Innovation, Application, and Trend Analysis of Digital Health in The Era of Big Data

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Abstract. Recent years have witnessed a dramatically technological boom in various realms. Big data is one of the cutting-edge advancements which are driving enterprises to make reformation and innovation. Especially, as a powerful tool to support and analyze the ceaseless new data surging from the Internet, big data is the key to help the traditional medical system make a huge breakthrough. This article is to give a brief overview of digital technology and medical evolution by analyzing the current system and application cases, including clinical support, personalized health and digitalization of medical information. Based on substantial data, the paper also shows the algorithm and the helpful predictive modeling technique for some special medical utilization. Furthermore, this paper summarizes the limitation of existing digital healthcare and claims its enormous promise. It reveals that this new model of healthcare is a new trend with the advent of digital times and then concludes that it will become an indispensable topic in the coming future.

Keywords: big data, medical system, tendency, digital health, innovation

1. Introduction

The traditional healthcare system has been applied for so many years. Even though the government of countries takes responsibility to grapple with the livelihood problems through their different institutional guarantee, the internal and external situations all over the world tend to be the same. Actually, when it comes to the allocation of medical resources, the efficiency of medical services, the management of patients' information and some other problems people may concern about, no one nation or institution could address these issues well. Even though it seems that there is an increasing number of people who come to realize the benefits of online medical services, the real advantage of big data that contributes to healthcare is often ignored.

Through document analysis, this paper not only explains the conception of these two nouns—Big data and Digital Health separately, but the real content of this promising technique and its constructive significance for nowadays medicalization. The main body part also adopts the method of case study and data analysis to help the readers to be acquainted with the concrete applications of digitization of medical information, development of medical supplies and clinical trials. Under the shadow of global infections, industries are mushrooming around the world and making immediate changes to the inner medical system. This paper is going to help those institutions or individuals to have a sense of what is happening at the moment and to raise their consciousness of the proliferation of big data in medical health so as to augment the productivity of the whole society.

2. The new healthcare based on big data

2.1. The Era of big data

Technological innovations and advances have been updated, followed by a large amount of data coming from all over the world. Big data then turned out as an umbrella term to cover a range of data, technologies and applications[1]. It brings about a change in our perception of a rush of data that carries the basic information. It is not only a random sample anymore but an analysis of the whole group so as to decide the developing direction of the future and to figure out the relationship between different things. McKinsey pointed out that based on the big data, enterprises and institutes could produce their values by different measures, such as discovering the demands of their target clients and making a point of the customization for special individuals, etc[2].

2.2. The conception and property of digital health

Digital health is the production of highly developed technology, using the power of cloud computing, AI, big data and others to create a medical information platform for cures, health records, biomedical research and so on[3]. To figure out what exactly this new type of medical system represents, it is inevitable to claim the difference between digital healthcare and the old one.

After hundreds of years of fatigued and weak diagnostic tools and treatments, the medical system finally flourished at the beginning of the last century. However, it soon became apparent that the commercial forces were making the medication more business-like. As the matter of fact, the companies emphasized the importance of some ordinary illnesses and made them more severe for the patients to maximize their own benefits. The medical treatment and sanitation system were still at a low level due to the affordability of the public. Because of the transition to this newly established system, people may have the opportunity to reach medical information with transparency.

Except for the individuals, the development of digital health also works on commercial property. For the sake of their competitive strength, some of the powerful companies would also focus on coming up with new techniques or providing more personal services for each instead of forcing their customers to choose things that they do not need. The medicine market is such a huge global industry that benefits and conflicts are always cofigurative. The competition under this new trend would ultimately boost the system itself.

Furthermore, Deborah Lupton showed more thoughts on different prospects for digital health in her report[4]. Since it had already been applied to the daily analysis and treatment, its political, cultural and other social functions should be taken into consideration.

3. The applications of digital health

3.1. Data Support for Medical Research

3.1.1. The clinical trials. Even though big data means much more than data analysis, it is the basic application in medication, especially in clinical trials. Hetanshi and her team mentioned an important pharmacogenetic trial that has applied, to a great extent, to digital health. For these cases, one of the difficulties is that it is rather complicated to follow the procedures. What else is highlighted is to provide a large number of samples and to make sure diversity. All of these plights would make the clinical trial design and operation more of complexity[5]. Fortunately, digital health could be used to ease the burdens of the medical personnel and the patients.

In common sense, clinical trials are fair enough to assess the sanitation system and medical availability. However, as mentioned above, it is usually hard to achieve as it costs much to conduct[6]. There was another research aimed to carry out a psychological analysis using digital health interventions (DHIs), reported by Chris Hollis and his team[7]. The DHIs take the advantage of many advanced techniques, seemingly bettering the popularization and efficiency of itself. Apparently, the therapists often adopt digital tools as adjuvant treatment, for instance, the computer and some applications

software, which strongly arouses the immediate interest and desire for exploration of the young. These assisted therapies then work so well and so appear to be very meaningful and promising compared with traditional medical treatment. It might be biased since the targets are much more made of children and young people. The public may be concerned about the actual role of DHIs and see the optimal results as the patient's subjective feelings. While in another case, the traditional way to describe the symptoms is exactly more subjective. As in Leonard Sacks and Elizabeth Kunkoski's research, digital health technology could be really useful in analyzing the pattern of the movement of patients with Parkinson's disease [8]. In contrast, digital medication gives a more intuitive and systematic clinical manifestation for the PDs.

3.1.2. The communication of information and Self-monitoring measures. The medical information of each person could be shared with the doctors if it is permitted. Being out of the paper form, the admission records, examination reports or medical images could be reached anywhere in no time. In that case, the doctors could give a relatively rigorous judgement and minimize the possibility of misdiagnosis.

In view of contemporary trends and modern lifestyles, keeping in a good shape and self-diagnosing with some small problems become increasingly popular among the young. Most of the communities in some developed countries have set up a professional platform online for people to record their body datasets such as the BMI index, the past medical history or their allergy information, urging them to monitor their own physical state. The implementation must be done by the inter-connected technology in the information age.

Telemedicine, as one application of digital health, is an integrated medical system using computer technologies through which doctors and patients could contact and solve some basic problems without the form face-to-face[9]. Different doctors from places could share the information and provide the best scheme together. This can not only reduce the workload of each expert but also save the cost for the clients.

3.2. Specialized Development for Medication

3.2.1. Database for special diseases and predictive models. This paper talked about the basic and widely-used applications of digital health which had been a hot topic since its emergence. However, it is more attractive when it comes to the more powerful function of digital health. The clinical prediction models, which are apparently based on digital technologies, often use the appeared characteristics of thousands of patients to estimate a demanding probability of some special diseases[10]. The dataset is so large that it has to set up corresponding databases to systematically analyze each kind of disease and so make more specific decisions.

3.2.2. Personalized medicine treatment. Along with the improvements in people's living standards, the needs for their own specialized services also switch to a higher level. According to the traditional medication, the doctors would roughly classify the patients into one or two diseases and make the same medical treatment plan for patients who have similar symptoms. However, people are differently made up by genes. It is not possible that the drugs or medical treatments for one person who recovers from a cyst happen to be effective for another. In that way, digital health could use the past dataset and make use of big data and AI techniques to provide a new treatment for every single patient. Including developing medical supplies and new therapies, digital health is dramatically improving the life quality of people.

3.3. The age of digital insurance

As one of the important expenditures for families, medical insurance is always a necessity. For those enterprises, the models of marketing should experience a huge revolution. In fact, the applications of medical insurance in the big data era has been existing for nearly a decade, including the monitoring of

medical services and settlement policy optimization. In 2020, G. Kostikidis and his team did research on the citizens' perceptions of electronic Health Insurance records (EHIR)[11]. It ultimately suggested that most people who had been interviewed showed an optimistic attitude toward EHIR and expressed their concerns about security.

4. The current stage and future tendency of digital health

4.1. COVID-19 is a significant turning point

The debate has never been reconciled on the solution to COVID-19. In this case, the pandemic really needs a coordinated mechanism to make things under control[11]. Digital health is highly adapted to this suffocating situation as it already showed its potential earlier this century. For example, telemedicine keeps the public away from the danger of infection. Many applications on smartphones also carry a lot to reach to digital healthcare for people at the same time. More precisely, the application of the health code is a whole new noun but is rooted in people's life. In all, different countries' situations may vary, while digital transitions for medication have never been so fast.

4.2. The challenges and opportunities

Just like anything else, the development of digital health would not have a free ride. As a global business, health is a historic question that deserves the attention of all human beings. The essence of medication is a highly skilled tool and so people tend to rely on it[12]. But the inequality always exists so the conflicts would never disappear. The most direct and urgent challenge is to actualize a well-organized system to reasonably allocate the resources. Secondly, it is necessary to set up a normative mechanism to monitor the order as the face-to-face model. Popularizing the conceptions of digital health, completing the online platform and ensuring the safety of information are not all measures to take. However, even if every path of innovation needs to be continuously justified, the trend of digital health is almost clear. With this promotion of the big circumstances, the answer to reshaping health care through digital technology should be found in exploration.

5. Conclusion

In this paper, the specific conception and some symbolic characteristics of digital health are explicated with examples of its applications in data supporting and medical development. It also explains the significance of this new type of medication and suggests its prospective future based on the current situation. The idea that making use of information technology to improve the health of individuals and all human beings appears to be convergent. It is a truth that the applied model of telemedicine and the digitalization of health information is promoting both the institutions and the individuals' perceptions, greatly contributing to the evolution of health systems for enterprises and to the well-being of people's life. From another perspective, the implementation of digital health could be a sensitive issue when the benefits of industries and the safety of patients are considered. This leads to another plight that the medical institutions would like to pursue their maximized profit, causing injustice between patients. It is also difficult for the whole public to form an established digital healthcare system due to the circumscribed technology and financial foundation. Therefore, the medical system based on big data still needs to be completed for all.

This paper is more based on the documents and theoretical analysis as it is not realistic to visit the relative enterprises and individuals to ask what they do and think about digital health. It could be more convincing if the method of survey analysis is adopted. Except for the content mentioned above, the popularity of medical treatment based on big data remains to be discussed. Obviously, the developing level varies between countries, and, in a single nation, the internal difference between cities and remote areas can not be ignored. It is worthy to explore afterward.

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