline of the health care sector, based on the use of scientific methods of maintaining safety in order to create a trustworthy system of providing health services and reduce the incidence of adverse events and minimise their consequences, as well as to increase the chance of returning to normal after the occurrence of these events (Patient safety, 2017). A sense of safety may be subjective and result from personal experience, awareness of rights, knowledge of the principles of the functioning of the health care system and the availability of health services, as well as from the experience of other patients. In the individual dimension, "patient safety means freedom, for a patient, from unnecessary harm or potential harm associated with health care" (The Council of the European Union, 2009).

Patient safety is also defined as a set of activities including "the avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of health care" (Vincent, 2011). These activities apply to all participants in the health system, including policy makers,

health service providers, medical staff and other stakeholders, and require cooperation within formal and informal networks. From the perspective of health service providers, safety is determined by the operating conditions (formal and organisational conditions, resources, infrastructure and competences) and responsibility for the consequences of adverse events.

It is recognised that safety is a dynamic property of the health care system; therefore improving patient safety means organisational continuous learning and knowledge transfer at the system level, resulting in a need to change the approach to setting organisational procedures and taking into account the specificity of processes, divisions, professions and levels (Wiig and Lindøe, 2009). Patient safety, as an indispensable determinant of the delivery of high-quality health care, concerns three basic elements of the system, such as: structure (resources, organisation of the health care system, safety culture, availability of knowledge, transfer of knowledge, trainings), process (activity of health care providers) and outcomes (adverse events and injuries, consequences of clinical activities by providers) (Jha et al, 2010).

Most developed countries have the following elements in their strategies for improving patient safety (Stroetmann et al, 2007):

1. a "just" or "fair" culture, conducive to reporting and questioning - incident reporting and analysis systems at local and national level;
2. an in-depth analysis process to identify and assess the causes of incidents and aggregated incident reviews;
3. a process that ensures the implementation of activities and demonstration of adequate improvement of patient safety and quality of care;
4. effective information exchange processes at various levels - national, organisational and clinical - for learning and improvement;

5. redefinition of compensation systems and their impact on culture and achievements in the field of patient safety.

R.M. Wachter indicates that improving security requires a multi-dimensional approach and identifies five main areas of relevant activities and initiatives such as: regulation, error reporting systems; information technology; the malpractice system and other vehicles for accountability and work force and training issues (Wachter, 2004).

The process of patient safety management aimed at permanently maintaining the designated security state has a multistage and complex nature. The organisation of safe processes for the provision of health services requires action both at the systemic level as well as at the institutional level. A comprehensive approach is essential in this process, including coherent actions related to the establishment of the following components: safety definition (the expected, target result of safety management), safety model (a description of the way in which organisation functions and accidents happen), safety management model (background assumptions adopted in the organisation to manage and improve safety, elements necessary for the management and improvement of patient safety) and safety management system (a set of systematic organisational processes necessary to manage the organisation to ensure and develop security, that aim to provide a structured management approach to control the risk in operations and increase the organisation's ability to function safely) (Macchi et al, 2011).

It is indicated that four areas are important for effective implementation of patient safety practices, such as: safety culture, team work and leadership commitment, structural organisational features, external factors (financial and performance incentives, patient safety regulations), availability of implementation and management tools (training resources, internal organisational incentives) (Taylor et al, 2011). Patient safety management should be comprehensive and consistent

with the overall management system. Safety management, treated as an integral part of good management in general, should be based on the model: Plan, Do, Check, Act, under which the following activities are undertaken (HSE, 2013):

- planning - defining and communicating acceptable performance and resources needed;
- doing - determining the risk profile, identifying and assessing of risks, controls/record identifying and process safety knowledge maintaining, organising activities and implementing the plan;
- checking - performance measurement - implementing and managing of control measures, investigating the causes of accidents, incidents or potentially accidental events;
- acting - performance reviewing, taking actions based on lessons learned, including inspection and audit reports.

Summing up, it should be emphasised that patient safety management is a complex, multifaceted process involving many different stakeholders of the health care system, which requires constant striving to ensure and maintain a state in which patients feel safe in the area of health. This process means a set of integrated activities consisting in planning (identifying threats and their conditions, setting safety and regulatory standards, procedures for reaching this state), organising (providing human, financial, material and information resources), stimulating to operate safely (creating and maintaining safety culture by training, promoting, motivating), controlling and improving (system for monitoring and processing of adverse events, measurement, analysis and evaluation of the achieved level of safety). These activities must be coherent and integrated at all health care system levels and take into account determinants of health policy, social needs, demographic changes and technological progress, as well as internal conditions and the specificity of the operation of entities providing health services.

eHealth in the Health Care System - The Essence, Tools and Goals

The concept of eHealth is defined in many ways, indicating, in a different perspective, the scope of activities (services), tools or functions. In broad terms, according to the definition of the World Health Organization, eHealth is “the cost-effective and secure use of information communication technologies (ICT) in support of health and health related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research” (WHO, 2016a). The European Commission (2012) defines eHealth as “the use of ICT in health products, services and processes combined with organisational change in health care systems and new skills, in order to improve health of citizens, efficiency and productivity in health care delivery, and the economic and social value of health. eHealth covers the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients and/or health professionals”.

In recent years, the concept of digital health has been promoted. WHO (2019) indicates that digital health or the use of digital technologies for health is rooted in eHealth and means a term that includes eHealth and mHealth as its subset. The European Commission (2019) uses the concept digital health and care that means “tools and services that use information and communication technologies (ICTs) to improve prevention, diagnosis, treatment, monitoring and management of health and lifestyle”.

In addition, the concept of digital health interventions has been introduced. According to WHO (2019), a digital health intervention is “a discrete functionality of digital technology that is applied to achieve health objectives”. Digital health interventions (DHI) may include activities such as: promoting healthy behaviours, providing remote access to effective treatment methods, enabling patients to

access information on their health status, improving results in people with chronic diseases, exchanging experiences with other patients, changing perceptions and cognitions around health, assessing and monitoring specified health states or health behaviours, titration of medication, improved communication between patients and health care professionals, explaining health priorities and making treatment decisions consistent with them (Murray et al, 2016). It is indicated that digital health interventions are conducted in four main areas such as (WHO, 2018b):

1. interventions for clients - potential or current users of health services, including health promoting activities and caregivers of clients,
2. interventions for health care providers - health care providers are members of the health workforce who deliver health services,
3. interventions for health system or resource managers - managers involved in the administration and supervision of public health care systems, including activities related to supply chain management, health financing, human resources management,
4. interventions for data services - cross-sectional functions, related to supporting a wide range of data management activities (collection, use and exchange of data).

Digital health interventions defined also as “the use of information and communication technology (ICT) as a tool to improve health systems and services” include mobile health (mHealth) and electronic health (eHealth) (Wilson et al, 2014). Mobile health (mHealth) is a dynamically developing field that can contribute to the transformation of health care and increase its quality and efficiency, and means medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices and including applications such as lifestyle and wellbeing apps that may connect to medical devices or sensors (e.g. bracelets or watches) as

well as personal guidance systems, health information and medication reminders provided by SMS and wirelessly provided telemedicine (European Commission, 2004). mHealth is expected to play a significant role in changing health care towards a patient-centred and value-based delivery model, improving work-place productivity, increasing patient engagement and patient safety, better coordinating care, and facilitating payments (Deloitte, 2015).

The concept of telemedicine (telehealth) is also connected with eHealth. Telemedicine is defined as “the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities” (WHO, 2010). It is emphasised that telehealth can contribute to improving (speeding up, reducing costs) equal patient access to high quality, cost-effective health services wherever they are, as well as increasing the uniformity of practice (higher quality of care) and providing universal health coverage, especially for vulnerable groups and ageing populations (WHO, 2016a).

It is also pointed out that the benefits of using eHealth (including mHealth and telehealth) services are multifaceted and relate to system performance levels. The main categories of benefits include (Reijonsaari, et al, 2005):

- quality of care: improved clinical data collection and analysis at organisational and national level, portability of patient information across health care network, improved patient-provider communication and more accurate and accessible patient records,
- cost: improved triage to reduce unnecessary office and emergency department visits, improved home care to reduce nursing home and

- hospital care, more robust disease management,
- efficiency: productivity of physicians increases, reduced paper flow and less telephone calls, faster processing of administrative transactions, automated scheduling and prescription refills.

However, there are a number of barriers that are not conducive to wider use of eHealth, in particular such as: lack of awareness and trust in eHealth solutions among patients, citizens and health professionals; lack of interoperability between eHealth solutions; limited evidence on a large scale regarding the cost-effectiveness of eHealth tools and services; lack of legal clarity for mobile applications for health and well-being and lack of transparency regarding the use of data collected by such applications; inadequate or fragmented legal frameworks, including the lack of reimbursement schemes for eHealth services; high start-up costs associated with the setting up of eHealth systems; regional differences in access to ICT services and limited access in deprived areas (European Commission, 2012).

The aspects mentioned above make the implementation of eHealth a difficult challenge at the system and executive level. eHealth means organisational (structural, procedural) and infrastructural changes, especially in the sphere of methods and communication tools that force the acquisition of new skills, thus generating the needs of interdisciplinary development.

An important challenge is the cross-sectoral cooperation and creation of well-functioning networks of relations between the participants of the health system (policy makers, organisations conducting health-related activities, medical staff and patients: potential and currently declaring needs in the area of health services and their families or friends) and sectors of services supporting eHealth (organisations responsible for information networks, etc.). According to G. Eysenbach (2001), eHealth is an area at the crossroads of medical informatics, public health and business,

referring to health services and information provided or improved using the Internet and related technologies, and therefore in a broader sense it is not only technical development, but also state of mind, way of thinking, attitudes and commitment to networking, global thinking, to improve health care at the local, regional and global levels by means of information and communication technology.

In conclusion, it should be noted that eHealth can be considered a dynamic socio-cultural phenomenon meaning the development and implementation of digital technologies in the broader sphere of health and applies at various levels of the care system (macro, meso and micro) and in various dimensions of action relating to different stages of the service delivery process, supporting not only the treatment, but also prevention, health education and management activities (planning, organising, coordinating and monitoring health care).

The Use of eHealth in the Management of Patient Safety - A Review of Scope and Functionality

Digital health interventions cover a wide range of services and tools that can be used at different stages of the patient safety management process. It is expected that digital solutions should contribute to clinical decision support, more efficient use of health care resources, better targeted and integrated and safer health care, in particular regarding the exchange of information between health care professionals, reducing the number of avoidable errors and adverse events, and improving coordination and continuity of care and better adherence to treatment (European Union, 2017).

WHO (2016b) emphasises that key gaps in patient safety in any health care system include communication and teamwork, ordering and interpreting diagnostic tests, data management, transition between care levels, and completeness of patient records. eHealth can contribute to the reduction of these gaps by providing decision support

for prescriptions and test orders, improving documentation and communication for transfer between providers, tracking and sharing the results of diagnostic tests and improving data monitoring and analysis (WHO, 2016b).

The core of digital health interventions is information transfer, which can ensure effective communication and interaction between participants in the health care system. In particular, mHealth enables multidirectional communication, which can be implemented in the following types (WHO, 2016a):

- communication between individuals and health services - health call centres, health care telephone helplines, emergency toll-free telephone services;
- communication between health services and individuals - treatment adherence, reminder to attend appointments, community mobilisation, health promotion campaigns;
- consultation between health care professionals (mobile telehealth);
- intersectoral communication in emergencies - emergency management systems;
- health monitoring and surveillance - health surveys, surveillance, patient monitoring;
- access to information and education for health care professionals - access to information, resources, databases and tools, clinical decision support systems, electronic patient information, m-learning (access to online educational resources using mobile).

The benefits of implementing digital health interventions affect both the patients themselves and those providing health services, and may include effects such as: improvement of results, reduction of unwarranted variation, reduction of preventable harm, improvement of the appropriateness of health care, better patient centeredness, increased possibilities for monitoring and quality improvement (Shaw et al, 2017). The main

functions of digital health interventions include (Shaw et al, 2017):

- electronic patient portals - providing patients with secure access to their health information and helping consumers to become active participants in decision-making about their health care;
- electronic patient reminders (mobile technologies) - delivering reminders to a large proportion of the patient population group; promoting successful outcomes by generating personalised communication between health care professionals and patients and impact on clinical workflow;
- information-sharing at discharge - critical to the continuity of care and promotion of patient safety and promoting timeliness of preparation and transmission of patient information to primary care providers;
- computerised provider order entry including electronic prescribing - improving organisational efficiency and prescribing safety (in the field of compliance with medication guidelines);
- clinical decision-support systems - matching patient-specific characteristics to the database; creating personalised predictions for the assessment of disease status, diagnosis, appropriate treatment options and other clinical decisions; generating reminders and alerts for the patient when a deviation from the recommended care is detected and positive impact on patient safety, especially in terms of accessibility, clinical evaluation, data integration, compliance with guidelines, indicated care, organisational performance, patient outcomes, resource use and safety prescription.

Fundamental to the provision of safe, knowledge-based health care is appropriate collection analysis and feedback of health information, robust process and system design for clinical care and supports, risk management in all governance processes, and monitoring and

activities based on real data connected with organisation performance and identified needs of the community (Stroetmann et al, 2007). In addition, it is pointed out that the keys to effectively manage health and safety are the following aspects: leadership and management (including relevant business processes); trained, qualified workforce; an environment in which people are trusted and involved (HSE, 2013).

WHO (2016c) indicates that digital interventions to involve patients in safer primary care fall into three broad categories such as: educating patients and health care providers for safer health care, obtaining retrospective or real-time feedback and engaging in improvement systems or services. Specific activities as part of strategies to increase patient engagement in safer primary care recommended by WHO (2016c) relate to:

- educating health care providers to involve patients, both at the organisational and individual level; including patient engagement and safety in educational curricula at undergraduate and postgraduate level and developing a learning culture, rather than a blaming culture;
- supporting patients to become actively involved - encouraging patients to report on safety incidents, near misses and safety concerns; actively promoting patient feedback systems; giving feedback to patients on follow-up actions taken about the issues they raised; considering legislation that supports patients and their families to engage in issues relevant for their safety and providing patients with appropriate, accurate and up-to-date information about treatment and safety issues in a user-friendly language and format;
- broadening the ways in which patients are involved - exploring alternative ways of communicating with patients, such as telephone, e-mail and online video calls; putting in place systems to facilitate patient access to their health records; involving patient advocates, where appropriate, to support the

engagement of patients at the direct care, organisational and policy level; supporting the work of patient-led voluntary associations and considering campaigns aimed at raising public awareness about the need for and benefits from the strengthened engagement of patients and their relatives in patient safety in primary care;

- recognising the importance of communities - adapting engagement strategies to the local social and cultural context and recognising that patients are part of social groups, families and communities and that these broader networks can be a positive force for change;
- providing an enabling and supportive environment - encourage and facilitate interaction among health care professionals, and engagement with patients and families; promoting open disclosure about safety incidents to patients; linking patient feedback systems to organisational systems for learning and improvement, similar to staff-initiated incident reports; providing information and support for self-care such as counselling, peer-support groups and coaching; designating and supporting patient safety champions or advocates, where appropriate, to help facilitate patient engagement and setting up mechanisms for patient engagement at the systems level.

In conclusion, it should be emphasised that the variety of digital solutions, including eHealth services and tools, creates a wide range of possibilities for supporting management processes in the areas of safety and quality of health care in particular. eHealth supports decision-making and controlling processes in the management sphere regarding the organisation and delivery of health services, as well as clinical decision, is a source and tool for data transfer, and enables measurement and monitoring of safety in the health care system, thus reducing errors and risk of occurrence of adverse events. As a communication and education tool for patients and staff,

eHealth supports the development of the idea of patient involvement and empowerment of patients in the health care system, which contributes to patient safety in a qualitative context related to accessibility, better communication, and information exchange processes.

Conclusions

The dynamic development of digital technologies creates opportunities for improving the health care system, in particular in ensuring patient safety. According to the World Health Organization (2016c), electronic tools will be crucial for improving safety, especially in the area of activities such as: the use of electronic health records for more accurate and complete patient records; timely and reliable sharing of health data; supporting the diagnosis, monitoring and management of diseases and conditions; effecting behaviour change and reduction of health risk, and empowering and engaging patients and families in their own care, support in organising communication between professionals in a way that reduces errors and improves coordination, reduction of unnecessary consultations and hospitalisations, improvement of access to knowledge about health conditions and management of them both for specialists and patients.

The implementation of digital solutions can be a source of threats, especially in terms of access to health data, the diversity of Electronic Medical Records, the lack of technical interoperability and access to digital health services (Commission to the European Parliament, 2018). The use of eHealth tools means the need to create a formal framework, consistent at the national and international level, in order to ensure the safe functioning of health systems. Key to the safety of patients is the shaping of data management systems, consistent knowledge management both in terms of personalised data and general health information. The necessity of efficient knowledge management concerns both the institutional and system level (in local and national dimensions) and also requires taking into account the

international context. The condition for the effective and safe use of digital technologies in health services is cooperation in the international dimension. As the European Commission points out, the concerns related to electronic data exchange primarily regard the risk of breaching privacy, the cyber security threat and the quality and reliability of data; therefore, the following actions should be prioritised: the development of EU-wide standards for data quality, reliability and cybersecurity, EU-wide standardisation of electronic health records and better interoperability through open exchange formats (Commission to the European Parliament, 2018).

eHealth services and tools are widely used in various activities in the process of patient safety management, however, they require coherent, complex interaction at all levels of the health care system (macro, meso and micro) and intersectoral cooperation, in particular with organisations dealing in research and development of digital innovations, implementation of digital technologies and ensuring data security. Effective patient safety management is possible thanks to the involvement of all participants in the health care system. eHealth is a challenge for health care providers, managers and staff, and requires constant learning, readiness for change, and the responsible use of digital solutions. In addition, the potential of eHealth, digital health interventions can be used with the active participation of patients in developing health awareness, their involvement in communication and education processes.

To support the practical, operational dimension of the provision of health services, it is important to present examples of activities, eHealth projects and to promote good practices in the field of patient safety management. The article is valuable for identifying, systematising and highlighting the importance of digital solutions in improving the patient safety management process and is the starting point for more in-depth research.

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