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ELECTRONIC HEALTH RECORDS IN MEDICAL INNOVATION: WHAT CAN BE IMPROVED FROM A EUROPEAN PERSPECTIVE?

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Electronic health records (EHR) operate with medical documentation in digitized format that allows its fast exchange between healthcare professionals and facilities, increasing the legibility of medical records, etc. Combined with artificial intelligence technologies, EHR have a great potential to boost innovation in healthcare. The presented mini-review aims to highlight the most challenging obstacles to wider EHR implementation and summarise solutions. Digitalisation of medical system (i.e. introducing digital technologies into routine practice) introduce a 'mistake-proof' system of decision-making in healthcare, multilevel protection of medical data, methods of control of prescribed treatment or intervention, sophisticated technologies for follow-up of patients outside the hospital, increased legibility of medical records and a lot more. Legal, security and interoperability issues could be the reasons that limit establishing widespread EHR implementation. In addition, financial reasons and need of motivation and education of medical staff to work with EHR might be an additional obstacle for EHR development. To overcome the mentioned issues, efforts in unification of medical data structure, classification and other technical aspects of data accumulation should be continued. Financial support from government and other stakeholders is vital for the development of high-quality and user-friendly EHR software. Continuous training of medical staff may improve results and experience of working with EHR. In conclusion, in order to provide the high-quality data electronic health records should be introduced into healthcare more widely and in a more structured way. Continuation of efforts on harmonious EHR implementation in the European Union, financial support of healthcare facilities and improvement of EHR software are needed.

Key words: *electronic health records, artificial intelligence, implementation, legislation.*

Маріус Джеанта, Адріана Боата, Бьянка Кукош, Віктор Семенов. Електронні медичні записи та інноваційні технології в медицині: що можна поліпшити у Європейському регіоні?

Електронні медичні записи (ЕМЗ) – це система, що дозволяє працювати з документами пацієнтів в оцифрованому форматі та дає можливість швидко обмінюватися ними між працівниками сфери охорони здоров'я та установами, підвищує їх розбірливість тощо. У поєднанні з технологіями штучного інтелекту ЕМЗ мають великий потенціал для стимулювання інновацій у сфері охорони здоров'я. Представлений міні-огляд має на меті висвітлити найбільш актуальні перешкоди для більш широкого впровадження ЕМЗ та запропонувати вирішення цих проблем. Цифровізація медичної системи (тобто впровадження цифрових технологій у повсякденну медичну практику) запроваджує «захищену від помилок» систему прийняття рішень у сфері охорони здоров'я, багаторівневий захист медичних даних, методи контролю призначеного лікування чи втручання, складні технології для подальшого спостереження за хворими поза стаціонаром, підвищення читабельності медичної документації та багато іншого. Питання законодавства, безпеки та сумісності програмного забезпечення можуть бути причинами, які обмежують більш широке впровадження ЕМЗ. Крім того, фінансові причини, а

також потреба в мотивації та навчанні медичного персоналу для роботи з ЕМЗ можуть бути додатковою перешкодою. Щоб подолати зазначені проблеми, слід продовжувати роботу з уніфікації структури медичних даних, класифікацій та інших технічних аспектів накопичення даних. Фінансова підтримка з боку уряду та інших зацікавлених сторін є життєво важливою для розробки високоякісного та зручного програмного забезпечення ЕМЗ. Постійне навчання медичного персоналу може покращити результати та досвід роботи з ЕМЗ. Підсумовуючи, зазначимо, що для того щоб забезпечити високоякісні дані, електронні медичні записи повинні бути впроваджені в охорону здоров'я більш широко та у більш структурований спосіб. Потрібне продовження зусиль щодо гармонійного впровадження ЕМЗ в Європейському Союзі, фінансова підтримка закладів охорони здоров'я та вдосконалення програмного забезпечення ЕМЗ.

Ключові слова: *електронні медичні записи, штучний інтелект, впровадження, законодавство.*

Introduction

Electronic health records (EHR) operate with medical documentation in digitized format that allows its fast exchange between healthcare professionals and facilities, increasing the legibility of medical records, etc. Digitizing of medical data makes possible merging them into big datasets with diverse information, so-called Big Data. Combined with artificial intelligence (AI) technologies, Big Data have a great potential to boost innovation in healthcare [5].

However, creation of the Big Data in healthcare demands huge efforts from the very basic steps of data accumulation. The information that is collected must be stored in the unified way, it must be stored securely, but at the same time it must be transferable when needed [3, 6]. In the last decades EHR has become a part of the daily routine of healthcare workers worldwide [3]. It is vastly acknowledged as having a positive impact on healthcare system and for its role as a source of data for biomedical research [2, 3, 5, 6]. Still, there is a lot to be done as the frequency and the level of EHR implementation in different countries vary substantially [7]. The aim of this mini-review was to highlight the most challenging obstacles to wider EHR implementation and summarise solutions.

Materials and methods

For the completion of the study aims an unstructured literature search was conducted with the usage of the keywords "electronic health records", "artificial intelligence", "implementation", "legislation". Scientific (PubMed and Google Scholar databases) and grey literature was interrogated.

Results

Benefits of EHR for clinical practice

EHR operate with digitised medical data (i.e. recoded into electronic format), which makes possible digitalisation of medical system (i.e. introducing digital technologies into routine practice) [4]. While being entered into the system the information is verified and the very way of data entering reduces the chance of error. Thus, EHR introduce a 'mistake-proof' system of decision-making in healthcare: checkbox fields for doses of a drug make impossible incorrect dosage or a system might not allow doctor to administer an unnecessary or dangerous for a patient test [6]. The benefits of digitalisation also include multilevel protection of medical data, methods of control of prescribed treatment or intervention, sophisticated technologies for follow-up of patients outside the hospital, increased legibility of medical records and a lot more [6, 10].

EHR interoperability in the European Union

According to the study by Rainer et al. (2021) despite being established in the majority of the European countries (the EU, Norway and the UK), interoperable EHR are not yet a reality [9]. Among factors that do not allow to establish the EHR network in the EU and are related to the creation of a big database, could be distinguished the following: legal, security and interoperability issues.

National legislation on EHR is the basis that makes possible its development and it was present only in 80% of participants. In 20 of 29 states the right to access medical data regardless of place and technology is guaranteed. In 18 of 29 states medical data are not allowed to be transferred across national borders. There are still countries that are lacking of cybernetic security regulations in healthcare, do not assign any unique patient or professional digital identifier, and do not train their personnel in the area of computer safety. Only around two-thirds of states used standardised terminology system, like SNOMED CT or LOINC. In general, despite the progress of the last years and continued efforts, the status of EHR in different countries is rather mosaic: there are leaders with a high level of implementation, and there are countries where the basic steps in EHR introduction are yet to be done. Altogether, it does not allow to create a unified interoperable EHR structure [9].

Other considerations

It is believed that the introduction of EHR into practice allows saving money and time, simultaneously improving the quality of medical services [11]. Indeed, storage of paperwork archives requires extra costs, space and personnel for the maintenance. The process of searching for archive information in such conditions might be challenging, and the

chances of loss of some parts of data are high and difficult to control. Digitisation of documents also allows for saving costs for paper, printers, and associated expenditures. However, the development of a high-quality EHR is a costly process that results in a high price for the end product. South Korea, which nowadays has a high prevalence of EHR in healthcare facilities [8], ten years ago had only 37% of coverage with basic/comprehensive EHR [12]. The cost of EHR, which doesn't seem to be compensated by paper savings, is believed to be the main barrier for EHR adoption [12].

Despite medical community acknowledges the value of EHR, healthcare workers have low motivation to enter the data into machines. The need to manage EHR reduces the time doctor can afford to spend with patients, thus disrupting a doctor-patient communication. According to the study by Arndt et al. doctors spend 44.2% of their time on digital paperwork that is rarely paid back in terms of time-saving [1]. Such a high burden of monotonous work, that is poorly related to professional duties, is believed to be related to the high prevalence of burnout in medicine [6].

Discussion

In order to overcome the identified issues, first of all, the efforts in the direction of unification of medical data structure, legislative regulations of medical data management and other technical aspects of data accumulation (e.g. common terminology) should be continued. Together with a wider implementation of EHR or its elements it will lead to the formation of a functioning network capable to generate valuable and comprehensive data. So far as EHR are the only tool that can provide AI with the necessary resource for the research – the data, these first two steps are crucial [3].

Next, high-quality EHR are rather expensive, and not all healthcare facilities can afford them. Their purchase might require support from the government or other stakeholders, but it seems absolutely necessary and imminent. Despite it is doubtful that the cost of EHR will drop soon, there is hope in open-source solutions that are developing rapidly.

Importantly, the issue of input of data into machines should be resolved. Investing into improving doctors' typing skills might be tempting, but it will hardly reduce significantly the time spent for data input. Introduction of the position of medical assistant, who would enter the data into the program instead of the doctor, would resolve the issue, but at a financial cost. Alternatively, natural language processing (NLP) algorithms that transform human speech into text may be the solution. Although the manner of speaking of different persons might pose a serious obstacle for the interpretation of verbal information, further technical improvement of NLP would allow to overcome it. Importantly, that NLP can be applied to various types of EHR, thus increasing the amount of comprehensive data. Augmented by NLP algorithms EHR may shift user-friendliness and time efficacy to a new level [6].

Last but not least: the poor interface and frequent troubleshooting. The suboptimal design of EHR software consumes the time of healthcare workers that is spent on redundant clicks. The problem of troubleshooting seems to be insignificant, however, it may occasionally lead to serious consequences. The case of massive drug overdose has been described when the doctor prescribed the correct dose in milligrams while the computer interpreted it as the dose per kilogram. Warning messages from the program were ignored as doctors were flooded with similar messages on minor occasions [6]. However, such kind of mistakes can hardly be ever avoided completely. As any other type of unsystematic error this one is expected to be reduced by the improvement in technical level of EHR.

Conclusions

In order to provide the comprehensive data electronic health records should be introduced into healthcare more widely and in a more structured way. Continuation of efforts on harmonious electronic health records implementation in the European Union, financial support of healthcare facilities and improvement of electronic health records software are needed.

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