DIGITAL HEALTH SYSTEM AND E-HEALTH IN THE FOLLOWING COUNTRIES: UNITED KINGDOM, NORWAY, SWEDEN, DENMARK, GERMANY AND UNITED STATES

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ABSTRACT

The Covid19 pandemic, the rise of chronic diseases and the high rate of old age worldwide are factors that have impacted the world's healthcare systems. This has led to hospital congestion, exhausted medical practitioner and a strained healthcare system. New information technologies, digitization and artificial intelligence are the levers needed to restore a resilient, robust healthcare system that can face up to the uncertainties of our current world. In this article, we present health systems in several countries to know the architecture, strengths, and weaknesses of the different systems. We also present the state of progress of the digitization of healthcare systems in these countries, the contribution of digitization to the quality of healthcare, and the obstacles and problems encountered when digitizing the system.

Keywords: *Digital Health System, Digital Health Policy, Data Health, Telemedicine, E-Health, Electronic Health Record*

1. INTRODUCTION

The Covid crisis has affected not only our lives, but also our healthcare systems. This crisis has allowed the world to question the flaws, limitations, and most importantly, the resilience of hospital health systems. Health systems have been put to the test during this critical period, and it is time to address the challenges posed by this pandemic and learn from this unprecedented crisis. This pandemic should therefore be a catalyst for developing a new, more robust and resilient infrastructure for better patient care.

The COVID-19 crisis has accelerated the redesign and deployment of hospital health systems. As a result, Digitalization of health systems in different countries is crucial to optimize them, and thus make improvements. What is the definition of an efficient health system? What is the architecture of the health systems of these world powers: the United States, Norway, Sweden, Denmark, Germany, and the United Kingdom? What are the main challenges that have been overcome thanks to the digitization of the healthcare system? What are factors influencing the digitization of the world's healthcare system?

2. DEFINITION OF "SYSTEM"

A system represents the interaction between different entities (human and material) governed by certain rules to achieve a common goal.

3. DEFINITION OF THE "HEALTH SYSTEM"

The health system refers to the set of organizations and institutions, resources, and actors, which participate in the implementation of the health policy of a country" (OMS, 2000).

Most health systems are divided into two categories:

- Public,

- Private,

Health systems include material resources (hospitals), human resources (health care providers), and financial resources (social protection).

3.1 DIFFERENT HEALTH SYSTEMS:

Health systems are predominantly built up from a small number of differently arranged health care financing and delivery subsystems" (OECD, 1992). The three predominant subsystems are:

  Private health insurance, in which the supply of care is provided by private sector providers (the case of the United States, in the majority since it has a mixed system).

- Social security system, where consultations are provided by public and private health care providers (most EU countries).

- The third system is tax-based financing (case of the Nordic countries and the United Kingdom).

The private subsystems (case of the United States, where the predominant system is the private system for the insured) allow for quality care, (low) waiting times and good responsiveness are noted. But, on the other hand, the cost of care is very high, which does not include equity in access to care for the population.

Social security health systems, in which care is provided by public or private providers, are paid on a fee-for-service basis. This system is said to be "equitable" because it is financed by mandatory contributions based on income and ensures very good responsiveness and low waiting times for access to care. Nevertheless, the persistent difficulty for this system is cost containment.[1]

Tax-funded systems are the most rigid: all providers are public; the consumer of medical care is not free to choose his or her provider. These systems are notorious for a "lack of responsiveness» and rely on the "conscience" of the provider (e.g., not taking on certain patients). Access to care is defined by need, not demand. Access to care is rationalized for the consumer of medical care, and he or she does not have the right to choose a provider.

The management of health systems can be divided into three categories: centralized, decentralized, and semi-decentralized.[2]

- Centralized health system: Provides all management of the system at a central level.

- Decentralized health system: Delegates some or all the management of the health

system (delegation of powers, transfer of responsibilities, etc.) to local authorities.

- Semi-decentralized healthy system: management of hospital care is under the authority of the central government.

4. HEALTH CARE SYSTEM IN THE UNITED KINGDOM

The British health care system is mainly decentralized. The four constituent nations of the United Kingdom: England, Scotland, Wales, and Northern Ireland decide autonomously how to organize their health care system. A budget is allocated by the British government in England, and grants are given to the other three nations of the United Kingdom. The British health system includes several actors: the Ministry of Health; the National Institute for Health Protection; NHS England and its local agencies; Clinical Commissioning Groups (CCGs) and the National Institute for Health and Care Excellence (NICE).

The Department of Health is responsible for overseeing the budget and monitoring the performance and effectiveness of the health system. The National Institute for Health Protection reports to the UK Department of Health. It is the guarantor of the protection of the health of the population. The National Health Service (NHS England) is managed by the UK Department of Health and is responsible for the management of the UK health system. Its role is to optimize outcomes and quality of care, control the organization of local agencies and allocate resources. Local NHS agencies (Clinical Commissioning Groups) run health care at the local level. NICE is responsible for assessing and ensuring the best possible safety of medicines.

In England, 85% of health care is publicly funded through the NHS, with the remainder to be paid by the patient. Primary care is provided by general practitioners. In the United Kingdom, they are the gateway to the health care system, and must provide follow-up care. They are paid directly by the state in two different ways: capitation and fee-for-service. Capitation consists of paying a lump sum to the health care provider according to the number of patients and not according to the number of interventions. So, whereas fee-for-service payment consists of granting remuneration to physicians for each intervention with a patient.[3]

Secondary care is provided by state-subsidized hospitals and by private hospitals (NHS Trusts). Most care is free, but patients are free to

purchase private health insurance. Several local GP practices are affiliated with local NHS agencies. They are responsible for providing care to the population (mental health services, various emergency services, private hospital services, and outpatient home care). Their mission is also to assess the needs of the health care system in conjunction with the authorities.

In the United Kingdom, each patient is free to choose his or her own doctor (under agreement with the NHS). The doctor is also entitled to treat patients who do not live in his or her locality. However, specialist care (provided by a specialist doctor) and hospitalization (excluding emergencies) are usually prescribed by the general practitioner. The patient is free to choose his or her own specialist doctor, and an NHS-approved hospital.

There are three types of hospitals in the UK: general hospitals, specialist hospitals and tertiary care hospitals. General hospitals are divided into 2 groups: Public hospitals (affiliated with the NHS) where care is free and private hospitals (run by companies or charities) which generally charge for care. Hospitals offer outpatient, maternity, emergency, and surgical services. Most public hospitals offer private services (more comfortable) to increase their budgets. There are also specialized hospitals (ophthalmology, psychiatry...) and tertiary care hospitals for the treatment of complex and more specialized diseases. They are in areas where there is a high concentration of population near medical schools and university hospitals. The nature of specialized and tertiary care is complex and therefore costly.

The digital transformation of the British healthcare system is under stress. The population is not yet convinced of the benefits of this digitalization. They still have apprehensions about the use and security of the health data provided. The United Kingdom is the only country in the world that stores health data in such a way that the patient's file can be accessed in any circumstance: change of region or doctor. The United Kingdom has been studying telehealth since 1993 with the creation of the national telehealth program NPfIT. Several public (NHS App) and private (Immedicare, medio.Link, push doctor) telemedicine applications are operational in the UK. These applications allow patients to access their health data, make appointments, renew prescriptions, and consult online. .... The goal is to reduce the number of face-to-face consultations by 30 million visits per year.

The GP2GP project (NHS connecting for Health) allows the sharing of patients' health information between health professionals. The shared medical record was supposed to be generalized in 2018 but finally saw the light of day in 2021.Babylon Health is software that allows to make an appointment with a health professional 7 days a week and includes a chatbot that gives health advice and diagnoses for non-urgent health problems. The transfer of the data of 1.6 million patients from NHS hospitals in London to Deepmind (an artificial intelligence company owned by Google) is slowing down patients' willingness to embrace digitalization.in UK, the creation of Health Innovation Manchester aims to improve the health of the 2.8 million inhabitants of the Greater Manchester area. The aim is to set up a system of very high interoperability between all the players involved by getting manufacturers, pharmaceutical companies, university centers and researchers, etc. to work on this project.

5. SWEDISH HEALTH CARE SYSTEM

Sweden's territory is divided into 21 counties and each county is subdivided into several municipalities (290 municipalities). The responsibilities of the Swedish health care system are divided into 4 levels (national, regional, counties and municipalities). Its mission is to provide equal and quality care for all. This mission is the responsibility of the county councils, and each county council is responsible for the organization of its health departments and the management of its health resources.[5]

As a result, the county councils have a great deal of autonomy and freedom in the management of their health departments. The financing of Swedish health care is collected directly by the county councils through taxes.

Medical services are provided by public or private facilities. Public facilities are managed by the county or local authority or municipality. Private facilities in Sweden are divided into two categories. In the first category, the care provided is free of charge since the facility is under the supervision (contract) of the county, local authority, or municipality. Private facilities that are not under contract with the county, local authority or municipality provide care for a fee.

The Swedish health care system consists of several actors: the Ministry of Health, the agencies attached to the Ministry of Health, the counties and municipalities and the Swedish Social Insurance

Agency. The Swedish Ministry of Health is responsible for following the government's guidelines for health care. Several agencies are attached to the Swedish Ministry of Health. The tasks of these agencies include disease prevention, licensing of health care personnel (doctors, dentists, and other health care personnel) and health promotion. The counties are responsible for managing and providing all health services autonomously, the municipalities are responsible for non-medical care (childcare, care for the elderly and disabled) and residential facilities for the elderly and disabled.

Thus, the Swedish health care system is divided into 3 territorial levels. Primary health care is provided at the municipal level under the authority of the counties. The primary health care centers are the patient's first contact with the Swedish health care services. These health centers include doctors, nurses, midwives, and physiotherapists. Unlike in other countries, nurses have a broader responsibility.

They can diagnose a patient and even take blood samples. The doctor is only available for the most complex cases that require a more advanced diagnosis. Each patient is free to choose his or her general practitioner, and each physician is free to choose the facility in which he or she will provide this care. Specialized health care is provided at the county hospital level. This specialized care (outpatient and inpatient services) requires equipment with more advanced technology. The patient can consult a specialist without a prescription from the general practitioner.

The third level of tertiary care is provided in hospitals located in the six regions of Sweden. These regional hospitals provide specialized, state-of-the-art care. They provide highly qualified medical care. The goal is to consolidate specialized expertise in a few hospitals, instead of having it spread out over several hospitals. The Swedish health care system aims to continuously improve by providing high quality care while keeping costs under control. To control rising costs, Sweden has reduced its hospital bed capacity (45% of hospital beds were eliminated in 1990, compared to 19% in France). As a result, many of the services that used to be provided in hospitals are now provided at home, or in retirement homes (e.g., cataract surgery is provided at home). Thus, hospitals have been decongested and are focusing on peak treatments. This restructuring has not impacted the quantity of operations provided. On the contrary, the number of operations has remained the same and Sweden has reported better results in the face of this restructuring.

In 1915, the Swedish University of Lund was among the first universities to experiment with remote ECG reading. The first telemedicine service started in Sweden in 1922 for Swedish ships. In close collaboration between the Swedish health authorities and the Swedish government, Sweden implemented its first e-health strategy in 2006 which was updated in 2010 and then with the new vision 2025. Its platform "www.1177.se" exchanges encrypted information between patients and doctors. This platform allows for online appointments, teleconsultation, access to patient data, etc. The 2025 vision focuses on privacy, respect for user data and interoperability. Several Swedish startups created between 2002 and 2014 (Kry, My Doctor, Telemedicine Clinic. They offer teleconsultation services (mobile application or tablet), prescription or prescription renewal.

As the Swedish healthcare system is decentralized, it is the responsibility of municipalities and communes to manage the implementation and use of e-health services at the local level. In Sweden, telemedicine is governed by national regulations that protect the exchange between doctor and patient via encrypted data or two-factor authentication. The startup Engaging Care aims to become the leading international e-health platform. The platform aims to become the first point of contact for patients and help them better understand their illness and treatment. Its interoperability will allow for easy integration with existing applications and platforms.

Since 2008, 100% of medical prescriptions are in electronic format and all primary care and psychiatric healthcare institutions use the electronic medical record.

6. HEALTH CARE SYSTEM NORWAY

Norway is a country divided into five regions. These regions are divided into eleven counties, and each county is subdivided into municipalities (365 municipalities in total). The actors in the Norwegian health care system are the Ministry of Health and the agencies that report to the Ministry. The Ministry of Health is responsible for specialized care and supervision of primary care.[4] Several agencies are affiliated with the Ministry of Health:

✓ The Norwegian Agency for Health and Social Services "Helsedirektoratet" is responsible for

reducing inequalities in access to care and ensuring quality of care.

✓ The National Institute of Public Health provides "technical" advice to the government as well as supervision of the health system (statistics). It is responsible for health monitoring, promotion and forecasting the needs of the community.

✓ The Drug Agency is responsible for determining the reimbursement rate of drugs.

The Norwegian health system is a semi-decentralized system, its organization is shared between the state and local authorities (counties and municipalities). The Norwegian health care system is financed to 85% by taxes, and the remaining 15% is paid by the patient. Thus, the hospital system is financed by taxes, and primary care is financed by local taxes. Membership in the insurance scheme is compulsory for all Norwegian citizens (NIS: "National Insurance Scheme"). It covers the majority of primary care and hospital care, with the remainder to be paid by the patient through co-payments. Adult dental care, long-term care, care for the elderly and disabled are poorly covered by the national insurance. The Norwegian health care system is a semi-decentralized system, with hospital care under the authority of the central state. Primary care is under the authority of the municipalities, and dental care is under the authority of the counties. The gateway to primary care is through the general practitioner. The municipalities are responsible for the recruitment of public or private GPs (who have signed a contract with the municipality). Patients are mostly affiliated with a general practitioner (family doctor, or GP) of their choice, and can change GPs up to twice a year.

Access to a general practitioner is generally (except in the north of Norway) very accessible in the country during working hours, or outside of working hours. Specialized or hospital care is only accessible through a prescription written by the general practitioner (except for emergencies). The patient always has a choice of specialist or hospital. He can go to a specialist without the GP's prescription, but he will have to pay more. The law on patients' rights (1999) states that the patient must have access to specialist care within 30 days. If necessary, the patient is free to go to a country of the European Union (E.U.), or the European Economic Area (E.E.A.). Reimbursement by the national insurance is based on the Norwegian health care reimbursement scale, and the patient is responsible for the transport costs. Private insurance

covered only 10% of the population in 2016. It avoids long waiting lists for access to care in private facilities. Most of these insurances are taken out by companies.

The Norwegian healthcare system is considered one of the best in the world. Its very low density has accelerated the digitization of its healthcare system. Norway is the country with the highest ratio of health expenditure per capita in the world. In 1993, Norway was one of the first countries to address the issue of telemedicine by creating the Norwegian center for integrated care and telemedicine (NST). The Norwegian center for E-health Research (NSE) was established in 2016 based on the NST project and aims to digitalize the healthcare system through a common and interoperable patient-centric solution. Teleconsultations are reimbursed like medical visits to the doctor. The shared medical record (EPR) is already deployed in Norway.

In 2011, the Norwegian portal Helsenorge.no allows patients to access their health care history (results of medical tests, prescriptions...), make appointments and see their doctor. However, each region in Norway allows a different level of access to the shared medical record. The 1 citizen - 1 newspaper project (Helsenorge.no) is a platform that connects several actors of the health system (hospitals, doctors, patients, municipality...).

E-consultation is very developed in Norway, especially in areas with very low density. The Health data program allows the use of health data to improve innovation in the health system and to better understand and therefore anticipate patient needs. Mixed Reality is a project currently being tested to improve patient care for surgical operations. In Norway, the municipality of Stavanger, the hospital and three industrialists have formed a partnership to deploy robots to rehabilitate elderly patients at home, equipped with sensors and video systems, to reduce the number of hospitalizations.

7. DANISH HEALTH CARE SYSTEM:

The country is divided into five regions and 98 municipalities. The Danish health care system is decentralized. Financial and organizational management responsibilities are divided between the different authorities of the country. Thus, the state plays a regulatory (budget) and supervisory role in case of infringements or overspending of the allocated budget by sanctioning

local authorities. Local authorities are responsible for the organization of primary and hospital care (at county level), and care for the elderly, disabled and home care (at commune and municipality level).

Access to health care is free for all Danish residents. It is universal and financed essentially by taxes collected by the state (82% and redistributed to the territorial authorities), and 18% are financed by the municipalities. The health care system is mostly public, with private insurance being a very small minority. The Danish health care system keeps a close eye on health care expenditure. Thus, the Danish health system divides access to care into two categories: compulsory (Group 1), and private (Group 2). Group 1" members have the right to choose a general practitioner within a 15 km radius (otherwise, the doctor must certify that he or she can travel to the patient's home). They have access to a wide range of free health care but can only consult a specialist on the prescription of their general practitioner and should pay a "rest à charge" for access to certain specialists (dental, chiropractors, psychologists...). Group 1" patients are free to choose the hospital of their choice. In order to manage the long waiting times for access to specialized care, the waiting time for specialized care was reduced from two months in 2002 to one month in 2007. Beyond this deadline, the patient is free to go to a private establishment, or abroad at the expense of the State. Nevertheless, despite this law, and due to cultural and distance issues, patients do not go to another institution, and wait to have an appointment in a hospital in their regions.

Only 1% of the population has access to private coverage. This category is distinguished by the possibility of accessing a specialist practitioner without having a prescription from a general practitioner. General practitioners are generally grouped together in medical practices. They have a liberal status under contract with the counties.

Access to general practitioners is 24 hours a day in Denmark. Specialized doctors also work in medical practices or in hospitals. They also have a liberal status. However, the staff of hospitals are employees of the hospitals and are not allowed to practice in the private system. In general, a "rest to pay" to be paid by the patient is estimated at 16% (mainly for dental care and drugs).

According to the European Union, Denmark is one of the leading countries in the field of telemedicine. Since 1994, general practitioners have been providing remote consultations for the benefit of people living in remote areas without doctors. Between 1994 and 2015, 81 telemedicine projects were launched. To comply with the regulatory framework for telemedicine, the "National Board of E-Health" organization was created.

As the Danish healthcare system is decentralized, the responsibilities and monitoring of the digital health policy are shared between the different levels. Thus, at the regional level, an interest organization has been created to coordinate the common objectives at the national level. At the community level, the main objective is to reduce hospitalizations at the hospital level and to promote hospitalizations at home through telemedicine. This ambition to focus on hospitalization at home follows the annual tax paid by the municipalities to the regions in relation to the number of people hospitalized. The main goal of telemedicine in Denmark is to avoid unnecessary hospitalizations.

Almost all the telemedicine supply is public, the regulation is more focused on the information system. For Denmark, it is the responsibility of the European Union to regulate the practice of telemedicine and not of its country: the flow of telemedicine information should not have any border at the level of the EU countries. The strategy for the development of telemedicine in Denmark is to support the public health system.

8. GERMAN HEALTH CARE SYSTEM

Germany is a country divided into "Länder" (regions), municipalities and communes. The German health care system is based on a health insurance model funded by employers and their employees. It is decentralized from the Länder to the central state. It is these Länder that delegate responsibilities and powers to the central state. The central state plays a regulatory role and defines the general organization of the health care system, but health policy, hospitals, the number of beds, and health care providers.

The health insurance funds also operate in a self-organized manner. They are responsible for collecting contributions and negotiating rates with health care providers. There are two types of plans: public (compulsory) and private health insurance. Private health insurance does not cover the family and spouse of the subscriber, which is possible with public health insurance. The entire population is subject to registration with a health insurance company. However, it is only possible to subscribe to private health insurance above a certain annual salary level. The public health insurance system

covers a wide range of health care (primary, outpatient and hospital).

In Germany, it is possible to choose a general practitioner (for a minimum of three months), and to consult a specialist directly. The general practitioner is not the gateway to health care in this country. Moreover, the health insurance company will only reimburse a visit to a specialist once it has received a prescription for a visit to a specialist from the general practitioner. The patient is also free to choose the hospital where he/she would like to be hospitalized or consulted. Unlike the public health insurance system, which offers third-party payment to its beneficiaries, private health insurance is based on the system of payment and reimbursement (subsequently from the health insurance fund).

Generally, ambulatory care (general practitioners and specialists) is provided by private doctors in their offices, who are contracted with the health insurance funds. Doctors are grouped in doctors' associations at the level of each Länder and are paid on a fee-for-service basis by the health insurance funds. A contract is established between the doctors' associations and the health insurance funds to negotiate the tariffs, and as a result the negotiations can differ from one Länder to another.

To regulate the expenses of the health care system in Germany, doctors are obliged to respect a certain number of visits per quarter. If they do not, they will have to pay penalties. As a result, access to a doctor in Germany can be subject to waiting times so that the doctor is not penalized. There are three types of hospitals in Germany: public, private for-profit, and private not-for-profit. Public hospitals are managed by the Länder and the health insurance companies. The Länder mainly manage and finance the hospital infrastructure, while the financing of care is managed by the health insurance companies. Private non-profit hospitals are run by charities and private for-profit hospitals are generally more specialized and are run by private health insurers.

In Germany   is a major concern. The strong decentralization of the German healthcare system: several stakeholders and therefore decision-makers makes the implementation of the Gematik project complex. The aim of this project was to introduce the electronic health card (eGK) and to establish and develop a secure telematics infrastructure (IT). The leaders are taking several actions to accentuate the digitalization in the country. From October 2011 several actors in the German healthcare system: insured patients, pharmacists, doctors and insurers are interconnected via a microchip that brings together the patient's medical history and these reimbursements. Since September 2018, the startup Vivy has extended its application for creating its digital health record (shared medical record) throughout Germany. The Big data project was started in February 2014.It provides healthcare data to develop research.

The lack of interoperability is a major challenge in Germany and therefore leads to heterogeneity and compartmentalization of existing systems. With the implementation of teleconsultation in 2018, the field of telemedicine has started to grow in Germany. Several telemedicine applications have emerged in Germany: Teleclinic, Auschein, Patientus, Justananswer...These platforms allow you to make an appointment with a doctor, teleconsultation, send symptoms by sms and receive a prescription. This technological breakthrough has allowed German residents to avoid waiting 2 to 3 days to access a doctor and thus make a diagnosis.

A department dedicated to the digitalization of health has been set up within the Ministry of Health to promote telemedicine. Teleconsultations are free for members affiliated with insurance companies partnering with the telemedicine platform.

Since 2017, remote consultations are reimbursed by mutual insurance companies and insurance companies. Nevertheless, the telemedicine offer remains very limited and lacks interoperability between the Landers.

9. U.S. HEALTH CARE SYSTEM

The United States of America is a country composed of several states. Its health care system is called "liberal" and is part of the "American liberalism model" (a political philosophy that aims to obtain the greatest possible individual freedom). It is different from European health systems because it is based on market mechanisms and is made up of several health plans, depending on the category of the population. We are therefore faced with a very fragmented system, from one state to another.

The American health care system is essentially based on private insurance, both for-profit and non-profit. The State essentially takes care of a certain category of population (poor, handicapped, and elderly) to have access to care. Therefore, it is the responsibility of the states to

manage the health policy of their citizens, and to finance part of the costs and organization of the "Medicaid" system (program created to provide health insurance to individuals and families with low income and resources). [6]

Thus, we find a great disparity in access to care within the same country and for a category of people who have the same health insurance. The obligation to join a health insurance is contrary to the liberal values of this country. As a result, many people may find themselves without health insurance.

There are two types of health insurance in this country: public and private. There are two types of public insurance that provide basic coverage. "Medicare (for people over 65) and Medicaid for low-income people. The number of residents covered by public insurance increased from 27% in 2015 to 34.8% in 2020 (source: U.S. Census Bureau). The Medicare program is funded by employee and employer participation. While the Medicaid program is essentially financed by the various states and the federal government. Private insurance "Managed Care Organizations" "MCO" are health care networks that rely on collaboration between purchasers and health care providers. Thus, people with private insurance see doctors who are affiliated with their insurance at a lower cost.

There are several types of MCOs: Health Maintenance Organizations (HMOs), Preferred Providers Organizations (PPOs) and High Deductible Plans (HDHPs). Individuals who contract with HMOs must be referred to a physician or hospital that is on a predefined list by the HMO. If so, payment is higher. PPOs are more flexible than HMOs. Providers are under contract with PPOs and are paid on a fee-for-service basis, hence their flexibility. The last type HDHP is the most successful insurance. Most of private insurance purchases are made through the employer. Access to specialist care and hospital care cannot be done without a GP's prescription within the HMO. But remains possible for subscribers of PPOs and HDHPs.[7]

Tax benefits are given to employers who purchase insurance for their employees. Therefore, large companies provide good insurance to their employees and their families. Smaller companies do not offer health insurance. Employees of small companies are left without health insurance because they cannot afford to buy insurance on their own and do not qualify for public insurance. There is another type of insurance for children of parents

with limited resources, but who do not qualify for Medicaid, called the Children's Health Insurance Program (CHIP), which is also funded by the federal and state governments.

Generally, to limit health care costs in the United States a consultation with a general practitioner is required before consulting a specialist. General practitioners are mostly grouped in medical practices (2 to 5 doctors) or in individual practices. Specialists may work in hospitals or offices. As in the case of general practitioners, they group together in a practice to be able to share and reduce their expenses. Access to private hospitals may be refused for people who are not insured, but it is accepted in public hospitals.

In the United States, there are several regulations concerning the protection of health data at the federal and state levels. But unlike in Europe where there is a national law that regulates the protection of health data, the United States of America does not have a national law. The two European and American visions concerning the protection of health data are different. Europe attaches personal health data to a fundamental right, while the United States focuses on the commercial aspect of this data: Private companies have the right to use this data. It is difficult to link and unify health databases since they are not very interoperable and are fed by private and public actors.

The United States is left with fragmented health data that is difficult to manage. As a result, GAFAM has invested in the data market by offering storage solutions, data processing via AI by signing partnerships with hospitals and clinics. GAFAMs have also signed partnerships with several giants of the pharmaceutical sector (Pfizer, Sanofi or Novartis) that allow them to find solutions to disease prevention, care management and post-treatment proposal based on the collected and analyzed data. In 2019, GAFAM provided a platform to the public insurance Medicare that allows health professionals to deposit their patients' computerized information.

In the United States, several billion dollars are invested each year in healthcare start-ups to develop telemedicine solutions. In the United States, despite the advances in telemedicine, reimbursement for this service differs from state to state and not all healthcare professionals are authorized to practice telemedicine and varies from one state to another. According to McKinsey, the number of Americans using telemedicine has

doubled since the corona virus pandemic. Amazon has thus expanded its telemedicine application, which was originally dedicated to its employees, to outside companies.

10. DISCUSSION

Digitizing the healthcare system has made possible to overcome many of the challenges and difficulties that weaken the system. Here are some of the major challenges that have been overcome:

➢ Digitization of the patient pathway will enable better analysis of the patient's care pathway (AI, Big data, etc.) and thus optimize the care chain.[8]

➢ Using e-health (telemedicine, teleconsultation, etc.) can relieve hospitals of congestion and thus reduce the time it takes to access care.[9]

➢ Optimization of hospital resources.[10]

➢ Management of emergency services to avoid tense situations. .[11]

➢ Detection of primary and secondary cardiovascular disease.[12]

➢ Telemedicine has made it possible for people living in remote areas to receive follow-up care.

➢ Better management of hospital beds thanks to home hospitalization and telemedicine.

➢ Autonomous management of operating rooms, which were generating financial losses.

➢ Reduce time wasted by doctors renewing prescriptions.

➢ Manage patient flow within the hospital system.

➢ The use of digital tools will also allow the patient to be directed to the right establishment (town medicine, dispensary or emergency room).

The article shows that several factors are influencing the digitization of the world's healthcare system:

➢ National legislation governing the analysis, use and security of healthcare data, to give users confidence.

➢ The shared medical record must be accessible and shared in all circumstances: change of region, change of doctor.

➢ Data must be hosted in a data center in the host country, to prevent data leakage and unauthorized use of medical data.

➢ Platforms and applications for the digitization of healthcare systems must be ergonomic, easy to use and enable management of the patient's care pathway (appointment booking/cancellation, prescription renewal, online consultation....).

➢ In the event of decentralization of the care system: E-health must be governed on a national scale to protect the exchange of information between patient and caregiver via encrypted channels or double authentication, while the management and deployment of applications can be carried out on a lower scale (at municipal and commune level).

➢ A healthcare digitization strategy must be shared between the government and healthcare authorities, considering all stakeholder constraints to achieve the healthcare digitization project.

➢ Managing hospitalization at home through telemedicine to avoid hospital congestion.

➢ Train healthcare providers in new technologies applied to the healthcare system (telemedicine, teleconsultation, use of shared medical records....).

➢ Reimbursement of remote consultations by health insurance companies to encourage patients to use telemedicine.

11. FUTURE WORK

In our future work, we will present the design and architecture of a hospital healthcare system using the multi-agent system that has proven itself in several distributed systems. Next, we will extend the hospital architecture proposed to a country's entire hospital system, based on hospital hierarchy.

The aim is to enable people living in remote areas to have access to healthcare, to enable small and medium-sized hospitals to focus on primary and secondary care, while large hospitals can concentrate on more advanced and complicated

care. The aim is also to take the pressure off doctors and enable them to follow up their patients.

We will also be developing artificial intelligence-based algorithms for scheduling and rescheduling in the event of more urgent patient arrivals, during periods of crisis (flu epidemics, gastroenteritis), road accidents, natural disasters or pandemics. Patients are rescheduled according to their urgency and address, by sending a message to cancel the appointment, redirecting them to a general practitioner or a telemedicine consultation. We're also going to develop a medical skills management system to avoid bottlenecks in the healthcare department when it's under stress, and to bring in additional medical staff who are underworked.

12. CONCLUSION

This article presents the progress of digitization of healthcare systems in different countries. It shows that these countries have already begun the process of digitizing their healthcare systems (telemedicine applications, telehealth, shared medical records, etc.). but not all have achieved the same result.

The Nordic countries are the most advanced, having begun this digitization process in the 90s and have won the shared medical record challenge. Norway has met the challenge of the shared medical record by placing the patient at the heart of the digital transformation of the healthcare system. Unfortunately, we're finding that the UK is having a hard time getting people to accept the digitization of the healthcare pathway: The transfer of data on over 1 million London hospital patients to an artificial intelligence company owned by Google has put a chill on the population. Germany is still lagging behind the Nordic countries in digitizing their systems, due to the heterogeneity and lack of interoperability of existing systems. The United States of America, unlike European countries, does not have a national data protection law and is even being exploited by GAFAM to speed up disease research and develop telemedicine in the country.

We have also discussed the contribution of new information technologies to overcoming the challenges faced by healthcare systems, as well as the obstacles encountered by these countries in digitizing their healthcare systems.

This article enabled us to target the digitization needs of healthcare systems to define the future works we'll be developing in our next articles.

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