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Research Article

A Few Words About E-Health

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Abstract

Today's systems and organizations that provide health care meet the complex requirements of providing efficient and cost-effective service, where the quality and safety of medical services must be at the highest level. Taking into account the need to improve the quality of the new generation of health care systems, electronic companies with their solutions in the field of health care want to help health institutions and other entities involved in the health system in improving efficiency, timeliness, safety and overall quality of medical services.

Keywords: E-Health; Benefits, Risks; Iot; Digital Health

Introduction

There is substantial debate over the benefits and risks of health IT, with many published studies in both categories [1]. Skeptics have questioned whether the technology merits substantial policy emphasis and investment. Several studies have documented dissatisfaction with electronic clinical alerts which use data to remind providers to take action ("alert fatigue"), and they have raised concern that electronic systems—while reducing some types of errors—introduce other ones. There have been concerns over privacy breaches and the potential for decreased patient satisfaction. There is also mixed evidence regarding care process efficiency, with studies supporting increased and decreased provider efficiency depending on the process or metric studied. Some physicians have also reported difficulty customizing EHRs (Electronic Health Record) to meet the needs of innovative practice models, which becomes ever more relevant as policymakers push towards health care and payment reform.

Healthcare systems worldwide are under stress mainly due to the expanding elderly population [2]. The World Health Organization states that the percentage of people over 60-years-old will double to 22% by 2050. This effect is a result of improved sanitation and medical services as well as breakthroughs in medical technologies and pharmaceuticals. Furthermore, low- and middle-income countries often lack adequate healthcare infrastructure and their populations have little access to healthcare services. Finally, the rise of chronic diseases, such as diabetes, cancer, and dementia, increase demand for long-term healthcare plans. These problems can only be addressed by restructuring and redesigning our healthcare systems. One of the technologies that is believed to be a big driver and also part of the solution is the Internet in its broadest sense. "Broadest" here means the three primary characteristics of the Internet that in the last decade have changed how many industries work (e.g., travel, finance, retail):

a) its ability to have people efficiently share and access information from and to almost anywhere and anyone.

b) it provides communication (real-time, store, and forward) between actors (human and machine) anywhere in the world, closing the gaps of physical distance and time, and

c) it provides a platform for creating networks and communities. The use of these attributes in the healthcare industry has been referred to as "telemedicine" or "e-health".

Health care, both in the private and the public sector, is rapidly moving into eHealth and telemedicine and, in the course of rationalizing administrative and delivery structures, is increasingly outsourcing diagnosis, consultation (both informatic and medical), data storage and manipulation etc. [3]. In that sense — and to that extent — it is rapidly becoming an international affair. This globalization is especially pronounced in the private sector as health care providers, taking advantage of market niches, move beyond their original national boundaries with a concomitant distribution of administrative and delivery structures. This development, which is still in its infancy, presents a series of ethical and legal problems that touch not only health care associated professionals but also institutions, policy makers and societies at large. More specifically,

the scale of health care delivery is shifting from the traditional, more-or-less immediate setting that involved direct inter-personal contact and accountability, to an aggregate corporate model that is dominated by electronic methods of diagnosis and communication where contact is frequently mediated rather than direct, is spread out among a changing variety of individuals, and responsibility is distributed among a whole host of players whose roles are intricately choreographed into a complicated service-delivery ballet whose every facet is necessary for the process to function, but where accountability tends to be seen in institutional terms instead of personally and direct. The situation is further complicated by the fact that the delivery model itself is in the process of moving from a jurisdictionally localized approach to one that transcends national boundaries.

Telemedicine

Telemedicine is 'the use of telecommunications technology to provide medical information and services' [4]. Use of telecommunications technology to facilitate health care delivery has evolved over nearly four decades, beginning with pioneer programmes such as telepsychiatry consultations and teleradiology in the late 1950s. Telemedicine, with varying degrees of success, has subsequently been applied to a wide array of medical specialty areas including radiology, pathology, psychiatry, cardiology, neurology and neurosurgery. Telemedicine has been undergoing a resurgence driven by several factors. These include economic pressures to contain the rapid growth of health care expenditures, the increasing emphasis on fair resource allocation, the socio-political desire for decentralised and locally adjusted access to health care, rising demand and expectation for 'quality' health care (and hence for an expert opinion) and the availability of major research funding streams for e-health (including national and global information infrastructures and e-health collaborative activities).

Another important reason for telemedicine's resurgence despite initial failures is that significant advances and development have been accomplished in both medical technology and IT. The pictorial archiving communication systems and advanced medical imaging systems such as computer tomography and magnetic resonance imaging are examples of exciting breakthroughs that were simply not available in the early years of telemedicine. Teleconferencing and high-performance communication networks represent additional critical advances in the field. These advances, along with the steady fall in price/performance ratio have contributed crucially to the improved relative advantage of the innovation. Enthusiasts say that the goal of telemedicine is to 'marry medicine with technology', capitalising on the advantages of technology to produce a robust system that 'reaches the parts other services do not reach', thereby delivering an enhanced service at an affordable price. Sceptics argue that face-to-face contact is fundamental to health care and that telemedicine can never be as good as the 'real thing', and that expansion of services is often driven more by doctors who are technology enthusiasts than by those genuinely seeking to expand services and redress inequalities.

Digital Health

"Digital health" is one of the preferred terms used by this new industry arising out of the intersection of electronic networked technologies with medicine [5]. Interchangeable with "mobile health," "e-health," "digital medicine," and other combinations of those terms, digital health is located both in the institutional settings of experts (offices, clinics, hospitals) and in people's quotidian surroundings. "Digital health" refers both to the technologies developed to capture data and to the practices of knowledge production that they support. Its constituent technologies are often named as: consumer DNA testing and the data gathered by the massive genome-wide association projects; mobile biosensors that collect biodata, among them fitness trackers, heart rate monitors, glucose monitors, the Apple Watch, even diapers that analyze human waste; imaging developments that enable instruments such as cell phones to be used for scanning skin, irises, or other body parts; electronic health records; and patient-networking sites, which gather data from these sensors as well as through data input by users. The knowledge production practices these devices feed are both open access and proprietary, and they contribute to both. However, within the industry, digital health development is premised on the profits that big data industries promise, an ecosystem dependent on selling and licensing software, hardware, and datasets, i.e., the proprietary model.

It is expected that electronic communication and exchange of medical data will change the course of medicine in many ways [6]. Hereafter, the main legal challenges of e-Health, and various e-Health applications will be explored, answering the question of what is going to happen from a legal perspective. For obvious reasons, the focus has been on the human rights perspective, how the use of information and communications technologies in healthcare will impact human rights. But given the border-crossing potential of exchanging electronic information, e-Health services fall under the scope of EU law, triggering internal market and competition rules, as well as EU Charter rights.

IOT

The healthcare services and communication technology industry have the potential for growth in specialised e-health services such as electronic health (e-health), remote monitoring systems, and home and community care among many others [7]. The IoT (Internet of Things) offers numerous opportunities to improve the operations and delivery of healthcare services. The IoT promotes a wider approach to healthcare by addressing the health needs of a population instead of individuals and by stimulating practices that reduce the effects of diseases, disability, and accidental injuries. Additionally, combining healthcare applications with other areas of the IoT stimulates sustainability in healthcare. It is established in the healthcare community that prevention of diseases is as equally important as providing medical treatments. Consequently, the IoT creates the opportunity of maintaining sustainable environments for a healthier lifestyle. The

integration of IoT technologies in healthcare is expected to result in promoting remote health monitoring systems as well. Remote health monitoring technology provides solutions for monitoring patients at home. These systems aim to deliver higher quality of care and reduce the cost on patients and governments without affecting the quality of the healthcare services provided. The use of a remote monitoring system allows biomedical and other vital signals of a patient to be measured ubiquitously during his or her daily activities. Such a system allows the collection of medical data related to patients' bodies, such as their heart rates, remotely via the Internet. There are also benefits associated with improving the quality of care and services, such as accuracy and freshness of data obtained and ease of accessibility to the patient's electronic health records (EHRs).

An IoT-based remote monitoring system can detect any changes in the persons' body conditions by monitoring their vital medical signs. The availability and accessibility of the collected data by this system via the Internet and the ability to access this EHR, in real time, by various other systems and entities such as healthcare providers and medical centres, open the door to numerous opportunities. For instance, an alert system can be designed based on analysing the EHRs collected by the remote monitoring system. In the case of a medical emergency, the system can be configured to alert the healthcare professionals, emergency services, relatives, and other concerned parties. Also, the system can provide insight into the health conditions of a monitored person, so the necessary help can be provided as early as possible, thus saving lives. On the other hand, applications of IoT in healthcare can be designed to help in the monitoring, early detection, prevention, and treatment of several illnesses. This includes diabetes, heart disease, cancer, seizures, and pulmonary diseases, among others. Such diseases usually require constant monitoring of body actions. So the person needs to be under a constant watch. Traditionally, the medical practitioners and healthcare professionals are responsible for the constant monitoring of patients. However, patients' monitoring is costly and not as effective as it ought to be. For instance, the doctor is not capable of constantly watching over one patient with undivided attention. An example of how the IoT can improve patients' monitoring is the integration of Body Sensor Networks (BSN) with other IoT health systems.

Intelligent Healthcare

The US healthcare system is often regarded as a complex, fragmented, and imbalanced system in the world, providing high-quality care to patients with advanced technological innovations and healthcare services, while accessible to only those who could afford such services with the high cost of care [8]. Thanks to the implementation of the Affordable Care Act, all Americans can at least give access to the basic healthcare service, which is considered as a significant progress in the history of healthcare reforms in the United States. No doubt, technological innovations, medical advancements, market conditions, use and analysis of electronic medical records (EMRs) and big data in clinical decision making, adoption of cloud computing, application of comparative effectiveness requirements for medicines, and evidence-based medicine have potentially created a convergent force that is effectively transforming healthcare. In particular, the healthcare industry has seen significant changes in how clinical decisions are being made using actionable intelligence with the integration of various technological advancements to provide real-time solutions to specific patients in a timely manner. The ability to analyze clinical and cost data across all settings of care is essential for the future clinical and financial success of the healthcare industry.

Actionable intelligence is derived from raw healthcare data though collection, integration, analysis, and decision making that results in the desired response when acted upon. The implementation of electronic health records has resulted in a rapid accumulation of data. Healthcare organizations can use business intelligence (BI) technologies to leverage the data and improve operational and clinical efficiency. The healthcare industry is now realizing that a BI framework yields meaningful and actionable knowledge about opportunities for improvement. BI supports evidence-based clinical decision making and assists the search for clinical evidence to support diagnoses, care plans development, and outcomes evaluation for patients. The demand for transformational changes in the healthcare industry motivates many hospitals and networks to adopt a healthcare analytics approach to ensure their survival and growth that requires investment in information technology (IT) for healthcare analytics. Healthcare advanced analytics uncovers trends, waste in terms of staff time and so on, and standardization of practice to reduce variability and other actionable insights; saves time; supports informed decision making; enables negotiations for greater savings both within and outside the department; and identifies utilization changes for improved quality of care. The shift to a healthcare analytics culture can reduce data silos and data ownership issues, creates an atmosphere of curiosity and collaboration, and finally allows organizations to see beyond what has already happened and begin to forecast what might happen next.

Clinical Prediction Models

Clinical prediction models have existed for decades, but they are just now attracting a wider interest in medicine [9]. Given the complexity and abundance of clinical information, the limited ability of clinicians to accurately prognosticate outcomes, and the plethora of prediction problems that clinicians face daily, it is not surprising that there is a growing interest in the field of prediction research. Unfortunately, while many models have been developed, few are appropriately validated, and almost none are routinely used in clinical practice. This paradigm will likely change drastically in the next few years given the intersection of four major forces:

a) the growing complexity and cost of patient care.

b) the advent of Big Data in medicine.

c) the adoption of machine learning methodology in biomedical research, and

d) the development of the digital infrastructure in healthcare.

The convergence of biomedical Big Data (as the fuel), machine learning (as the engine), and prediction research (as the scientific framework) is defined as predictive analytics in medicine. Biomedical Big Data refers to the thousands of petabytes of data being generated by electronic medical records (EMRs), biomedical "multiomics" data, physiologic signals, medical images, financial transactions, hospital operations, and so on, much of which is being captured and stored electronically. Machine learning overlaps with other constructs, such as artificial intelligence and data mining, and is defined as the science of how computers learn from data. Machine learning, in turn, falls under the auspices of data science, which is the scientific discipline that brings together computer science, statistics, informatics, and domain expertise to gain knowledge and insight from large amounts of complex data.

If there were one phrase that could be used to describe the current status of e-health care system evolution, it would be e-health paradigm shift [10]. Hospitals have been downsizing, reducing staff and closing hospital beds. Fiscal economics is playing a key role as governments scrutinize funding for health care services and delivery. New forms of alliances among health providers have also emerged, and new modalities of health service delivery have proliferated. The Internet has played an important role in many of these changes. Patients are becoming empowered e-consumers, demanding greater responsibility and accountability from their health care professionals. Health providers are challenged to go on-line. Even attitudes and views of health are changing, recognizing the value of e-health business alternatives and possibilities in terms of healing modalities, e-medicine, e-preventive care, e-health promotion, e-home care, and e-holistic medicine. Thus the evolving e-health care system is a dynamic entity that is being continually shaped by economic, political, technological, and social forces. In this book, the topic of e-health is not seen to exist in a vacuum but framed within this dynamic e-health paradigm shift.

Legal Chalenges

The possibilities that exist for using technology in healthcare, both within the borders of nation states and across groups of states, such as the EU, have given rise to many legal concerns and challenges [11]. These legal concerns and challenges are considerable, and relate to many different aspects of implementing and managing eHealth. They arise in many contexts, including: implementing ICT in a clinical setting; providing and managing eHealth in organisations; providing medical products and services across borders; and developing policy decisions for eHealth that have regional, national, or international legal implications. In many cases, existing national and supranational legislation do not adequately address concerns related to recent forms of technology use, and new capabilities offered by technology (e.g., the use of EHRs). In other areas, such as the application of electronic commerce in healthcare (e.g., telemedicine), there is a need to ascertain how existing laws can be properly applied and harmonised especially to facilitate cross-border activities. The widespread application of information technology (IT) as an enabler of economic and social development in the EU, including in public health, has meant that there is a need for greater legal clarity and harmonisation of laws related to eHealth. The first area is data protection and privacy laws, in light of the increased collection and sharing of patient data. The second is laws on liability for goods and services when using eHealth tools. The third is trade and competition laws which face the nascent emergence of the eHealth industry.

Future

Nevertheless, the application of modern technologies opens a wide range of possibilities, unthinkable up to a few years ago, that cannot be missed [12]. As we have seen many are the benefits that could come from eHealth, and many are the actors that could take advantage from its implementation, being the improvement of wellbeing and of quality of life as the final targets of this process. But because these challenges that lie inside eHealth, only a scientific approach could help to individuate the better strategy to put into action. Besides, it is not different from what medicine has done so far: why a commercial or enterprise model (mainly designed to solve specific and isolated problem) should be used, when is the complexity of the human being we are dealing with? Scientific evidences, based on verifiable data, are needed; evidences that have to be submitted for peer revision to the scientific community. In such cases where a process cannot be completed, the use of logical thought is paramount. Besides, the viewpoint of experts, who are able to exploit the experience achieved ''on the field,'' have to be considered, although the creation of lobbies able to influence the decisions with unproven dogmas and dictates is not acceptable. In contrast, strategies that come from governments, directive bodies, and enterprises are likely to bring rules and models that simply do not apply to health care. This approach in fact often considers only the commercial, administrative, and economical sides of the problem. The missed opportunity would be the misunderstanding of the real and perceived needs of the populations and of single patients. Moreover, it brings about the definition of false priorities that could give a measurable benefit at the beginning but that are bound to take the project to its failure once the economic boost is exhausted.

Conclusion

One of the most current trends in healthcare in this moment is digital health. Digital health represents a wide range of technologies including mobile health, health information technology, telehealth, telemedicine services, and personalized medicine. This means that we are facing a radical change in health care as we know it. And it presents a great opportunity for investors. Electronic companies offer a wide range of services and products in their product programs: from stand-alone systems for specific health services such as patient administrative data management, electronic health records, e-referrals and e-prescriptions to comprehensive and integrated healthcare information systems applications such as hospital information system and remote patient monitoring system.

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