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The future of medical documentation - review of selected literature.

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Summary

This work addresses the problem of application of artificial intelligence to the creation and maintenance of medical documentation and the use of big data in medicine to support efficient patient diagnosis and treatment. This study covers the latest advances in AI and big data, based on literature reviews and interviews with leading experts in these fields.

The following conclusions were obtained:

1. Based on the needs of patients and providers of medical services, and given the latest technological advances, all medical documentation should be digital and the processes of its creation, access, sharing and consistency checking should by supported by suitably designed AI systems.

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2. The knowledge contained in medical documentation constitutes a resource of strategic importance for humanity, with almost unlimited potential.
3. All medical documentation should be anonymised and should be made widely available, just like data and research results in the field of experimental physics. This will accelerate development of new treatments, best practice and help to identify new medical emergencies, such as Covid-19.
4. In practice today, unfortunately, the design of medical record systems is fragmented between institutions and countries, often focusing discussions on narrow technical details, and forcing clinicians to waste time on filling up multiple pages of illness history. This leads to many inefficiencies and lost opportunities, and necessitates a fundamentally new approach.

Key words

Medical documentation, medicine, public health, computer networks, artificial intelligence, smart city

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The beginings of Technology IT.

,,Russian political scientist (…), prof. Walerij Sołowiej, (…) in August 2019 stated that the opinions of Russian elites, as to how optimally solve the problems of the nation are divided.(…), the military establishment is convinced that one should reach for "the good old methods", checked, the methods of introducing prohibitions and repressions, and the representatives of civil elites (…), that the use of new technologies will be not less effective.'' [1].

The opinion of former Dean of Moscow Institute of International Studies can be looked at more widely and recognise it not only as solving internal problems in one of the countries through different pressure groups but also as a distinction of two fundamental directions of activity in contemporary world: the way known as traditional, often even not very nice or new, tempting by its extraordinariness with the use of modern technologies.

In the 60s of the XX century there was armaments race. It changed, and certainly accelerated the development of many Fields of science, such as Nuclear Physics, information technology or Cybernetics. Simultaneously, there has been an acceleration in the development of various types of modern technologies. One of them was building and the usage of digital networks. In development of the fledgling Technologies IT the priority was given to American. Solutions they accepted have become the obligatory standard. The founders of technological revolution from ,,Silicon Valley" not only did they influence the development of one field of science and industry sector but also to a large degree changed the course of development of civilisation. At the same time, it is them, who introduced the nomenclature in these areas. They invented all significant names of the IT industry such as digital network, the internet or www network. The finished product reached Poland at the end of the 80s of XX century. The products of IT technology such as computers and digital networks started being gradually used in all industries in it in medicine, of course. The network World Wide Web (WWW) at the same time, acquired , according to the name, a global character, and using it in a new industry of ten led to rapid acceleration of its development, it also led to technological breakthroughs.[2].

The problems on the verge of medicine and IT technology.

Speaking about the breakthroughs in medicine, in most instances one has spectacular discoveries in mind (for example, new drugs, unknown pathophysiology of disease processes), performed, for the first time surgical procedures (for example, organ transplants), or introduction of new technologies (for example application of endoscopy, robots or nanotechnology in surgery). These are certainly the spectacular events and the ones that generate progress. Though, the real changes in medicine, similarly to other Fields of science, are made through the most prosaic, the simplest, repeated many times activities. The real progress is the result of "ant work". These activities are more of the public health interest than in typical clinical medicine. The example will be obeying the basic sanitary epidemiological standards which is elimination of harmful substances from our environment such as asbestos, drinking clean water, not heating stale food, washing hands (in it before the surgical procedures and before and after the contact with the ill person), disinfecting injuries, cleaning the operational area, secure disposal of human excrement through appropriate sanitary equipment. These activities, as not really spectacular, most often are not visible for an average observer, but their positive result for population's health is tremendous. These make up the mainstream of the progress in broadly understood medicine. In context of breakthrough activities the problem of created algorithms is entirely omitted as well as perfecting the medical documentation. Changes of standards applicable in emergency medicine have occurred to a large extent based on analysis of results of treatment included in the medical documentation. This is one of many examples. Contemporarily the medical documentation exists in many countries in a traditional "paper" version or electronic one, or mixed. The last situation we can find in many different countries of the world. With existing technological progress and introducing newer and newer recorders and low digital data, and also because of man getting used to making use of a sheet of paper and pen. It is most probable that the mixed documentation will coexist very long. Unfortunately, visible on many levels underestimating the abilities of potential usage of digitalised documentation is an attempt to deny the laws of high numbers and statistics. [3,4,5,6,7,8].

For many outer as well as inner observers. The system of medical documentation existing in units of health protection is perceived as a huge, monolithic and difficult in Osage and configuration structure, in a state of Inertia, lacking flexibility. The paradox is that the most popular in the world systems of data archiving are most of them created based on old information Technologies dedicated in a moment of its creation to building without data. Maybe that is why for an average user, they seem to be more intuitive to use. It is so especially when the person evaluating the system is from generation X, or Y but not Z. Research shows that paradoxically even the above average intelligent man, not being an IT specialist, has problems in the case of systems created on the basis of super-modern technologies. Not clear intuitive accepting a part of novelties in the range of the interface of some programmes overlaps it. A classic example is here not accepting Windows 8,0 in place of the previous, very successful version of Windows 7,0. Of course most users are concerned, not chosen among a group. The upgrade modifying screen image (tiled desktop) was performed urgently to the previous version. Similarly as with introducing each newer version of software by Microsoft company, Windows 8,0 was analysed by testers. The problem which arose later they did not notice, though. It resulted in the probably the selection of testers, who in this instance, were the fans of novelties and the newest graphic solutions. A similar problem concerns the intuitiveness of data handling and databases and other medical software. If the basic assumptions and graphics are created by IT specialists from generation Z it often becomes not intuitive for the representatives of generations X and Y. To their handling join people from the youngest generation acting according to the rule „connect, communicate, change". The problem is that there is lack of correlation between people belonging most often to representatives of generation X or Y performing complex diagnostics and therapeutic procedures in medicine and people creating software, namely the ones from generation Z. It is like „a dictionary" in which doctors who write their observations in a language, was created by people who speak a bit different dialect.[4].

The existence of difficulties was diagnosed not only on connectors between IT specialists with doctors namely generation X and Y with the generation Z. much more important problem lies at the interface between man and machine. David Woods, theoretician and researcher of computer systems, evaluates it from the point of view of evolution. It consists of two overlapping processes: mutation and selection. Mutation is responsible for variety and deviation from the initial image. Selection cheeses the best and eliminates the worst functional mutations. David Woods notices that evolution educated the individuals from homo sapiens species as creatures adapted to dealing with not typical situations. It is connected with the evolutionary success of the species and Winding oneself on top of the evolutionary ladder. People within each organisation from primary community to corporation have been able to improvise in the face of unforeseen events. Thus, according to the rules of evolutionary adaptation, man and his medicine are, by David Woods, complex systems subject to self-adaptation as well as self-reparability. At the same time going on for ages, before-computer development of many branches of science, in it medicine, was to a large extent a mutation without a selection. Everybody could be an innovator. A part of absurd healing practices have been existing for ages, if not for thousands of years, and each "healer," could attach to it their own ideas. Nobody verified them. Computer and computer systems are a totally different story. Computer software, for the time being, is a complex system, not adjusting itself to the surroundings. It is not governed by the laws of evolution. The abilities of self-repairability of the Web are very limited. In part of systems, failures and not fully functional for 2% of the time computer network is regarded as norm. This condition is stated in most signed agreements. It is the merit of the problem for people, it is the computer users and computer networks. Computerisation in medicine joined in human functioning a very significant element: computers and computer Network where nowadays there is a selection or choice of one of the options of software for the created database but there is no possibility of mutation or change of the system. The primary decision is most often the ultimate decision. [9].

Due to the rapid development of IT technology, everybody could see global experiments in this respect. Large organisations, possessing huge, monolithic computer systems, have a priori difficulties with the change in the system or mutation. Frequent experiments and changes are practically impossible. Each alteration lasts very long and in a moment it makes no sense. Comparing it to the processes, which were in IT trade some 20 years ago, and possible Exchange attempt in Tag or ChiWriter's systems for a more modern one WordPerfect, would not be able to be made, because earlier there would appear newer products, as Word was. A different modification of the programme was necessary. We have here the phenomenon of inertia. In large organisations with large computer systems existing, selection is made more seldom, based on fewer number of mutations. It is regarded that the Root cause is the purpose of creators of the system or helping groups in doing what they cannot do by themselves. It is the job as part of co-operation and the necessity of linking individual activities with others. Does it really function like that, or is it only the keynote of the authors' of the programmes, it is another story. It seems a bit doubtful. [4].

It may be totally different in small organisations. The ex ample can be one-person medical practice, where the whole database and the attached to it applications are situated or may be situated in a smartphone. The configuration of the settings may be very easy and quite flexible. It allows the user to be himself or herself. There appears a question, can these systems be linked? What we want, and what we expect, and what we do not have is the system which will consider both mutation as well as the ability of selection. There appears a question of individualisation of software for particular people. Obviously, in the system serviced by an orthopaedist, the access to the radiological tests' results of the locomotor system should be the easiest and the quickest, but to EWCP it certainly does not have to appear on the first page of the interface. Contrary to it, there is a situation at the gastroenterologist. Nowadays unfortunately, in case of the available databases on the market in Poland most used without databases, so called individualisation relies on choosing the colour of the background, font, letter size or icons. It makes an impression as if the individualisation was proposed to the illiterates. [9].

Common and constant use of smartphones, even if in public places, indicates the necessity to draw some conclusions concerning how a digital device is to look like, optimal to be able to enter and read data. More thorough research may have a scientific meaning, the trend is obvious, though. Most often it is not taken into account by institutions such as health care units. When it comes to the management, there is repeated over and over again information about malfunction of computer systems, about pronounced, increasing dissonance between expectations and an actual state in functioning the network, most often only cosmetic changes occur. In reality at this stage, revolutionary changes are necessary, whose nobody has the courage to conduct. In ancient times, Scribes prescribed the texts. In times closer to us, because of the failure of doctors, who would not leave the typewriters, and now computers, in this work they were replaced by medical secretaries or medical assistants. These are contemporary Scribes, having rather a status of an Egyptian fellach, the status comes from work character reminding the assembly line. However, this forces a certain amount of mutation even if bureaucratic systems resist. Medical Scribes are trained assistants who work together with doctor in order to remove from them the most tedious task related to the computer. Arising Turing mutual cooperation interpersonal relations result in desire to changes. The doctor is expecting to possess a co-worker but not a slave. As a result, both the doctors and their medical assistants ask questions if what is now, should go on. It is so in Western European countries and in the United States. In Poland, the doctors still deal with the job worthy of Benedictines monks. Question of if that should be so, appear among doctor. The change made of common introduction of medical assistants which took place in the United States in the last 20 years, and in Poland it is still waiting for its introduction, is not satisfactory, taking into consideration the possibilities of contemporary technologies. Taking into account the possibility of text prediction or changing voice into the written text and other achievements of contemporary IT and AI techniques it is a "change" or so to say "expected change" postponed for several dozen years. The problem is more profound, though. Despite replacing paper in many countries with an electronic record, the system is still not effective. One should remember that medical secretaries are an underpaid group. In the United States these are people minimally trained, as it turns out, learning Chile commuting to work and the rotation in this profession is very large, incommensurable to the employers' expectations. Research showed that error rates in key data are therefore 20-50%. These are the sizes which do not require a comment. Doctors still waste their time, this time correcting errors, which is obvious, in some cases they do not notice them.[9,10,11].

Another ex ample, or mutation commonly applied in English speaking countries is a service of „virtual writer". It is outsourcing, creating at least part of documentation in other places in the world, most often in India, Indian doctors based on sound files create text documentation from the digitally recorded patients' visits. In comparison to „writing live" which most of them takes place in case of medical assistants in the United States, this system is more accurate. Indian Scribes are most of them doctors, and they work for much lower rate. This system nowadays is a fast developing market. A question arises about the ethic side of the business. Exchanging this time Indian doctors into Scribes certainly is taken by Hindu people than Americans. In this system, on the consent of the patient, the doctor record the whole patient's visit as a text file and it is automatically encrypted and send online. Later, it comes back to the United States as a text file. An operation algorithm remains data anonymous while being sent in www network and it is effective. The question is if it is proper in 2019. At present, looping at the overall picture from the perspective of the world as a global village, it can be assumed that there exist in the world a few systems of interview record, examination, decursors, discharge recommendations etc. The first one is a self-generating documents by the doctor, second is generating these documents up to date with the help of a medical assistant pitting with a doctor in the work place, the third one is to transfer the sound files to a secretary in another place, the fourth is conveying the same files to a secretary in a different place in the world and the fifth one adequate to the level of civilisation of XXI century, processing the voice into a text file by techniques AI and writing it down in a proper system. One needs to remember that introducing automation and replacing people with machines at tedious tasks repeatedly was an element of real progress. This was the industrial revolution. There arises a question if the path of development of medicine should not lead to release the medical staff from performing the function of scribe. One must remember that logistic and organisational activities not including this lead to many adverse phenomena, in it occupational burnout of doctors and nurses in place of their initial enthusiasm. [9,11,12,13,14].

Once again it should be emphasized that the technology of conversion of speech into a written text is not actually a novelty, nor something unusual. It offers the possibility of perfection of the process of creating the medical documentation, cost reduction and time of registration of information, improving the quality of documentation, improving the quality of services provided to patients. From the point of view both care for patients' health as well as the costs, both the direct and the indirect ones, the lack of common introduction of technology speech conversion is not understandable.[15].

Coming back to the theory of David Wood, one solution to the problem is evolutionary connection of mutation and selection or individual ingenuity and the group's preference or the whole organisation. What is the problem was shown on the example of Epic company. In this modern organisation a problem appeared. Its employees wanted to „build something that would have potentially much of intellectual property in one's system." The companies dealing with medical databases objected to opening and conveying part of codes to their systems and this way partially lost of control and potential income. Currently, the legal basis on this matter is being resolved. The step in the right direction in this case seems to be appearing the product called „App Orchard" made by the said Epic company . the designers noticed that each doctor and each nurse expect a bit different activities of the same application. This information, obvious to all the workers of health care became revealing to the IT specialists. Attention was paid that modifications of the system cannot ruin the group work and the system as the whole. This sets the boundary of modification able to introduce by the users. Proposing the orthopaedist and the psychiatrist the same o almost the same documentation of the patient seems absurd for everybody. It is so in most of the systems, though. Looking for an analogy in history, it seems that with the „stiff" monolithic medical documentation we are on the chase of the Prussian army of Frederic II. Not many years later, loose columns of Napoleon's army showed its true, apparent value, despite the fact that it lasted in stiff, monolithic structures. The best commentary for the incomprehensible from the point of view of common sense in not changing common patterns is the sentence said by the conqueror of Prussian soldiers Ludwik Davout after the battle of Auerstedt: ,,have they really thought that nothing ever changes in the world?" unfortunately, a large number of medical systems is still waiting for their Ludwik Davout. History will certainly record contemporary medicine as a time of fight with the amount of data and its complexity. It concerns primarily medical documentation. For the sake of digitalisation of more and more researches, its number in part of cases is duplicated with each year. The amount of knowledge, data and possibilities increases faster than anybody can manage it. Our technologies are not up to date with it, which would enable to use this information. The biggest problem is data quantification or obtaining opportunities to analyse them by computer programmes. In the final analysis we need the systems which will make that proper care will be easier for both the patients and the doctor and not more and more complicated. Psychologists claim that it must take place in a tightening interpersonal relationships, and not the other way, causing many negative consequences for the sick and the medical staff. The problem of interaction on the verge of man – computer system is currently one of the quickest developing research themes. [1,9,15,16,17,18].

Medical databases as a resource of humanity of a global meaning.

With all the analyses concerning medical documentation one needs to pay attention that it is a great, actually inexhaustible source of data and also knowledge. At the moment, there is a war going on „with data" and „war for data" in which "the players" are all the biggest technological companies, indirectly also each of the biggest corporations. To the rivalry over

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the access to „the big data" join countries as well as other bigger organisations. Their strategic plan is analogous or very close. It comes to downloading maximum much of non-structural data, generating it, systematising and what is the most important quantification. Based on them, we can only draw conclusions, most of them medical ones, pharmaco-economic and logistic ones. These analyses can concern also totally different areas of interest, from military to the religious ones. Data used in medicine are regarded as sensitive data as they contain a lot of private, personal and intimate information about particular people. They can still be used for meta-analyses as impersonal information. With amount of information used in databases, with a proper security, unauthorised taking sensitive data is very unlikely. Many authors claim that the degree of anonymisation of medical data in it , in particular personal data, may be as perfect now that it is more likely to obtain information from within the system than the vulnerability of hospital medical databases to external hacking. It means that the weakest link in the system may be man. [19].

As it was mentioned, medical data constitute an economic resource, which countries, big corporations as well as bigger or smaller firms are or may be interested in. The problem of sharing this economic resource is not successfully solved. Because of its great value, it should be properly used. Possible sum of medical data from the whole world might be the most valuable humanity possesses big data. It is a potential global resource of human knowledge of strategic importance for its development and prosperity. The whole requires appropriate infrastructure, developing the way of gathering and sparing medical data as well as proper legal conditions. Each time one needs to remember that it is not about the data of particular people, but the population data. The pattern could be laws, informal rules as well as trends obligatory for years in modern physics. Of course, proper legal modifications and providing full anonymisation are necessary because unlike humans, elementary particles do not have sensitive data.

The usage of data in Physics.

In Physics, so called rational research data management policy operates. Open access to them has become one of the most significant priorities of the agency financing them in recent years. In experimental physics of elementary particles, free access to all data and results of experimental research is crucial for the development of science. It has taken place for a long time now. It is a consequence of existing constant, strict international cooperation. Large international laboratories such as CERN work for the needs of all researchers. According to its status, at the base of which is free access to data and results of experimental research, it shares their big part (over 1 peta-byte), on website http://opendata.cern.ch/. It is not technically and logistically simple, of course. In physics of high energy, data must be kept in a format adapter to the experiment, otherwise the results may be unique. To ensure the possibility of unambiguous, comparative, critical, analysis of the results, dedicated software must be used. Therefore, it is necessary to save not only the data, but also the description of the experiment structure together with the full software. Currently there is a tendency to use virtual machines for this, maintaining the environment required for simulation of the experiment and data analysis. The alternative is the root format, the so called CERN homeclass, which has become popular recently. In this case the existing data is converted to this format. Teams conducting large experiments and large laboratories which have already noticed the need for long data storage, have created a special group of scientists dealing with this topic. Due to the importance of the problem, a number of international interdisciplinary meetings dedicated to optimization of the proposed solutions were also organised. (Data Preservation in High Energy Physic DDHEP). To be able to archive and analyse even the initial data itself, it si often required to understand both the essence and the details of the experiment itself. This is important when determining how to store data. An already proven solution is the analysis of data obtained and the problem of archiving them with the participation of relevant experts. The example will be here Particle Data Group. The rule applied by it, is data averaging including statistical significance as well as systematic differences between experiments. In case of "The Heavy Flavor Averaging Group" (HFLAV) apart from combining, interpretations and extrapolations of obtained results are performed. [20,21,22,23,24,25]. The model described above may, after appropriate modifications be a kind of „road map" of using databases generated by broadly understood health protection.

Examples of using and not using big data in ,medicine.

Based on medical documentation, understood as big data, new opportunities for the development of medicine have appeared in recent decades. In particular, in recent years, thanks to the use of artificial intelligence (AI) and machine learning has multiplied these possibilities. It is a truism to say that the great opportunity for the development of medicine in the coming decades seems to be the use of artificial intelligence. In practice, what seems nowadays, it will lead to probably placing a huge amount of data in computer or more networked databases and then subjecting your database to permanent analysis. As it was mentioned above, the actual progress including in medicine, is the result of „ant" titanic work. Until recently it was only human work. The „drudge" of software and hardware will serve to discover people's unnoticeable dependencies, obtain optima algorithms and other, often completely unexpected results. This is to apply not only to clinical medicine but to all sciences associated with it.

Treating medical documentation as a potential source of human knowledge of strategic importance one should look differently at its destruction. There is a legal storage period for the history of the disease. The longest period in the case of death of the sick person is 30 years. Considering the possibility of scanning documentation you should consider whether electronic copies of all existing documents should be made. Some of them will certainly not be able to read by OCR system. However, it should be remembered, that artificial intelligence changes medicine and in a few years it may be possible. The goal of this should be to enlarge the big data. Of course the cost of doing so should be calculated. The idea itself seems to be consistent with the thesis that humanity's greatest resource is its knowledge. The author of this work personally came across a situation attempts were made at the beginning of XXI century to read descriptions of gas gangrene of lower limbs contained in the medical history of the beginning of XX century. The purpose of this was to make an unambiguous diagnosis in the case of disease we have not encountered for many years.

Jonathan Bush in Harvard Business Review notices that in 2018 in the United States about 14% of expenses on health care which is 91 billion USD, was waste as a result of inefficient administration. This indicates that the analysis of errors made in establishing principals and daily tasks for bureaucratic structures in health care, carried out for decades, in a traditional way, does not work. This is probably due to too complex and invisible in a simple analysis of the relationships between the various parameters affecting the final result. Ensuring proper of operations and optimization of procedures by using artificial intelligence, should contribute to reducing the value of the costs of lost opportunities. Estimated analyses were made based on already existing large databases. It is eloquent for Jonathan Bush's unequivocal assessment of the situation. Excessive formalities resulting from improper, often duplicated or even multiplied document circulation, He no longer calls formalism, this term is for him disproportionate to the scale of the problem. Jonathan Bush describes the excess of bureaucratic procedures as „sewage" or „sewage" of modern medicine. According to his futuristic vision, the application of techniques of artificial intelligence in data analysis for broadly defined administrative procedures will allow them to reduce, improve, and redirect to useful operational paths. One of the basic expected results of these activities, which are to be achieved thanks to big data analysis, is to be the indication of optimal directions of cash flows, reorganization of the use of owned funds, and a significant reduction of the costs of lost opportunities. [4,26].

It should be remembered that every doctor who comes into contact with a patient, meets simultaneously with a huge amount of information, often exceeding the actual perceptual capabilities. Analyses carried out at the end of the XX century showed that excess of information becomes „information noise" hindering effective action and generating unnecessary costs. [27,28,29].

In each case, data analysis is performed to make the optima therapeutic decision. It has been happening since the beginning of medicine. The main difference is only the increasing amount of information. At present, various clinical data are being analysed primarily information from history and physical examination, laboratory and imaging results as well as other information recorded in the history of the disease. Observations indicate that the quality of collected data improves year by year, but also their quantity is constantly increasing. It is estimated that in 2011-2020 the amount of medical data will increase more than 50 fold up to 25 000 peta-bites (mega –big data) worldwide. It is logical that even a small part of such a huge amount of systematized information can be used for more effective therapeutic activities involving individual units as well as entire populations. The "Entilic" company dealing with this problem professionally calls it „wealth of data" This allows for an actual holistic assessment of each patient and also allows on pleiotropic system to see the effects of the drugs used. It also gives you the chance to find a relationship between the effects of selected substances or their groups or the health of the population. This is already a kind of revolution in pharmaco-economics. It leads to a generation of a more accurate, optimal and individualized treatment algorithm proposed for a specific individualized patient. Thanks to existence of medical computer networks operating on the basis of big data, it is possible to generate changes in the method of therapy based on on-going monitoring of its results and with the finding of greater effectiveness of one of the methods of treatment, it can be done almost in real time(so called electronic levers). These analyses may also ensure the selection of the most adequate drugs for reimbursement procedures, and thus may have a visible impact on macroeconomics.[30].

The vast majority of computer network software supporting healthcare entities, in particular the larger ones, is made by professional companies specialising in this. System installation, on-going maintenance and network maintenance is a source of costs for the healthcare provider. From the IT company's point of view, this is a source of stable income, because health care institutions, due to the possible loss of access to some data, are reluctant to change the IT service provider. The possible exchange of services provided by a medical institution in this area is almost always associated with this problem. The author's own observations indicate that this is very onerous. It is widely believed that databases functioning in health care should meet specific multi-industry requirements: medical, legal and economic accounting (due to the need to make financial settlements). At present software is also being tested on an ongoing basis comparing the clinical status of currently treated patients with meteorological and air pollution data. However, the rule remains that a good database must meet clinician's expectations. If it is to be "friendly" for them, then its ongoing replenishment should not be time-consuming and therefore cost-intensive. It is not possible to copy the model of such a database from other areas of the economy for ex ample from banking, trade or industry, which unfortunately often happens. [4,10].

This is even noticed by a layman who carefully reads the names of individual records. Then there is the desire to change, and with it the question whether the famous phrase of Ray Blitzer's „The only person who wants a change is a child with a wet diaper ",is adequate in this case? One may have doubts since this thought referred to an organisation and not to the computer system or an interaction on the border of people vs computer system. Unfortunately, even the smallest changes in already used system need well-thought-out decisions. Even in the case of evident errors, their rep air or correction requires deep analysis so that the new code does not destructively affect Any critical part of the system, which can lead to damage to all software. In some cases, because of the often modular software development, changes in one place disrupt the system in terms of other functions. This is called code sensitivity. In addition, repeated overwriting of the software code will definitely slow down the system. Such software increases the time consumption of generating medical records and thus reducing the time allocated by medical personnel for other activities, in particular direct patient care. If , in addition, the testing and debugging period after changes shows errors, you will have to perform individual tasks again. For this reason, the nuances and specificity of particular industries, including of course health care, in the construction of databases are of key importance. In a sense, this resembles the differences between the genome and apes, where a maximum of 1% incompatibility makes a qualitative difference. [4].

At the moment, all the largest IT companies are entering the medical services market. Apple, Google, Microsoft and IBM, offer the Watson supercomputer as a service for retrieving and segregating key data from originally unstructured resources, from Healthcare facilities and materials from previously published research. IBM Watson Health Cognitive Services in fact uses artificial intelligence to generate therapeutic and research hypotheses, recommend treatment, or select patients for clinical trials. These were and are the assumptions. Unfortunately, at the moment IBM Watson, especially in oncology, to those who were recommended do not support the expectations placed in it. In addition, it does not apply to the same system that is used at any other computer system or is used on the site bordering two or more systems, there can even be an error. This situation and the risk of „leakage" of personal data due to a „hole" in the programme code occurred when a scientific study, whose goal was to develop an application warning about kidney damage, implemented in one university, used data for analysis the British National Health Service (NHS) Google DeepMind software. The crisis situation was only resolved by a proper upgrade of the program. It is believed that "leakage" of data can occur much more often on the border between two systems, in the case of their incomplete compatibility, often not found originally by the testers. This happens most often when the two software created in the compilation model are built on the basis of codes created in other eras. For laymen, the Best comparison will be to observe the number of upgrades of commonly used programmes such as antivirus operational programs, like Windows. [19,31,32,33].

It is a truism, that a compatibility of systems and medical databases is easier to remove in the case of small networks, smaller software sizes, and therefore most often in the case of small medical entities. Until recently, the simplest database based on Microsoft Office Access was used by many entities to adapt it exactly to their own needs. Among other things, hence probably the software for small entities is free in some cases, but unfortunately its update requires the user to incur high costs. Sometimes it leads to no further updates. It is believed that relying on open source systems therefore increases the risk of data security. As already mentioned, some entities have been working on databases based on Microsoft Office Access. After entering the limit amount of data, they stopped functioning property. Current databases of large medical facilities have data that is a multiple of what can be saved in Microsoft Office Access or similar programs. Simple software no longer provides an adequate level of security.

Referring to the realities of the Polish medical market, due to the costs, a large part of computer in Polish hospitals worked based on Windows XP, and what is more, part of them are still working on it. For several years Microsoft Has not provided logistic al support, and therefore does not give a security certificate to computers working on this system. When combined with „test" non Professional versions of antivirus programs, the data security situation can be debatable in some cases. It is similar with the efficiency of the system incompatible with modern software solutions. In the event that we cannot use, for various reasons, most often financial, new versions of Windows, a much more logical solution which is not heard in Polish hospitals, is the use of a free operational program such as Ubuntu, Linuks, Lubuntu, Zorin OS, Tails or Neverware CloudReady. When discussing these probably less popular programs, it should be noted that the last of these is even advertised as a program "giving new life" to old computers or laptops. Unfortunately slowing down the Tails computer is suggested if you intend to use the TOR program, which in many cases of medicine may be beneficial. [34,35,36,37].

Artificial intelligence techniques can also be helpful in ensuring security Turing Network work. Then the systems would be more flexible. Some networks, are making progress in this area in cooperation with platform providers. An example here is a [Professional IT company, Dragon Medical Virtual Assistant, which thanks to artificial intelligence techniques ensures the possibility of secure data transmission, but above all, this is the main task of the company's software , including data conversion in the field of performed medical procedures. In selected situations these techniques additionally automate operations and support them using artificial intelligence. This applies to both simple searches and confirmations as well as generation of complex charts, logistic activities or analyses, or CPOE (Computerized Physician Order Entry). By CPOE we literally mean the computer introduction of orders by a doctor. In fact it is a very complex process of electronic generation of doctor's orders for patients, in particular, hospitalized ones. Introduced orders, recommendations, instructions, and orders are transmitted via computer network to medical staff, pharmacy, laboratory, diagnostics laboratories and other structures responsible for the implementation of specific activities including procurement. CPOE shortens the time of passing commands, and at the same time, it increases the efficiency of operations by reducing transcription errors, which is very important in this case, prevents duplicate implementation of the same procedure. At the same time, inventory management and financial accounting are simplified. Document circulation time decreases, but it also shortens the number of administrative links they pass through. All activities take place simultaneously in the network. Procedures that have previously lasted several hours or even days may take place in a split second. [38.39.40,41,42].

The possibility of significant progress are provided by companies that introduce unique software often treated initially as futuristic. In some cases this is simpler for organisations that are not „Giants of the Silicon Valley". In the United States, One Medical, Flatiron Health and OncoCloud Roche are mentioned as example of small companies specialising in implementing new ideas in the world of digital data analysis comparing the populations and the numbers considered in them as small, it can be considered from the Polish point of view, that the databases based on which their software using artificial intelligence works are huge. It should be remembered, however, that we live in a global village, and with the modern economy, and scientific analyses the relevant reference is comparisons with the order of numbers characteristic of China (at least 15 cities with more than 5 million people, the city of Chongqing with agglomeration of over 32 million) and other current world centres. Eurocentrism introduces a mental error at the entrance. The data obtained by the companies mentioned above, are party automatically entered among others for EHR applications such as Epic Rover and Haiku, MEDITECH Expanse. These products are

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associated with Nuance brand. Its basic product in the field of artificial intelligence used in medicine is the Dragon Medical One system [15,40,43,44,45,46].

At present, deep learning or (deep learning) technology in other words, one of the foundations of cognitive processing, is mentioned as analytical and software "top one". The inspiration to its creation is the human brain. ,,Learning" of neural networks is a process modelled just by the mechanisms of action of the human central nervous system. Artificial neuron networks analyse large data sets of big data to generate algorithms and detect existing patterns of action automatically without human intervention. At present, development in this field is focused mainly in the analysis of various types of graphic files. Enlitic's deep neural networks examine millions of images originally stored in various formats, to include automatically learn to recognize the disease. In contrast to traditional CAD; Computer Assisted Detection), deep neural networks can look for many diseases at once. Data analysis by such systems many times exceed the human capabilities. They can also provide unexpected information on areas of research such as early detection, treatment, planning and monitoring of epidemiological problems. From the management and logistic point of view, Entelic products offer specific algorithms and solutions that seamlessly integrate with existing computer systems already operating in healthcare. Medical documentation or rather parts of it, generated by this type of system has nothing to do with how traditionally it is understood. It resembles Rather a series of scientific dissertations with research hypotheses and conclusions. [30,47,48]

When discussing the problem of artificial intelligence in comparison with the use of data contained in medical records, IT industry giants cannot be ignored. Amazon's strategic goal when introducing Amazon Web Service is to dominate the medical information industry. The Amazon Web Services Internet platform created by Amazon allow you to choose from millions of unstructured files saved in various formats, including from the patient's documentation, relevant information about him, selected strictly for the analysed problem. It is possible thanks to the application of the so-called engine (name per analogy to a mechanical engine), i.e a program (library)implementing the basic logical functionality of the application (for example database). Comprehend Medical Amazon is a software with so called ability to machine learning which can extract such elements as clinical condition, performer procedures, diagnostics procedures, with their results and put them in a systematic spreadsheet compatible with the analytical program. The idea of these activities is simple, the details are much more complex. The so-called process sampling clinical data and linking them to the right patients, requires tedious screening for standard activities. The most time consuming procedure is the initial stage. However, the use of Amazon Comprehend Medical reduces the time and therefore financial burden. Amazon 's Comprehend Medical is not yet perfect enough to be Fuldy used in clinical trias. It is important, however, that it speeds up the selection of property selected patient groups. This relieves entire groups of researchers from tedious statistical research. All activities take place in a virtual network, in a cloud. The AWS Cloud Comprehend is a complex data processing system that „reads" text records. (including medical history, physical examination) doctor, patient's prescriptions entered into the database, transcripts of audio-interviews, and results of imaging and laboratory diagnostics. It uses machine learning for self improvement. Oncology analyses are presented as standard. For ex ample, the Fred Hutchinson Cancer Research Centre in Seatle, used the Amazon's Comprehend Medical Program for a series of pilot studies to obtain accurate analysis results very quickly. This Cancer Research Center using this artificial intelligence program was able to evaluate millions of clinical records to isolate and index selected diseases , drugs and cancer treatment options, reducing the processing time of each document from hours to seconds. Due to applicable law and ethical standards of doing business, one of the priorities is the protection of personal data. Amazon Web Service, i.e the Cloud, through which data is transmitted, does not collect or store any data processed by Comprehend Medical. After the analysis, the output data is provided only to the client (doctor, researcher or the patient himself). The data is encrypted and the keys to it are stored by the medical institutions that provide it. Amazon emphasises, that no customer data is used to train or improve other machine learning models under Comprehend Medical. One can have doubts as to the last of the discussed issues. It will be discussed below. [19,49,50,51].

Another problem concerning the possibility of using but also increasing the amount of data obtained from broadly understood medical documentation is the introduction of virtual assistants and robots, including human-like ones. The use of robots whose scope of activities Has been developed among others based on information contained in a big data about patients and their needs, and about modern medical procedures, in some countries i.e. Japan, is no longer a futurist. Virtual assistants include in various data transfers with health care providers. The simplest is answering typical questions asked by the patient by phone. It is a technique used in many non-medical but nowadays also in medical institutions. Many processes including patients' registration, no longer Has to be performed in a traditional way. Similarly to the technique used in banking for several years, initially in City Bank, it is possible to answer many questions of the patient and the patient automatically, even at the telephone keypad by pressing the appropriate keys. These types of virtual assistants reduce costs, but also allow ongoing full qualification of the data obtained, at least to the extent that the visual assistant deals with, using artificial intelligence techniques. These virtual assistants in this situation relieve the doctor of questions that are not focused on the patient's main medical problem. According to the results of clinical trials, this increases the trust and authority of the doctor interested in the merits of the case. According to the results of clinical studies, this increases the trust and authority of the doctor for and at the same time, which is also confirmed by research, it reduces the burnout of the doctor resulting from repeated painstaking activities and answering the same questions many times. Similar activities allow the patient to be educated and taught him the correct algorithms related to medical, nursing or therapeutic recommendations. Another positive effect is the reduction of patient's frustration due to the possibility of obtaining comprehensive answers to questions not necessarily related to his main clinical problems. [40,52,53].

The results of survey conducted by Nuance among health care workers clearly (80%) confirm the usefulness of virtual medical assistants and the potential of modern technologies to reduce overload of the tedious work of medical teams, increase the amount of time for additional patient diagnostics, improve patient health education, in particular in the field of disease for which he is being treated and recommendations for his further behaviour. Such technologies not currently used in Poland, cease to be just a futuristic vision, mainly from the Pacific Zone and The United States. By using face and voice identification, the system simplifies access to information contained in it to authorized persons, which reduces the time spent on documenting all medical activities. Technology similar in its assumptions, but with a higher advancement rate, allows monitoring of complex medical devices, e.g. defibrillators. It records the activities of the resuscitation team on an ongoing basis, thanks to the sensors connected to the patient recording numerous vital parameters, including electrical activity of the heart muscle, but also enables the recording of conversations conducted by the team, and converts them into written text. If necessary artificial intelligence systems can even suggest optima operation from the point of view of currently used algorithms. This is especially helpful in stressful situations, generating the possibility of making a mistake. The whole can be automatically included in the patient's medical records. De facto, after the resuscitation operations is completed, without any additional actions of medical personnel, thanks to the use artificial intelligence techniques, the required numerous forms, surveys and charts are already generated. By "medical records" we clearly understand multiple types of files and data, not standard printouts of a medical history in a paper folder. In orthopaedics and traumatology of the musculoskeletal system, similar systems can prompt and record activities even when using modern computer navigation. [40,54].

Radiology is the area in which we deal most with the modern, once unknown type of medical documentation. In addition, over the past 20 years, it has gone almost entirely from radiological films, to images saved in a digital version. Currently, over 300 million radiographic images are taken each year in the United States alone. In addition, there are x-ray images in various surgical areas such as orthopedics, vascular surgery and neurosurgery. As the number of tests performer increases, there is a problem of staff availability that can interpret them. At the same time, public expectation is increasing to increase the accuracy , but also the number of tests performed. Perception tests carried out centuries ago, similar to those currently used, e.g during pilots or drivers tests, show that it is impossible for anyone to notice and remember all the details visible in the picture, and this is the radiological image. Increasing number of pictures (in this case photos) automatically reduces the reliability and perfection of observations. Enlitic technologies partially allow to solve this and similar problems. In addition to computer analysis of radiographs, they can redirect them to the optimal physician available in the Network, specialising in a clinical problem, automatically pre-diagnosed using artificial intelligence algorithms, without any human intervention, and to give appropriate priority to a specific test. This allows you to speed up the receipt of the test result, but also to increase the probability of its correctness. Other solutions of the company regarding image, analysis give the possibility simultaneous communication with external browsers, archiving systems and computer image support systems. This is especially important when obtaining custom results. Artificial intelligence and computer image analysis systems proposed by the company allow you to interpret the medical (e.g radiological) image delivered as a bitmap (or other universal standard recording method) in a time period set in million-seconds. This is up to 10 000 times faster than the average radiologist does. With the help of artificial intelligence this is done by comparing the analysed image with the patterns characteristic of often very rare disease entities, with the pathognomic elements of the images being compared mainly. [9,18,30,55,56].

The contemporary approach to compulsory analysis of the philosophy of improving the quality of life promotes „Early recognition ,for release..." this is in line with one of these social views contained in his proposal in 1920 by the creator of this concept professor at Yale University , Charles Windslow. Early recognition and activation of the connection, among other screening. In many countries it is applied nowadays on mass scale, particularly in all developed countries. A large proportion of deals with radiological diagnostics. For the purpose of their dissemination, the only logical solution seems to be increasing the share of artificial intelligence for the analysis of individual images, as well as their global results. This will result in creation of huge databases containing radiological documentation in a Digital form. The combination of this type of big data with artificial intelligence will not only optimize treatment, but also improve current knowledge of human descriptive anatomy. The manuals present a standard picture at the moment, mentioning the variability. When big data is used with artificial intelligence, the anatomical variants currently known in individual cases, and perhaps occurring in tens of millions of cases, will be described. The current analysis of PubMed database (2019.08.01) does not show any such works as of today.

The primary task of screening, however, is to be mainly to reduce the recognition of cancer processes only at an advanced stage. And so, in the United States, millions of people over the age of 40 receive an invitation twice a year for screening tests or preventative examinations in the field of oncology. The programs most often concern the breast cancer. However, they also include other cancers, mainly prostate, cervical and lung cancers. These tumors are important because of their incidence, but also those where the rapid implementation of appropriate therapy can be combined with full recovery. Diagnostic solutions related to the artificial intelligence system allow to increase the sensitivity and sensitivity of the diagnostics used. For example, LIDC, Enlitic's lung cancer technology can evaluate according to randomized results, the malignancy of nodules in the chest CT images by 50% more accurately than a group of expert radiologists without this system. These analyses were made for experts not „average ” diagnosticians. This indicates that currently real-time clinical support for artificial intelligence is becoming for doctors. An analysis of medical documentation by the National Institute of Medicine indicates that in the United States alone, about 12 million people suffer from diagnostic errors every year. The percentage of radiological errors is also high. The caliber and the consequences of these errors vary, from insignificant to those that have lethal effects. The percentage of false positive results can be up to 2%, whereas the percentage of false negative results is thought to be as high as 25%. In some cases, this is of primary diagnostic and prognostic importance. After taking into account the effectiveness of human support by artificial intelligence, it seems obvious to want to introduce him as soon as possible on the widest scale. The key here will be the problem of obtaining the maximum number of appropriate diagnostics patterns. A huge big data will be necessary for this including but not limited to the verification of false positive and false negative results. More accurate and effective tools that support decision making by doctors can significantly reduce the number of errors. Real-time clinical support solutions proposed by Enlitic, to assist the doctor in interpreting difficult cases provide guidance on subsequent decision moments. Suggestions may change as data flows. For example, Enlitic's deep neutral network technology allows in orthopedic diagnostics to detect fractures visible only on 0,01% of the available X-ray image. The overlay appearing in the program in the form of so-called the heat maps draws the orthopedic radiologist's attention to the system prompts. This is important not only in difficult cases, but also with monotonous repetition of similar tests, when perceptiveness weakens. Diagnostic difficulties in the case of fatigue fractures are a classic example presented in orthopaedics. It is important and necessary to include the activities increasing the quality of diagnostics that in order to improve the perfection of artificial intelligence systems if necessary to retrospectively analyse their effectiveness, time and cost. Retrospective analysis also helps in clinical trials. [30,57,58,59,60].

Unlike traditional analytical predictive solutions that only identify high-risk patients , Jvion's artificial intelligence system indicates patients whose disease can be changed and provides personalized suggestions for specific patient recommendations that lead to improved treatments outcomes. This is a qualitative and not just a quantitative change in the operating system. Jvion MachineTM is a combination of Eigen -based mathematics, a

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database of several million patients and software that can be quickly applied to any of the several dozen avoidable so called vectors of complications and damages (such as sepsis, disease remission, falls, heart attacks, and ischemic episodes, but also avoidable medical appointments) based on existing complex models. Jvion turned out to be one of the world leaders in analytical research to prevent iatrogenic medical activities both in the aspect of strictly diagnostic and therapeutic as well as organisational aspects. 10 year observations indicate that the system's operations reduces some complications by up to 30%, which dramatically reduces costs. Referring to the current problems of the Polish healthcare, this would more than solve the problem of expenditure percentages allocated to healthcare. A necessary condition for such activities is the possibility of access to Electronic Health Record-(EHR)and its high substantive value. As the quality increases, so does the effectiveness of the artificial intelligence algorithms used. At present, hospitals usually collect EHR's for their needs. Its value for the care of entire population of sick people is negligible, despite the large amount of data recorded. This can be compared to having a large library of unread books, Jvion Machine bridges this gap by offering extensible analytical solutions that increase the likelihood of success, reduce time and reduce therapy. Comparing the costs of lost opportunities resulting from not taking advantage of a possible 30% complication reduction and the price to be paid for the system , the question should not be whether to introduce Jvion Machine TM, but why not tomorrow? We are talking here about prescriptive analytisc to prevent complications and losses.[61,62,63].

The basic possibilities of the modern use of artificial intelligence in healthcare:

- Data extraction from free text (Data extraction from free text)
- Co-creation of clinical documentation and data entry
- (Diagnostic and/or predictive algorithms)
- Clinical decision support) [17,19,43,50,51].

Data extraction from free text technology allows to extract, index and quantify data obtained from the text. This can concern both the data originally in electronic form and as well as data obtained by fax or scanned after by OCR. The lack of the use of OCR technique in managing medical records is huge. On a single medical history scale, there are currently at least a few non-digitized pages printed on or typed or handwritten so clearly that after scanning it would be possible to use the OCR effectively rather than save as a graphic file. In the next stage, these data could be used for analysis using artificial intelligence techniques. Amazon Web Services has provided a cloud-based service that uses artificial intelligence to extract and index data from unordered clinical records about patients. Flatiron Health software reviews unstructured medical documents, searches for structured data and uses artificial intelligence to suggest the right keywords and concepts to increase the likelihood of proper assessments and insights, and to improve the quality of analyses. [17,43].

Similarly, the Diagnostic and / or predictive algorithms technology introduced by Google among others, works. It works with networks to develop predictive models for large data sets. The goal is to alert medical personnel to the potential high risk to life of a given patient being diagnosed or already treated. The algorythm covers the most common causes of death, among others sepsis, myocardial insufficiency, hemorrhagic and ischemic stroke. Image interpretation algorythms based on artificial intelligence are being developed, to but they are already functioning one of them is the Eigenface technique. It allows, among others, to identify the characteristic elements within the face, and Hus to recognize the disease symptoms. One of the most interesting tests performer using this technique, is the prediction with a probability of up to 90% of the onset of Alzheimer's disease based on the analysis of a person's face photo, even 20 years before the first symptoms appear. In some centres in the United States, hisis also used to Fuldy diagnose retinal diseases. Due to reliability of the Eigenface technique, currently used for „police patrolling" street in selected Chinese cities, it can be expected to introduce authorisation to conduct medical documentation (patient's identification and registration, "signature" with the photo of examiner, etc.). a similar role is played by the Eigenfoot technique constructed for the analysis of pedobarographic images. Currently work is underway to introduce a system for automatic search of people at risk of developing foot ulcers as a result of developing diabetes. Algorythms not yet dominating the IT market are also developing their own recognition and interpretation based on artificial intelligence. The assumption of the project is to identify the patients most at risk and a hint in the implementation of appropriate algorithms of treatment protocols, and thus decision support. Among the leaders of this implementation of these projects are Enlitic, Jvion [30,63,64,65].

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Introducing the records in medical documentation based on processing a voice message into a written text allows to make data record „on the go" which means during the examination, avoiding tedious spending time in front of the computer and enables you to spend this time examining the patient and treatment. Logistically, the examiner usually a doctor clearly dictates the subsequent phrases that are processed and saved in a text version. Nuance company offers technological support in this area based on artificial intelligence. The software facilitates the collection and creation of data based on "oral records" of medical personnel. The software proposed by various companies Works on similar principles. In some cases, it is suggested „to teach the system" of your voice and diction. The person who is supposed to work with the program reads the text specialty prepared by the producer. Then „manually" corrects errors, in the next stage he reads another text. After reading the standard texts 3-4 times, transcribing the next version of the sound on the written one is usually error free. It helps in this internal system dictionary, the T9 algorithm used on cell phones (*Text on 9 key).* In his case, functional based on 8 significant keys of the sms-r service allows access to known words based on text prediction. This system has been patented by Tegic communications [66,67].

When analysing these technical improvements, it should be taken into account that medical documentation is a key element in a patient's treatment. At present, because of the overload of staff bureaucratic activities, documenting patient- related information , which is generally considered a secondary act, has deficiencies and inaccuracies. This often leads to incomplete medical records and poor patient data. Advances in informational technology (IT) in the healthcare system and the registration of information in electronic health records using text -to speech conversation software help to avoid this type of neglect. In addition, key words appear in integrated computer system. They allow for prediction of the text, but also for ongoing searches, proposals, for individualized treatment of the patient. This is done based on available web resources, including digital libraries, Science Direct databases, PubMed, Proquest, Springer, SID, but the most popular search engines Google and Yahoo. The basis is always the use of keywords and their combinations. It also allows speech recognition, automatic documentation of ongoing decursions etc. Facilitation can be algorithms that have been around for years, even before the age of the computer revolution. Already at the beginning of the 90s , descriptions of chest radiographs e.g at the Radiology

Clinic Hadassah Hospital in Jerusalem were performed using an appropriate logistic algorithm. The radiologist entered one of the numbers from 1 to 10 in the description of the photo which meant the catalogue number of the pattern. Then additionally he added one or more sentences. When dictating text to the system, you can also use keywords that automatically enter longer texts. For example, in orthopedics, „dictating the system" password/keyword ,,Watson – Jones one" can mean for the system to paste the entire standard description of hip replacement from the anterior lateral approach of Watson – Jones [10,19,50].

Currently artificial intelligence is mainly used to modify and improve the techniques of detecting and obtaining the data from possessed digitized text, as well as personalising therapeutic recommendations. Modern digital technology, however, also makes it possible to make electronic records more user-friendly. Literature draws attention to this, because one of the main reasons for the burnout of doctors is to disturb the proportion between the time spent at the patient's bed and the time spent on creating medical records. It seems that adjusting the image and how to be friendly to medical staff should be one of the strategic goals of developing modern healthcare. The primary task is to free key resources, such as doctor, nurses, from supplementing the existing electronic documentation in a „traditional way". People who perform this task are reduced to the role of secretaries complementing the database. Critical problems, such as the „rigidity"' of systems, should be solved with the help of artificial intelligence recording behaviour and algorithms of doctor during "manual" documentation. Artificial intelligence and machine learning can help you continually adept to user preferences, improving both clinical results and the quality of life of clinicians. [66,67,68].

Optimization of electronic medical documentation requires integration of many activities. Most of the currently available options for the application of artificial intelligence are „closed „ systems, not related to other software, which does not provide a satisfactory degree of integration and requires doctor and nurses to learn new interfaces every time. In response, the world's leading providers of medical documentation software are beginning to add additional attributes to the use of artificial intelligence to make their systems easier to use. Companies such as Epic, Cerner, Allscripts i Athena are gradually introducing not only functions such as processing human voice into a written text, but also machine learning to support clinical decisions, integration with telemedicine technologies and automatic image analysis. It will be necessary, as is party the case to gradually access to data stored in different systems. In the United States, over 90% hospitals have been computerized in the last decade. This means that health information for more than half of Americans is already in the Epic system. It si a multi-functional program that allows, among others, to keep hospital records, generate a hospital logistics program (including others) and conduct complex patient analyzes. Unfortunately, a study conducted in the United States in 2016 showed that regardless of the brand of medical software, doctors spent about two hours on computer work for each hour spent face to face with the patient. Computer work was often done after standard business hours. The University of Wisconsin Said the average day of family doctors had risen to eleven and a half. The result is what can now be called „burnout epidemics" of clinicians. Research shows that as many as 40% of respondents had symptoms of depression and 7% had suicidal thoughts. This is twice as much as in the control group (average working population). Researchers write in their application that „something went wrong". This actually requires further research and analysis. Atu Gawande's statement that „something went wrong" seems very accurate. Doctors are a group of enthusiasts, one of the largest enthusiasts in society, for whom profession is a kind of drug. The best of their characteristics in a version definitely over-exaggerated and comedy presented the series MASH — Mobile Army Surgical Hospital. The form of the story showed, however, that it is not the profession, but a sum of profession, fascination and addiction. The mentality of surgeons can probably be compared to that of military pilots of conquerors of eight thousanders and a few other "subcultures" but certainly not to average bread eaters. Misunderstanding of this phenomenon by superiors prevents their national management of so-called „inteventors". However, there is one more element- for years doctor have been "the top" enthusiasts of innovations in the IT industry. They are still people who often program and use highly-advanced computer programs outside of work. What happened that this group somehow reached a point where people actively and intuitively hate their computer at work? [9,40,66,67,69,70].

Documentation of the future should be developed with seemingly only futuristic thought about integration with telemedicines technologies. The prototype of this can be at system One Medical. The introduction of various individual readers of vital signs (blood pressure, heart rate, respiration rate, blood glucose level, etc) should provide their integration with medical systems of hospitals and clinics. Ultimately, one should lead to an individual patient co-managing his treatment process. [15].

Hexoskin Health Sensors & AI is one of the possible solutions. It is a leader among companies dealing in the sale of intelligent clothing reminiscent of „Star Wars". Since 2020 it has offered a line of the most modern smart clothes, which , based on the sensors placed in them, provide precise control, not only of the simplest life parameters. Similar outfits are, among others, produced for special units. This inteligent clothing allows you to closely monitor many quantifiable health parameters. To monitor your health evolution over time, Hexoskin smart clothing offers activities and sleep tracking. Hexoskin smart shirts are clinically approved, among others, for continuous monitoring of heart rate together with an accurate ECG,in particular with analysis of QRS waves, as well as parameters of lung function (respiration rate, minute ventilation). The list of parameters that can be monitored is constantly growing. The Hexoskin System provides Bluetooth connectivity including with iPhone, iPad and Android. Data is analyzed based on Hexoskin Connected Health Platform. Open Data API allows you to download raw data and use your own analytical software to monitor your health yourself. The whole can also be continuously entered into the patient's medical records in another database in his choice if it is compatible with Hexoskin Connected Health Platform. It then allows for ongoing monitoring of the patient's health by the attending physician. If in doubt as to the patient's condition, A1 techniques may trigger alarm algorithm. [71].

Observing the development of IT industry, you can expect miniaturization of the proposed solutions. When comparing the size of ,,Odra" computer and modern laptops and their computing power, it can be assumed that a small sensor installed in clothes will fulfil all the functions of Hexoskin's clothing.

Most networks providing services related to creating medical records will probably want to apply a hybrid strategy, supplying the user with part of the system and providing the remaining part based on partners. The possibility of system integration will be provided based on artificial intelligence technologies. It seems that this process will require years of experience and development of computer systems and computer in accordance with Moore's law. [72].

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Network-centralization vs blackchain technologies.

There are currently two opposing concepts for the development of Digital medical networks. The first of them is network-centralization. It is a technology with military roots. The operations of such a system was tested Turing the First Gulf War, and, which is rarely mentioned, it was a strategic advantage of the United States. Corporations such as IBM, Wal-Mart and Deutsche Morgan Grenfell were the first to use the IT achievements and capabilities of computer networks thanks global commercial practice. Thanks to the introduction of network-centric organisation, these companies increased their profits by several dozen percent and achieved a significant improvement in the quality of customer service. The essence of network-centric activities is to create a Fast and effective information exchange platform. [73].

In the opinion of military analysts, the Network- centric Network is „indestructible" thanks to its design-eliminating any of the decision nodes or information channels will only cause that their functions will be taken over by another decision node or another information channel. [74].

Similar requirements to the military networks should ensure the security of medical networks. Blockchain technology, whose design assumptions are different, is increasingly being introduced in this industry. It allows you to work in a distributed environment i. e in a decentralised network, which does not require having one central administrator for all data available in it. Blockchain technology is becoming more and more popular and is currently pervading the entire information and communication industry, and its use has been growing rapidly. The interest in development of this technology, as well as its penetration into various domains, resulting primarily from the appearance and subsequent rapid increase in the value of cryptocurrencies, in which it currently supervises all operations. All transactions in the Blockchain network are secure thanks to the use of cryptographic principles. [75].

It is currently expected that the blockchain technology market will grow rapidly in many areas of the economy in the coming years. The literature on blockchain technology discusses both the architecture of various networks and application of this technology in big data based applications. Both industrial and scientific research. There are also Works on the possibility of using blockchain technology in the field of healthcare, but they are not of meta analysis. [76,77,78,79,80].

Medicine in the broad sense is one of the areas in which blockchain technology has great potential. Estonia is the „top student” in this area. It based its databases on this particular system.[81.82].

In healthcare it is a basic need for a more patient-centred connection of different, previously completely independent and non-communication systems, and for a continuous increase in the reliability of electronic databases. The originally unconnected systems of two hospitals, or even different links in the same facility, must be optimally connected. This determines the development directions of blockchain networks in medicine. The results of the analysis indicate that nowadays the discussed technology in medical industry, is mainly used to manager medical records, share data (including imaging tests), and control access to them. Unfortunately it is rarely used for other possible purposes, recommended by many authors, such as: supply chain management, drug management, or audit management. At present it seems that the great potential for the blockchain technology, mainly in the management and logistics process, is still used to a limited extent. This is due to a comparison to other industries. Still, other applications of the discussed technology in medicine are much rarer and often only in implementation stage. [76,77,78,79].

The available literature presents few technical details regarding this type of technology used in medicine, including details on the implementation of prototypes. This probably results, to a large extent, from patenting various types of the latest engineering solutions. Blockchain is a distributed book technology that can also be defined as a chain of blocks with time stamps connected to each other by means of cryptographic hashes, where these blocks are protected in a constant way. The chain is growing all the time and finally new blocks are addend , with each new block containing a link with a content of its precious link.[76,83,84].

Blockchain is called not only the distributed general ledger, but also the distributed database, also known as the registry or common register. Each supplement, each new bit of information, is a new item in an electronic record. According to a technology algorithm, there are thousands of independent copies of the registry, stored on personal computers, company

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computers and servers around the world, hence the name decentralised or distributed database. A priori the record is never stored, in only one location, hence among other things, its security is assured. Depending on the construction and purpose, the register can be used in many ways, such as sending and receiving data, or what is currently the most popular, sending and receiving money (the most popular currency based on blockchain is bitcoin). When one person intends to send to the other data specifying the procedure,(transaction), it simultaneously sends to thousands of other computers on the network that have a copy of it from that moment. The Software of these computers confirms that the operation is allowed, and authorizes it by agreeing to it. For authorisation to be granted, each detail of the analysed copy must match with the copy of the previous operation. If there is no compliance, there is no authorisation. The innovation of blockchain technology results from the fact that a central supervisory institution or any intermediary is not needed. The transaction or transfer of information takes place between two Network users, Chile others are only observers and at the same time depositaries of copies of the operations carried out. The joined register does not belong to any of the organisations. It belongs in some sense to every web user who has a copy of a blokchain. This does not mean however, that every copy depositary has control over it. In addition, and perhaps most importantly, the joint register is immutable and not modifiable backwards. Each previously entered item will exist indefinitely, along with information about when it was created, as long as the www network exists. Thanks to the internal structure of the blockchain chain, manipulation of items saved in a common register is not possible for any of the network users. Any web user who has a copy of the registry on their computer and would attempt to modify it would not be able to verify its changed version from other network computers because the data would not match their pattern. This technology uses public keys so there is no need to disclose anyone's identity. [85,86].

Users operate in the network de facto as block chain nodes and are organized into peer-to-peer (P2P) system. Each node in the network i.e. a public one, which is used to encrypt messages sent to the node, and a private key that is used to decrypt messages and operate the read node. In this way , the public key encryption mechanism is covered by the function of merging, irreversibility and irreversibility of the blockchain block. When reading data only the correct private code owned by the user can decrypt the information using the appropriate public key. This concept has long been known as asymmetric cryptography.

Therefore, three elements are most important in blockchain technology. These are block chain, protocol and data. [76,77].

Looking at the same from the hardware point of view, the essence of the network are computers that provide computing power to verify and store data in a block chain. [85].

For medical data, the most appropriate type of blockchain, according to experts in the field, would be a private blockchain. This describes the decision model of Würst and Gervais. The block chain can be used in this case in so-called ”scenario” in which many parties who do not trust each other must interact and exchange common data, but would not involve a third party. (TTP). This model contains additional elements ensuring full security of the blockchain system. A chain of blocks acting as a distributed book (database) , which then stores all sensitive data is additionally secured, just as in all technology, new blocks containing medical data can be added continuously. [76,79].

Possible application of big data in Poland.

The use of new technologies based on medical databases can also take place Inter alia, on the border between medicine and engineering. It is optimal to use large databases (preferably big data) containing the tomographic images. Nowadays in engineering research it is common to use finite element analysis (FEA). They are used, for ex ample, to design aircraft or space vehicles. They are very accurate because of their spatial nature. However, building such models is currently time-consuming, requires additional access to modern computer hardware and software. The use of such applications does not currently occur as part of typical standard surgery planning. Such analysis should be performer a priori on „diccifult”users before making decisions as to orthopedic provision (conservative, possibly available). At present, not only in Poland, but also in the world, it cannot be used in therapeutic activities, in operations or in silicone analyzes. A possible analysis of the computer model would allow making optimal from the bio-mechanical point of view intraoperative decisions and a more objective assessment of complications. This would reduce the cost of treatment and the consequences of avoidable complications. [87,88,89,90].

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The environment of smart cities.

It is important to remember that human beings and healthcare in the broad sense do not exist in a vacuum. Contemporary homo sapiens most often inhabit big cities. It does not matter whether according to the city life cycle model by Leo von Klaassen in the era of urbanisation, suburbanisation, deurbanisation or reurbanisation [91], it endeavours to be so called smart city.

The uncontrollable process of industrialisation had an impact on the image of cities, their environmental degradation, and the living conditions of their inhabitants , and thus their health. The situation became so serious that in 1993 the so-called Athens Charter was created. It proposed such a reorganisation of Urban planning of cities that created a national and health living space for their residents. [92].

New Athens Charter 2003 the vision of cities of the XXI century presents a picture of the city, which is ideal in its essence, and it is characterised by cohesion in various fields: social, economic, environmental and spatial. According to urban planners , a coherent city will also provide better access to education, healthcare and other social services. Healthcare and entire range of public health based on the use of IT technology, in particular the use of artificial intelligence, is naturally integrated into the concept of smart city, a city based on artificial intelligence. [93].

Therefore, they present a visions of cities operated in the knowledge economy. Also work in industry ceases to play its dominant role and it is taken over by services and processes related to information. According to D. Bella post-industrial society becomes informative. The realized vision of the city presented in New Charter is a smart city, an intelligent city. Smart extensively uses information Technologies. Knowledge supported by modern ICT should at the same time give visible positive effects that are subject to research in 17categories called in the international document ISO 3720:2014. One of them is health. [91].

Various methods are used to measure the intelligence of cities. The Smart City Model developer by researchers from the Vienna University of Technology, Delft University of Technology and University of Ljubljana seems to be the most comprehensive. The model they developed allows for comparison of 6 categories. Each of these categories consists of

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additional elements which allow a more comprehensive assessment of the city's level of intelligence. The problems connected with health are mainly in smart living and smart living. [91,94,95].

The ranking of cities in the top three created in this way locates Luxembourg (LU), Aarhus (DK) and Turku (FL). Luxembourg gained its position mainly through intelligent management and environment, Aarhus intelligent environment and living conditions, Turku's success was determined by intelligent economy and mobility. Rzeszów was ranked 47 th in its ranking. This is the highest position among Polish cities. [96].

Considering the problems related to health protection, it is Worth paying attention to the Global Smart City Performance Index developed by Juniper Research (Digital Markets Intelligence Centre). This index presents the results of the analysis of 4 categories within the smart city: mobility, healthcare, safety and productivity. In the study for 2017 Singapore, London and New York. the first, second and third place respectively. In health category the winners are Singapore, Seoul and London. In this category there are 20 elements, among which there is both the number of hospital beds per capita and their occupancy percentage, but also security on the roads (the injured -per capita), public transport, bicycle communication, or conditions of electric vehicles. Due to the nature of this work, however, the Smart Healthcare activities are considered the key item. They include telemedicine services, digital health portals, virtual medical advisor assistance, digital health portals for the elderly, transparent healthcare KPIs promoting healthy lifestyles and actions for road safety. [97].

Healthcare is also taken into consideration in Global Liveability Index developed by The Economist Intelligence Unit (The EIU). The availability to both private and public health care are analysed there, as well as the quality, availability of medicines without a prescription and health care rates by World Bank. For 2018 the maximum of points gained in category of "healthcare" were achieved by cities: Vienna, Melbourne, Osaka, Calgary, Sydney, Vancouver, Toronto, Tokyo, Adelaide [98].

<u>To conclude:</u>

From the Polish perspective, this sounds futuristic, but medical documentation of the future is not detached from reality, often sealed several times on each page" a mountains of papers", locked in a magazine and available to few. It is gradually becoming more and more global big data providing everyone with full anonymization of their personal data, but also the opportunity to use this great key intellectual resource for the good of each individual and all together as a great community. The whole is suspended in the emerging global smart city network. This significantly reduces the direct costs of lost opportunities in terms of well – understood well – being which is health.

Summing up the divagations on application of IT technology and especially the artificial intelligence in medicine, public health in generating medical documentation now understood in a different way, the best seem to be words of cited here many times Atul Gawande. He repeats them after one of artificial intelligence enthusiasts. They are: ,,Isn't about time we all came on board?'' and further: „I am playing a long game and full faith that all this will bring us to a success."[9,99].

Conclusions:

1. Based on the needs of patients and providers of medical services, and given the latest technological advances, all medical documentation should be digital and the processes of its creation, access, sharing and consistency checking should by supported by suitably designed AI systems.
2. The knowledge contained in medical documentation constitutes a resource of strategic importance for humanity, with almost unlimited potential.
3. All medical documentation should be anonymised and should be made widely available, just like data and research results in the field of experimental physics. This will accelerate development of new treatments, best practice and help to identify new medical emergencies, such as Covid-19.
4. In practice today, unfortunately, the design of medical record systems is fragmented between institutions and countries, often focusing discussions on narrow technical details, and forcing clinicians to waste time on filling up multiple pages of illness history. This leads to many inefficiencies and lost opportunities, and necessitates a fundamentally new approach.

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