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The Use of E-Tools in Health Care Management for Social Safety and Security in Poland

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Abstract:

Purpose: *This research aims to present digital solutions used in health care for social safety and security, which are applied on a large scale by both patients and medical staff, improving management in health care and healthcare security.*
Design/Methodology/Approach: *This research focuses on the analysis of the e-tools that were implemented in Polish healthcare system in order to improve: the functioning of healthcare, accessibility to healthcare services and the quality of healthcare delivery for social safety. The analysis in the article shows the increasing interest of e-tools among healthcare providers and patients. The article also highlights the advantages of implementing innovation e-tools in healthcare from the perspective of the patient, medical staff and the safety system as a whole, and highlights the challenges and threats of the digitalisation of healthcare. In order to achieve the study aims and answers the research questions the following research methods were used: a critical analysis, synthesis and evaluation of science literature and websites presenting digital solutions for the national health care system, an analysis of source materials and statistical data of the e-Health Center.*
Findings: *The digitization of health and the use of e-tools in healthcare are crucial for the development of healthcare in Poland, from the point of view of patients, medical staff, and people involved in creating the healthcare system. The numerical data referred to in the article indicate the high use of e-tools and their growing popularity among patients and healthcare entities, although their functioning is often not without problems or drawbacks. The study presents a description of e-tools implemented in the Polish healthcare system. The described e-tools include: e-prescription, e-referral, Electronic Medical Documentation and Medical Events, the Internet Patient Account application (pacjent.gov.pl), and the MojeIKP mobile application.*
Practical Implications: *The article attempted to cover an expansive subject area of digitalization in healthcare system and its impact on higher quality, better accessibility to healthcare services and, summing up, ensuring the proper healthcare security. Undoubtedly, the tools offered to patients and healthcare providers improve the quality of service provision, create a more participant-friendly healthcare system, however, they need to be constantly modernized, upgraded and secured against cyber-attacks.*

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Originality/Value: *A key factor influencing future healthcare services delivering will be the implementation of a new and modern, often innovative, technical and technological solutions. The wide spectrum of current, as well as continuously evolving, modern e-tools, computer systems, applications, communication systems, and intelligent solutions by internet of things (IoT), artificial intelligent (AI) and augmented reality (AR) in the field of digitalisation have laid the foundation for creating and developing modern healthcare systems.*

Keywords*: Digitization, e-tools, quality, health care system, management in health care, social safety and security.*

JEL classification: *I11, I18, O3.*

Paper type*: Research article.*

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1. Introduction

The digitization of the economy and society is one of the most dynamic changes that may be observed in recent years in most countries in the world, and as a continuous process of convergence of the real and virtual world, it becomes an inseparable element of our functioning. In addition, its almost revolutionary pace has accelerated as a result of the COVID-19 pandemic.

Digitalization is the main driver of innovation and change in most economic entities, both private and public ones. It creates an opportunity for development, more efficient use of resources, and opens up new opportunities in creating business models, but it also brings uncertainty and various types of threats related to, among others, security in its broad sense (Gajewski *et al.,* 2016).

The article presents detailed data on the use of e-tools supporting the provision of healthcare services. The information contained in the article can serve as a basis for further studies and research, as well as a bench mark for those healthcare systems that are at the beginning of their digitalisation journey.

The article answers the following research questions:

1. *What e-tools supporting the delivery of health services have been introduced in Poland?*
2. *What is the scale of their application?*
3. *What are the benefits of implementing particular tools?*
4. *What challenges does the digitalisation of healthcare in Poland face?*

The aim of the article is to present digital solutions used in health care, which are used on a large scale by both patients and staff of health care entities, improving health care management. In order to achieve the objective, the following research methods were used: critical analysis of literature and websites presenting digital solutions for the health care system, analysis of source materials and figures of the Centre for e-Health (CeZ).

2. Literature – Digitalization in Poland

Digitization understood as the integration of digital technologies with existing business/economic/administrative processes determines digital transformation, i.e., a change in the way we think about customer experience, implemented business models, and operations (sap.pl, 2023).

This technological process is reshaping private and public sectors as well as influencing on safety and security of the society functioning (Leviäkangas, 2016; Parviainen, *et al.*, 2017; Reis, 2020).

It is considered as a major and inexorable driving force of innovation, quality and effectiveness improvement. With all economic and societal sectors being affected, digital economy is very dynamic and increasingly competitive (Lang, 2021).

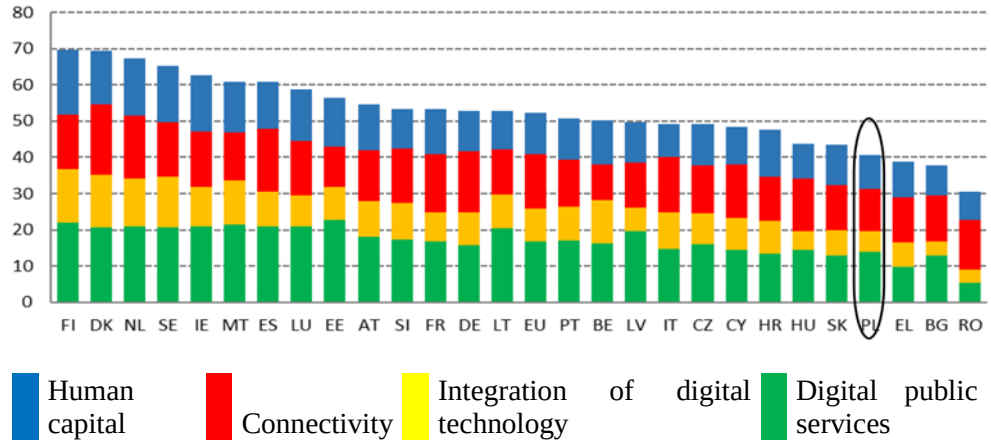
The intense transformation processes in the field of digitization are taking place in most Polish companies and institutions of the public administration sector, but we are not the leader in this area. The "Digital Intelligence Index" report (2019) classifies Poland in the group of break-out economies – those rapidly developing digitally, which, thanks to high dynamics and growth potential, are very attractive to investors. In this report, Poland was ranked 34th in the world and 21st in Europe (the value of Poland's index was 63.6 points).

In the 2017 report, Poland was ranked 35th. As far as the pace of digitization of economies in the last twelve years (2007-2019), Poland ranked 13th in the world with a score of 57.3. Globally, so far, the fastest pace of digitization is reported in China (85.5 points) (Chakravorti, 2020).

On the other hand, in this year's digital economy and society index (DESI 2022), published since 2014 by the European Commission, Poland was ranked 24th among all European Union Member States (4th from the bottom).

In 2020, Poland was ranked 23rd, and in 2021 - 25th out of 28 countries (Sokół, 2021, Zegarow, 2020, DESI 2020, 2021, 2022). In the DESI study, the European Commission examines four areas of the Digital Compass 2030 policy, human capital, connectivity, digital technology integration, and digital public services.

Figure 1. *DESI, 2022.*



Source: *Digital Economy and Society Index (DESI) 2022, European Commission, https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2022.*

The highest value of the DESI 2022 index in Poland - 55.8 points - was awarded to the digital public services component. Despite this fact, the value is not considered satisfactory. This result, regarding digital public service, places Poland in the 22nd position in the EU and it is much lower than the average value for all EU countries.

The components of the digital public services are:

- users of public administration services – the number of persons who used the Internet to contact public authorities in the last 12 months, as a % of all Internet users,
- pre-filled forms - the amount of data that is pre-filled in public service online forms,
- digital public services for citizens – the share of administrative activities that can be performed online with regard to important life events, e.g. the birth of a child, a new place of residence for citizens,
- digital public services for enterprises - the indicator broadly reflects the share of public services needed to start a business and conduct regular business activity, which are available online for national and foreign users,
- open data - the indicator measures the extent to which a country applies an open data policy (including the transposition of the revised PSI Directive), the estimated political, social and economic impact of open data, and the characteristics (features, data availability, and use) of the national data portal, % of the maximum result.

In 2022, 55% of Internet users used eGovernment services (it means an increase as compared to 49% in the previous year). This figure brings Poland slightly closer to

the EU average, which is 64%. As for the pre-filled forms component: Poland's score is significantly better than the EU average (74 vs. 64). Poland also achieved a very good result in the area of open data (95% compared to 81% for the EU).

Unfortunately, the country still has a low score regarding the availability of digital online services for citizens (score 57, EU average 75), and in the case of digital public services for businesses, it scored 70, compared to the EU average of 82. As a result of the COVID-19 pandemic, one can notice a significant increase in the use of e-government services. The last item, i.e., open data, ranked highest - 95% of the maximum score, while the average value for the EU was 81%. Thus, Poland was ranked fourth in the ranking, which is much higher than the EU average.

Digitisation is revolutionizing Polish public administration by increasing access to services, improving their quality, and reducing their costs. Polish citizens can use several hundred public e-services located on various government platforms and portals, such as Electronic Platform of Public Administration Services (ePUAP), Platform of Electronic Services of the Social Insurance Institution (PUE ZUS), Obywatel.gov.pl portal, biznes.gov.pl portal.

The Portal of the Republic of Poland (Portal RP) - gov.pl - was also created, as a kind of gateway to all information and public e-services. Its purpose is to integrate the websites of ministries, central offices and voivodship offices and to facilitate access to digital services offered by the state to citizens (gov.pl, 2023).

Health care systems in many countries face challenges related to: increasing spending on health care services, an ageing population suffering from many diseases, including chronic diseases, and access to health services. This requires complex systems for prevention, rapid diagnosis and treatment, and efficient management of the treatment process (Niechzial, 2020). These challenges make digitisation in healthcare inevitable and e-tools essential to support the health security of the population.

In this context, it is worth describing the digital tools used in the healthcare system, as this area of public administration in Poland has been under great pressure since the outbreak of the COVID-19 pandemic. Also, the pandemic itself has significantly contributed to the propagation of digital solutions and their application.

3. Discussion - E-Tools and their Use in Healthcare Management

E-health is an area that uses information and telecommunications technologies to support activities related to healthcare and covers, among others, telemedicine, remote medical care, medical informatics, health information management, and information and communication technologies in healthcare. It uses tools or solutions that include products, systems and services for health authorities and professionals, and healthcare systems for patients and citizens, such as telehealth services and

many other ICT-based tools to help prevent, diagnose and treat diseases, and monitor one's health (www.nfz-lodz.pl, 2023).

The potential of ICT tools in the area of e-health is mainly used for the following purposes (Gryncewicz *at al.*, 2014):

- improving communication between patients, medical service providers, and healthcare professionals,
- fast and continuous transfer of data between individual institutions in the healthcare system.

E-services are fundamental and essential given the challenges that have currently mounted in health care in Poland, for example, changes in the demographic structure of the population and aging of the population, limited access to medical services in rural areas, difficult access to professionals, or fragmentation of healthcare.

The development of e-health in Poland is the responsibility of the Ministry of Health, which is supported by a subordinate unit, the e-Health Center (CeZ). The main activity of CeZ is the implementation of tasks in the field of building the information society, including the organization and protection of healthcare and supporting the management decisions of the minister competent for health, based on conducted analyses. The Center is also responsible for monitoring the planned, built and operated ICT systems at the central and regional level (gov.pl, 2023).

The main product of the e-Health Center is the P1 system - "Electronic Platform for Collecting, Analyzing and Sharing Digital Resources on Medical Events", which has been operating since 2017, but its beginnings date back to the early 2000s. It enables the collection, processing and sharing of digital resources regarding patients' medical events and indexes of electronic medical records (EDM).

The system covers all medical entities, regardless of the source of financing for the services they provide. In addition, there are IT systems, which include medical registers, field ICT systems, and systems supporting prevention and treatment. Each of them has been developed in line with the standards for collecting and exchanging data in medicine - Integrating the Healthcare Enterprise.

The P1 system is a kind of information platform, which is the core of the entire health system in Poland. In the first stage of the e-health project (P1), the following were implemented: (1) a free application for patients Internetowe Konto Pacjenta (IKP), (2) for medical employees - biuro.gov.pl, and (3) services supporting e-prescription (issued by a medical employee and filled in pharmacies) and (4) e-referral (full-service process).

The next stage was the implementation of (5) services allowing for the registration and (6) sharing of electronic medical records and medical events.

The period of the COVID pandemic translated into over 2 years of active development work on the P1 system and the implementation of the following e-solutions:

1) an e-vaccination card: initially used only for COVID-19 vaccinations, then influenza and HPV vaccinations,
2) support for UCC (EU COVID Certificate) - generated based on registered vaccination cards or test results (antigen or PCR tests) and verified with a dedicated mobile application,
3) a record of vaccination against COVID-19,
4) handling of COVID-19 tests.

In June 2022, the last service under the P1 project was implemented, i.e. e-registration for medical services. P1 offers the following services and applications:

- e-prescription,
- e-referral,
- EDM and Medical Events,
- Patient's Internet Account application (pacjent.gov.pl),
- MojeIKP mobile application,
- biuro.gov.pl - dedicated to medical staff,

as well as other solutions improving the processes of planning and implementing healthcare services.

They support the daily work of medical entities, medical employees, and public administration responsible for the functioning of the health care sector in Poland. On the other hand, they provide patients with digital tools that support and facilitate their health management.

E-prescription – a digital prescription - appeared for the first time in May 2018. It was the first digital service within P1 and the first, on such a scale, in Poland. It concerned every patient and medical staff: doctors, nurses, and pharmacists. It was introduced as part of a pilot project financed from the EU funds, and then its application was extended to the whole of Poland.

The first implementation of the e-prescription took place on May 25, 2018 in Siedlce with the participation of the Minister of Health, and the first patient who was issued an electronic prescription was the then mayor of Siedlce. The first stage of the e-prescription implementation, which ended in December 2018, consisted in connecting of all pharmacies to the e-health system (i.e., P1). This caused the propagation of e-prescription throughout Poland. The COVID-19 pandemic also had a significant impact on the spread of e-prescription, especially in places where medical staff (or patients) had been prejudiced against the e-prescription implementation.

The restrictions of COVID-19 accelerated the pace of e-prescription implementation there. Since January 8, 2020, doctors have been obliged to issue electronic prescriptions only.

From a technical point of view, e-prescription is information on the drug prescribed to a patient (including the dosage regime), which is always available to the patient on the Patient's Internet Account or in the mojeIKP application. The electronic record is transferred via the system from a doctor to a pharmacist, and from there to the institution that reimburses a particular drug, i.e. the National Health Fund (NFZ).

The e-prescription document also contains information on the drug dosage regime and the issuing doctor. There is also a prescription fulfillment document (DRR) which contains the information about the price of the purchased drug (or, if applicable, a drug substitute).

To buy medicines from a pharmacy, a patient gives a pharmacist a four-digit code (received by SMS or e-mail) or presents a prescription information printout (received from the doctor) and their PESEL number (Majewska *et al.,* 2020). The easiest way, however, is to scan the QR code available in the MojeIKP application.

As a system solution, e-prescriptions are stored in the Medical Information System. Since July 2023, it has become possible to issue a cross-border prescription, i.e. an e-prescription that can be used in a different EU country than the one in which it was issued. The purpose of the cross-border e-prescription functionality is to enable foreign patients to fill an e-prescription in a Polish pharmacy, and Polish patients to fill an e-prescription abroad.

In Poland, you can use a cross-border e-prescription issued in Estonia, Portugal, Finland, Croatia and Spain. On the other hand, a Polish prescription can be filled in Finland, Croatia, Portugal, and some regions of Spain (cez.gov.pl, pacjent.gov.pl, 2023). The benefits of an e-prescription may be grouped by beneficiary: benefits for doctors, or patients, and pharmacists.

Obviously, the large-scale implementation of e-prescription encountered many obstacles, including system and computer limitations in healthcare facilities (the lack of appropriate software, the lack of printers to print e-prescription confirmation, the lack of company computers, and the need to use private laptops).

The use of electronic solutions posed a big fear for patients (especially seniors), but from the beginning of the implementation of e-prescriptions statistics show that seniors are the group of patients that fulfill the highest number of e-prescriptions per year. Nevertheless, e-prescription has become a common key tool for digitizing the public health system in Poland.

Table 1. *Benefits of implementing e-prescription*

For doctors	For patients	For pharmacists
• saving time - a quick search in the database for the name of drugs and their substitutes, hints on interactions, and renewing previously issued prescriptions; • less bureaucracy - no need to download a range of numbers from the National Health Fund, the entire prescription issuance process is carried out digitally; • better communication - efficient exchange of information between the patient, doctor, and pharmacist; • facilitating the treatment process – the doctor may check whether the patient has purchased prescribed medications; • control of the treatment process –a doctor may have an insight into the patient's medical record by other specialists; the ability to plan therapy so that the prescribed drugs do not interact and produce adverse effects; • shorter queues - limiting the number of visits related solely to prescribing medicines.	• greater flexibility - the possibility of buying medicines in various pharmacies (without losing the refund) or partial fulfillment of an e-prescription; • greater convenience - e-prescription cannot be lost, it may be obtained by SMS or e-mail, it is always available on the Patient's Internet Account; • saving time –the patient does not have to visit the doctor in person to receive another e-prescription, one can receive it by SMS or e-mail; • lower risk of error - the e-prescription is always legible. This eliminates situations where the pharmacist cannot read the name of the drug or its dose; • easier accessibility – the e-prescription may be filled by any authorized person. The patient does not have to go to the pharmacy himself; • to fill it, a patient just tells the prescription code and PESEL number. • a patient has access to medicines for a longer period of time thanks to a long-term prescription, and can also spend money on medicines in a more planned manner.	• faster dispensing of drugs - no need to enter data into the system; the reading is automatic after scanning the code; • saves time - no need to issue copies of prescriptions; • greater security – reducing the problem of false and illegible prescriptions, lower risk of making a mistake and dispensing inappropriate drugs; • a pharmacist does not have to waste time on the so-called assessment of prescriptions because the system performs this functionality itself. Significant reduction of reimbursement errors and faster refunds to pharmacies

Source: *https://www.gov.pl/web/zdrowie/od-8-stycznia-czas-e-recepty.*

Table 2. *E-prescription in numbers (as of September 17, 2023)*

e-prescriptions issued	1 749 973 825
of which: e-prescriptions fulfilled[3]	1 329 306 658
The number of doctors who issue e-prescriptions	151 877
The number of authorized nurses who issue e-prescriptions	18 394
Number of patients who received an e-prescription	37 583 789

Source: *e-Health Center data.*

E-referral, following e-prescription, is another electronic document introduced (in January 2021) in the Polish healthcare system. It enables full electronic management of the treatment referral process - from the moment it is issued to its implementation. An e-referral document may be issued for a hospital or sanatorium treatment, to a specialist doctor, for rehabilitation, surgery, or an examination. To issue an e-referral, a doctor or an institution employing him must have access to the P1 system.

[3]*The patient may complete the e-prescription with a delay - a situation when the expiry date has an indicated date "from"; in addition, many e-prescriptions in Poland are still not filled by patients.*

On the other hand, to receive an e-referral, a patient may, but does not have to, have an account on the "Trusted Profile" platform (pz.gov.pl) and the InternetPatient Account (IKP) or the MojeIKP application. He only receives a referral code, which he presents at the referred medical institution. If the patient has the IKP, he can decide on the form of receiving e-referrals: by SMS or e-mail and track his medical treatment. The advantages of e-referral service include (ezdrowie.gov.pl, 2023):

- possibility to sign up for an appointment or examination by phone - if a patient receives an e-referral, he is not obliged to provide the referral within 14 days of its issue to the clinic, but only during making an appointment by phone he has to provide a four-digit code, which he received in a text message or e-mail and his PESEL number (like for e-prescription). This is especially convenient if the place of medical service is far from the patient's place of residence.
- facilitation of a registration process – patient's data are downloaded automatically while registering an e-referral by the implementing entity.
- a patient will not lose his referral - since the referral is in an electronic form, there is no way to lose it. By logging into the IKP, the patient always has access to all the data needed to sign up for medical services.
- there is no need to additionally sign the referral - the referral issued in an electronic form does not require any additional signatures. A doctor signs the e-referral with an electronic signature, which is legally equal to a handwritten signature.
- no need for additional electronic signatures - to issue an e-referral, a doctor can use the same signature that is used to issue an e-leave (medical leave).
- (a) doctor(s) may access patient's e-referrals - this allows tracking patient's treatment better, and also it reduces the risk of too frequent radiological examinations, for example.
- it is possible to cancel an issued referral - in the case of irregularities, a doctor may cancel the referral. However, no later than the referral has already been registered at the executing entity.
- there is no possibility of registering in multiple medical institutions at the same time thus blocking access to specialists or examinations.

It is worth emphasizing that the entire vaccination process within the National Vaccination Program (NPS) in Poland was based on the mechanism of e-referrals. They were the basis for registering a patient for a vaccination visit in line with the sequence and rules set by the NPS.

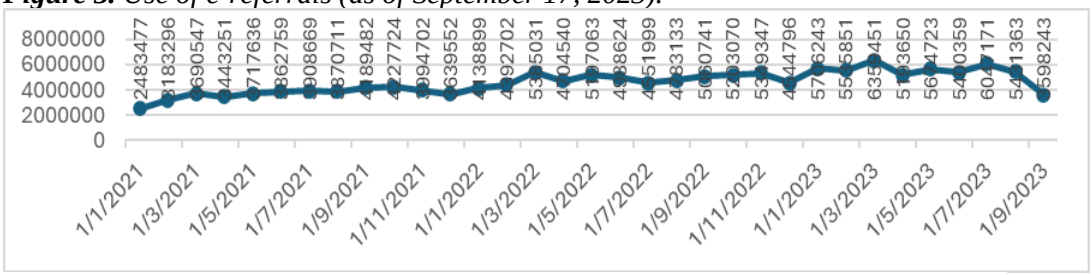
Table 3. *E-referrals in numbers (as of September 17, 2023)*

	E-referrals issued		E-referrals completed
From the implementation of e-referrals	151 456 805	From the implementation of e-referrals	47 419 027

Number of entities that issue e-referrals	34 192	Number of doctors who issue e-referrals	145 808

Source: *e-Health Center data.*

Figure 3. *Use of e-referrals (as of September 17, 2023).*



Source: *Based on the e-Health Center data.*

EDM - Electronic Medical Documentation - these are documents generated in an electronic form, signed with a qualified electronic signature or a trusted signature, a personal signature, or signed using the method of confirming the origin and integrity of data available in the ICT system made available free of charge by the Social Insurance Institution (Act of 28 April 2011 on the information system in healthcare, Article 2(6):

- e-prescriptions,
- e-referrals specified in the regulations issued under Article 59aa para. 2 of the Act of 27 August 2004 on healthcare services financed from public funds.

Moreover, it also includes (ezdrowie.gov.pl , 2023):

- information about the diagnosis of a disease, a health problem or an injury, results of the tests carried out, the reason for refusing admission to the hospital, health services provided, and any recommendations made - in the case of refusal to admit the patient to a hospital, referred to in the regulations issued on under Article 30 of the Act of November 6, 2008 on patient rights and the Patient Ombudsman;
- information for the doctor that refers a patient to a specialist clinic or hospital treatment regarding the diagnosis, the method of treatment, prognosis, prescribed drugs, foodstuff for particular nutritional uses, and medical devices, including the period of their use and the method of dosing and scheduled control visits referred to in the regulations issued under Article 137 para. 2 of the Act of August 27, 2004 on healthcare services financed from public funds;
- a hospital discharge summary report referred to in the regulations issued under Article 30 of the Act of November 6, 2008 on patient rights and the Ombudsman for Patients' Rights;

- laboratory test results together with their interpretation;
- orders for supplies and repair orders;
- vaccination cards.

It is worth mentioning here that documentation in an electronic form and electronic medical documentation are not identical concepts. Documentation in an electronic form is simply an archiving process carried out using electronic devices, whereas electronic documentation enables the collection and transfer of data between a medical entity and the medical information system (SIM) platform and a patient's online account (IKP) (Modro, 2021).

Electronic medical documentation, replacing paper documentation (stored in one clinic only), allows one to track medical records and in the long run reduces the fragmentation of patient care. Thus, it supports the coordination of the treatment process and improves the diagnosis process, because a doctor has full knowledge of the patient's health and previous therapies, also conducted by other doctors and in other medical institutions. It is also important for other medical staff who are involved in the implementation of patient care.

The benefits of using electronic documentation for doctors include (ezdrowie.gov.pl, 2023):

- quick access to the information about the diagnosis of a disease, a health problem or an injury, results of tests carried out, the reason for refusing admission to the hospital, health services provided, and possible recommendations made- in the case of the refusal to admit a patient to hospital;
- access to information for a doctor referring a patient to a specialist clinic or hospital treatment about the diagnosis, the method of treatment, prognosis, prescribed drugs, foodstuffs for particular nutritional uses and medical products, including the period of their use and method of dosing, and scheduled follow-up visits;
- access and insight into hospital discharge summary reports;
- access to the interpretation of diagnostic tests and the results of laboratory tests with their interpretation.

To sum up, the advantages of generating and exchanging EDM data are as follows (ezdrowie.gov.pl, 2023):

1. Increased security and control of sensitive medical data;
2. Minimizing the problem of lack of access to a complete set of medical data concerning patients;
3. The possibility of obtaining electronic medical documentation relevant to the implementation of health services, issuing e-prescriptions, e-referrals;
4. Medical staff may have more knowledge about the patient's health condition;

5. Elimination of technological barriers related to the exchange of medical documentation;
6. Increasing patients' safety through providing medical staff with access to patient's medical records;
7. Standardization of services and documents influences the improvement of quality, completeness, and readability of medical documentation in healthcare entities;
8. Improving coordination of the treatment process;
9. Increasing interoperability of the healthcare sector.

EDM also brings measurable benefits to patients, because owing to full automation and smooth transition between individual sections (an appointment card, a bill, a prescription, etc.), a doctor reduces time spent on necessary formalities, which improves the quality of the visit and frees up time that can be used providing better care for a patient (medfile.pl, 2023).

One of the most important advantages of EDM is gathering data on a patient and his health in one place, which every medical professional involved in the healthcare process may access. This undoubtedly constitutes the basis of coordinated care, which was introduced in Poland in October 2022. At the same time, such accumulation of data in one place is a challenge when it comes to preventing unauthorized access.

Table 4. *EDM in numbers (as of September 17, 2023)*

Medical documents	142 071 565
On-line medical documents	135 337 715
% of on-line medical documents[4]	96.26%
Medical event	672 798 424

Source: *e-Health Center data.*

Figure 4. *Medical incidents recorded at the P1 platform (as of September 17, 2023).*

Source: *Based on the e-Health Center data.*

[4]*Online documents can be downloaded by other entities, according with the rights granted by the patient at the IKP level or by law.*

IKP – Internet Patient Account – is a free platform developed by the Ministry of Health to collect, search, monitor, and share medical data with patients and persons whom the patient has granted access. A patient who has an IKP account has access to his/her (as well as his/her children and persons who authorized the person to view the data) e-prescriptions, e-referrals, vaccination documents and other documents related to medical visits. The IKP also allows receiving notifications by text message or e-mail about received e-prescriptions and e-referrals.

Using this account, the patient can also apply for an EHIC card or apply for a change of a primary care doctor, a nurse, or a midwife. To log in to IKP, one needs a trusted profile, an ID card with an electronic layer or an online account in one of the banks supporting e-services. The mobile equivalent of IKP is the MojeIKP application for a smartphone. It allows you to fill an e-prescription without having to provide a PESEL number, but only by presenting the e-prescription QR code.

This is extremely convenient when medicines are purchased for a relative (linked to the IKP account) and the buyer does not know the PESEL number. The application also displays a list of e-prescriptions to be filled, along with their expiry dates, which reduces the likelihood of "missing" the deadline for purchasing medications.

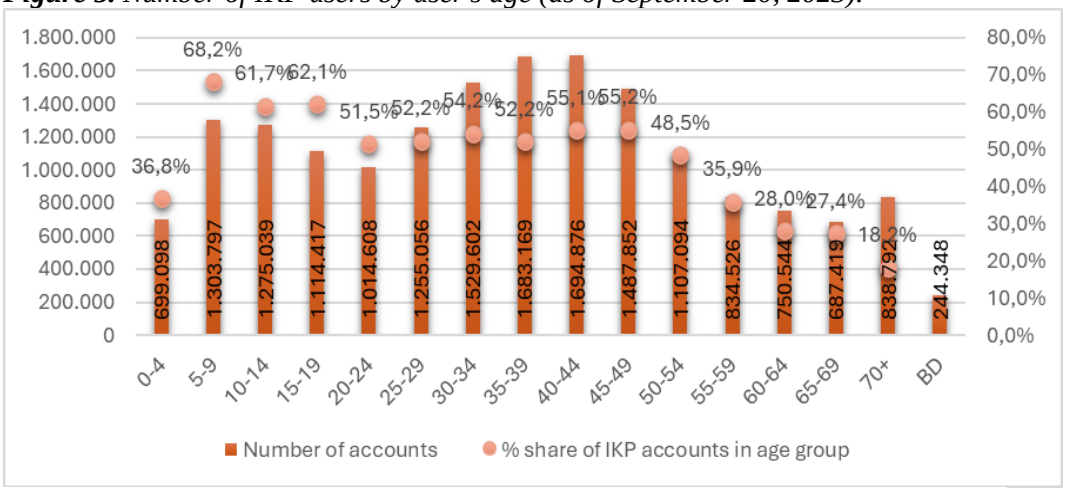
The application contains a full record of e-prescriptions issued since 2019 and those purchased under the National Health Fund since 2008. It also allows you to check the names of prescribed drugs, their dosage regime, as well as leaflets accompanying prescribed drugs. Currently, according to the e-Health Center, there are over 17 million IKP users and over 2 million mobile application users.

MojeIKP – mobile application - it is a free mobile application that allows access to selected IKP functionalities, including e-prescriptions and e-referrals, allows one to register for vaccination against COVID-19, as well as purchase medicines via a QR code. The application also enables easy and constant access to the EU COVID-19 Certificate.

In 2022 Q3, as part of introduced measures new functionalities were launched such as “8 weeks to health” a physical activity component and the "First Aid" button was added. In 2022 Q4, other functionalities were made available, i.e. scanning a drug barcode, displaying medical events the user participated in, and the full treatment record broken down by year.

The application also allows one to grant a power of attorney to use the IKP to another person or to make medical records collected in P1 available to medical staff. A total of 17,520,237 IKP accounts have been created (at least 1 login), of which 17,510,702 are active (PESEL is active). This number translates into approximately 45.8% of the Polish population.

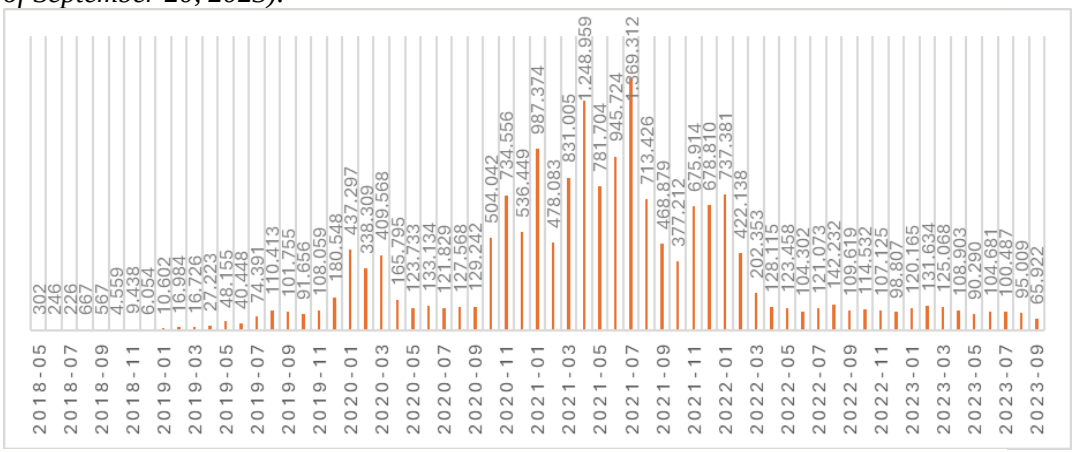
Figure 5. *Number of IKP users by user's age (as of September 20, 2023).*



Source: *e-Health Center data.*

The number of created IKP accounts is strongly correlated with the services that were made available in the so-called peaks, these included, among others possibility of checking the result of the COVID-19 test, registration for vaccination against COVID-19, and downloading the UCC.

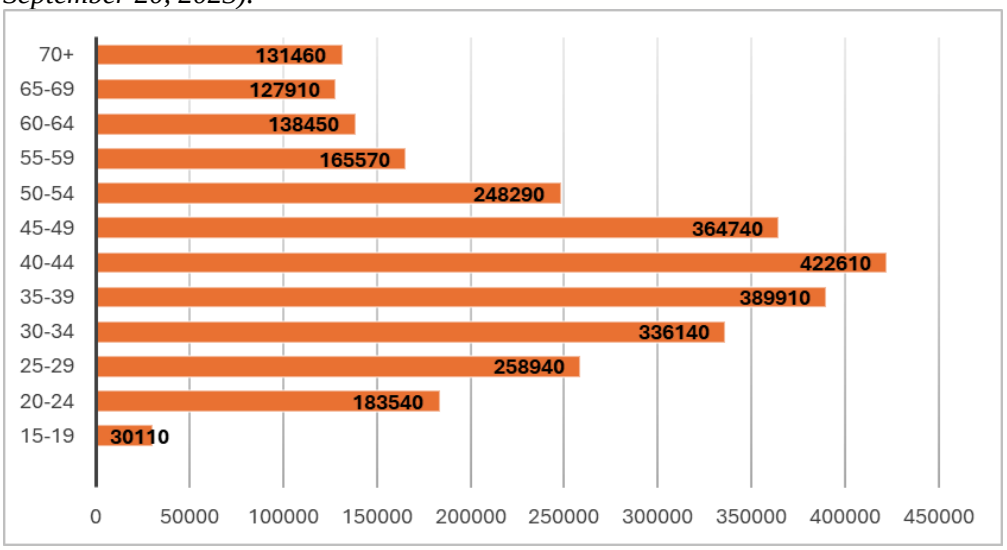
Figure 6. *The number of accounts created in the application since its inception (as of September 20, 2023).*



Source: *Based on the e-Health Center data.*

The MojeIKP application was installed by 2,797,807 persons (source e-Health Center, as of September 20, 2023). The breakdown by user's age is presented below (Figure 7).

Figure 7. *Number of installed MojeIKP applications by user's age category (as September 20, 2023).*



Source: *Based on the e-Health Center data.*

The highest number of MojeIKP applications were installed by people in age 40-44: 422 610, then in age 35-39: 389910. The lowest number is in age of 15-19, however there are also some users in age 10-14, but they reperesnt very low numbet, invisible in the draft 70.

As part of further development of the P1 system, additional services have been made available:

1. 40+ preventive care (filling out the survey by the patient or medical worker or via hotline and generating an e-referral, recording the results in the form of medical records);
2. school medicine (registration of the student's health record and routine health check-ups);
3. e-Registration for HPV vaccination (launched on June 1, 2023);
4. IPOM (Individual Medical Care Plan);
5. e-referral to a sanatorium;
6. SMPL (monitoring system of the drugs' programmes)

Since March 2021, the e-Health Center has been working on a new area planned to be made available. The area will relate to the generation and storage of electronic Death Cards and electronic Birth Cards (including those with a note on stillbirth) in the P1 system.

The integration of the P1 system with the e-Blood system is planned for October 2023. First, the service will be dedicated to the entities performing medical activities

which order blood, in the next steps, services will be prepared for blood donors so that they can see information on the IKP about the donation or download appropriate certificates (currently issued only in hard copy at Blood Donation and Blood Treatment Centre).

4. Challenges Facing the Digitization of Health Care in Poland

Recent years in Polish health care have brought a kind of revolution in the digitalization of medical services. It resulted from growing problems and challenges faced by Polish health care such as the aging society, limited human resources, and increasing financial expenditure on healthcare, which do not correlate with results and quality. On the other hand, the pace of these changes was determined by the COVID-19 pandemic, which became the main drive for the large-scale implementation of digitalization solutions.

Due to the implementation of many of the above-mentioned e-tools in the healthcare system, proposals for changes and challenges facing e-health are widely discussed in the media, medical press, and industry conferences. They may be considered from the perspective of a patient, an entity providing healthcare services (clinics, pharmacies, hospitals, etc.), the entire system (including its organization and legal regulations), as well as in the context of improving individual e-tools.

Among the threats that are most often mentioned in the context of the computerization of health care, the most important is medical data security. Since the introduction of electronic medical records, medical institutions as well as banks and public institutions, have been exposed to hacker attacks, which may result in uncontrolled leakage of sensitive data. Medical service providers are responsible for ensuring the security of the data they have. A constant improvement of the data security system is their priority.

In 2022, the e-Health Center conducted a survey on cybersecurity among Polish entities conducting medical activities, in which participated 83% of the entities. Over 61% of them described the level of cybersecurity as average, and the most common challenges included the implementation of a backup policy, increasing the number of security employees, and training to raise awareness of threats, especially ransomware attacks (cez.gov.pl , 2023).

Moreover, e-health poses further challenges for healthcare entities that do not only concern cybersecurity but are related to the implementation of so many e-tools. The most common problems faced by healthcare entities include (Żuk, 2022):

- the need for constant improvement of the digital competencies of staff,
- increasing costs of infrastructure and security: quality of Internet connections, costs of data storage (repositories), costs of anti-virus systems and passive security (e.g. firewall),

- increasing expenditure on computerization, equipment, and operation of computer systems,
- the need to maintain highly qualified and competent IT department employees or conclude contracts with outsourcing companies,
- too frequent system changes that result in changes to computer systems and updates,
- finding solutions for digitally-excluded patients so that they are not omitted from medical care, because the increase in digitization may lead to this,
- reducing interoperability barriers,
- "over-pilot" - implementation of programs, the introduction of tools as part of pilot projects, which often suffer from lack of continuity and financial sources in the long term,
- lack of scientific research that would prove that e-health will have an impact on public health and that it is better than the current (face-to-face) form of medical care, which means that many medical entities and patients are still reluctant to use e-tools,
- bureaucracy – understood as sending the same medical data in different formats for different institutions, which results in increased, unnecessary workload (Zieliński, 2022).

Considering the challenges that arise in the context of using individual tools, we may mention those related to the improvement of the developed e-tools. For example, as for e-prescription one may mention (Witkowski, 2022):

- tightening the P1 system by extending the validation mechanisms of medical records within e-prescriptions, i.e. improving dictionary databases, including the dosage method record,
- providing a patient with information in the IKP application about the availability of the drug in the pharmacy, its withdrawal or suspension of production,
- automation of the entity certification process for the P1 system,
- simplification of the system for issuing and dispensing prescriptions,
- possibility of filling partial prescriptions in various pharmacies,

In the case of EDM, the challenge is not only to ensure security and protection of sensitive patient data but also to enable doctors and pharmacists to view the patient's EDM in the area of issued and filled prescriptions. This is because patients attend different medical institutions/clinics, and different doctors (specialists in particular) who prescribe different, sometimes mutually exclusive, or overlapping drugs.

5. Conclusions and Recommendations

The digitisation of health and the use of e-tools in healthcare for the social safety and security are crucial for the development of healthcare in Poland, as a very important

point of view of patients, medical staff, and people involved in creating the healthcare system. The numerical data referred to in the article indicate the high use of e-tools and their growing popularity among patients and healthcare entities, although their functioning is often not without problems or drawbacks.

It seems that the most important measures that can be taken to improve their functionality are:

- full implementation of electronic medical records available to all participants of the health system to the extent necessary for individual persons or institutions. For example, in a situation where a patient from town X, while on vacation in town Y, requires emergency hospitalization, a doctor from town Y should have access to the patient's EDM,
- unification of IT systems so that all healthcare units have technical access to patient medical data,
- building further services based on already available mechanisms - an example is the obligation to issue e-referrals for health resorts, implemented on July 1, 2023 (an already existing mechanism was used, i.e. electronic referral, and dedicated integration with the National Health Fund systems was prepared - so that the patient does not have to deliver the documents to the provincial branch of the NHF and the health resort employee could check the patient's medical documentation in the P1 system to adjust the planned therapy).

A key element of the digitalization of health care there is also the positive attitude of medical workers towards newly, innovative implemented technologies. Thus, it is crucial to undertake the educational and information activities presenting the benefits of new functionalities implemented in the P1 (e-health) system for social social.

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