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Review Article

ROLE OF ARTIFICIAL INTELLIGENCE IN PHARMACEUTICAL MARKETING: A COMPREHENSIVE REVIEW

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ABSTRACT

Artificial Intelligence is the field of study that describes the capability of machine learning just like humans and the ability to respond to certain behaviors. The need for Artificial Intelligence is increasing every day. It is being used in different domains of the healthcare sector like medical screening and diagnostics, medical devices, drug development, and other aspects of the Pharmaceutical value chain. This paper focuses on the role of Artificial Intelligence and advanced analytics in the Pharmaceutical marketing and commercialization process. Also, the growth and future scope of AI, as well as the limitations that companies have been facing in the application of AI, have been discussed.

Keywords: Artificial Intelligence, Analytics, Digitalization, Pharmaceutical Marketing

1. INTRODUCTION

Artificial intelligence [AI] is the replication of human intellect processes by machines, especially computer systems. These processes include knowledge [the accession of information and rules for using the information], reasoning [using rules to reach out to possible conclusions], and self-correction. Artificial Intelligence was first defined by John McCarthy who worked in the Computer Science Department of Stanford University. He founded the term in 1955, and he defined it as "the science and engineering of making brilliant and quick-witted machines [1]". The field was built on the claim that a central characteristic of human beings, intelligence can be so accurately described that it can be replicated by a machine. This paper discusses the current practices of artificial intelligence in the pharmaceutical field and also discusses its future scope and its limitations.

Artificial Intelligence is a branch of computer science [2]. There are several definitions of Artificial Intelligence. Wikipedia defines AI,sometimes which is called machine intelligence, is intelligence shown by machines, contrary to the natural intelligence displayed by humans and animals" [3]**.** As per SAS analytics "Artificial intelligence [AI] makes it possible for machines to learn from experience, adjust to new inputs, and perform human-like tasks [4]".

So if we were to understand what artificial intelligence is? It is concerned with a particular set of behavior that depicts intelligence [5]. These are the programs that help the computer to respond in ways, that help human seems intelligent. Such processes or systems are called an artificially intelligent system [6]. It has emerged into consciousness as new technology. Artificial intelligence at its core meaning is a branch of computer science that helps understand and develop intelligent entities, often named software programs.

Alan Turing, a British mathematician, was one of the founders of modern computer sciences in the late 1950s.Turing defined intelligent behavior in computers in the middle of the last century; along with other researchers he explored the applications of such intelligent techniques in every aspect of healthcare and medicine domain [7-8].

Artificial intelligence includes natural language processing, computer vision, chatbots, intelligent agents, machine learning, and voice recognition. From finance to Healthcare, from medical imaging to diagnostics, artificial intelligence is being used in almost every domain.

2. USE OF AI IN HEALTHCARE AND PHARMA INDUSTRY

Artificial Intelligence is being used in the healthcare sector and is changing the way healthcare and biomedical research. It can be seen as a collection of technologies that facilitates machines to sense, perceive, interpret, and generate results so that they can perform administrative and clinical healthcare tasks. Also, it aids in research and

for training purposes [9-11]. There are artificial intelligence systems that are designed to assist healthcare employees in their everyday work, duties, and tasks that utilize the knowledge generated through analysis of data. Such systems are fuzzy expert systems, artificial neural networks (ANNs), evolutionary computation, and hybrid intelligent systems [6]. Artificial intelligence can help in avoiding biases that arise from physician cognition such as "Recency bias" in which the physician is more likely to follow the same course of treatment for the next patient as done for a patient treated prior [11,12].

Machine learning which a subset of Artificial intelligence, can be utilized to address the problem of reporting e-health records and redirect these records towards predictive modeling and analysis. With the help of artificial knowledge, we can mix an individual's – omic [proteome, metabolome, microbiome, and genome] data and it can be merged with his/her e-healthcare record to predict the probability of developing a certain disease, which can then be addressed with help of preventative therapy [11, 13].

Seven major factors are enabling the adoption of artificial intelligence and machine learning in healthcare. First is the digitalization of patient history records and data sharing. Second is the robustness of digital mapping over human interactivity. The third is the adaptability and ease to evaluate heterogeneous data sets. Fourth is its power to streamline clinical working and accredit patients. The fifth is the capability of AI for hypothesis development in research. The sixth factor is the open sharing and deep learning programs and the seventh factor is the capability of AI to improve results even in the presence of huge data sets [14].

A lot of attention in the Pharma industry is being given to the digital transformation of the complete pharma value chain starting from R&D, manufacturing, supply chain management, sales, and marketing to patient care as shown in figure 1. The digital uprising is allowing new models of partnership in research and competence in operations to generate "beyond the pill" solutions to handle the medical conditions of patients and consumers in a better way. Electronic Medical Record data can be used for making smart assessments and interpretation and by using AI algorithms important judgments can be made. Healthcare IoT devices play an important role as they can feed data into patient treatment plans and patient records and also into large AI-driven healthcare analytics systems and they are important in this modern period of healthcare [15].

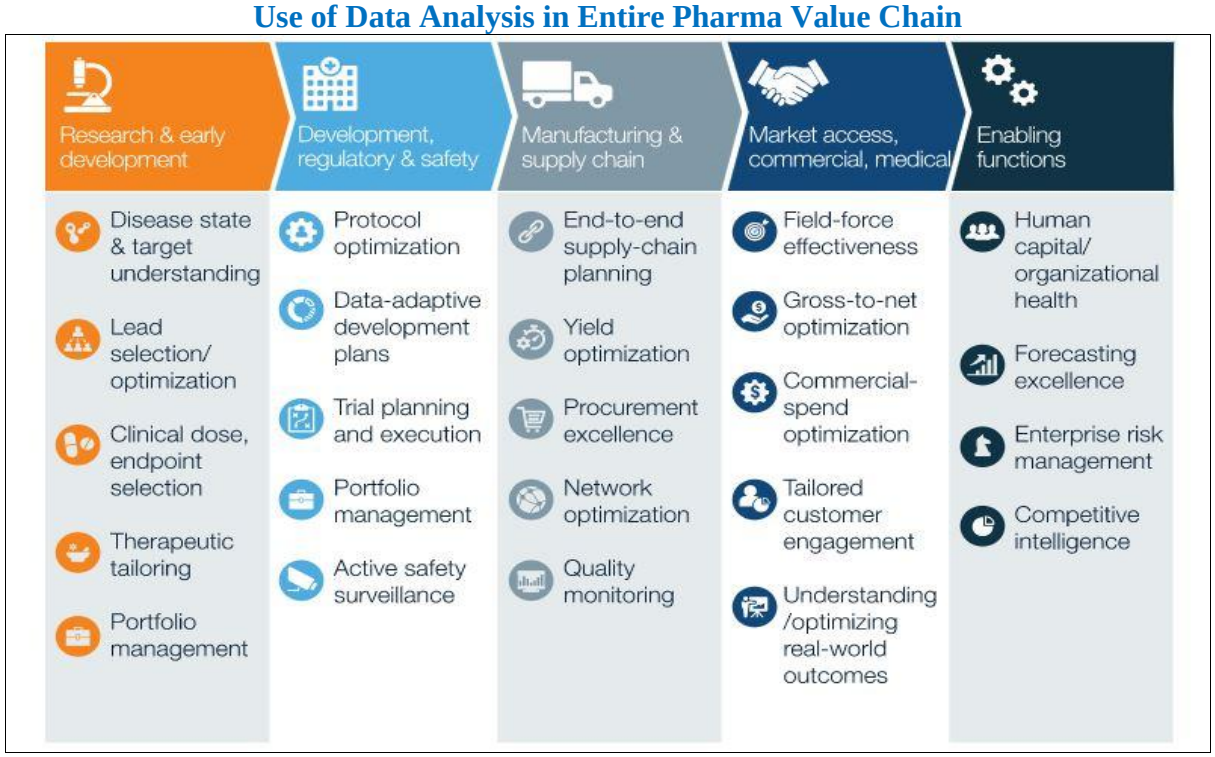

Fig. 1: Use of data analysis in the Entire Pharma value chain, Mckinsey.com,January 2018.

3. USE OF ARTIFICIAL INTELLIGENCE IN PHARMACEUTICAL MARKETING

The process of promoting the sales of a company product and services is called marketing [16].

As per an interview with, Jon Resnick, President, Real-World & Analytics Solutions, IQVIA, he stated that "Machine learning and artificial intelligence allows global life science sales, marketing and branding team to come up with more profitable and actionable commercialization strategies from the insights uncovered from AI". He also emphasized on the fact that AI/ML enables healthcare companies to dive deeper into granular layers of HCP, patient, and payer data to reveal previously untapped insights, show predictions on which actions can be taken, and enable better and faster decision-making" [17].

Fig. 2: Spotlight on AI in pharma marketing, pharmaphorum.com

The use of artificial intelligence systems in pharma offers additional advantages such as enhanced value proposition, optimal resource allocation for better market share gain, ability to maximize growth, customized sales, and marketing information, and channels [advanced analytics for pharma marketing efficiency and growth.]. Companies such as Google and IBM and some other companies are starting up to specialize in harnessing AI in disease diagnosis. India is employing predictive and descriptive artificial intelligence. Also in India, the companies involved in developing medical equipment and supplies are using descriptive and predictive artificial intelligence [8].

A Top US Pharmaceutical company used physician level-intelligence explored by optimizing multichannel marketing activity data to increase promotional strategy and its implementation. With the help of distinctive targeting, segmentation, and promotional campaigning plan they tried to optimize return on investment. There was a gradual increase in sales of about $25 million in six months without having to increase in its marketing expenditure.

In another case study, a Europe based pharmaceutical company employed AI and machine learning to know the HCP's preferences regarding digital engagement. The new insights helped the company to segment doctors and generate a digital engagement strategy as per knowledge collected from a physician. It showed an increased rate in the opening of emails sent to HCP and requests for more product details.

This use and acceptance of AI can be seen at different places across the healthcare network. Artificial intelligence can help to study a person's genome to recommend the most effective treatment option with fewer side effects[18].Artificial intelligence is being adopted globally by various businesses including the healthcare and pharmaceutical industry. Implementation of AI can help improve commercialization strategies from patient adherence to a sales call and to help find out ways to make better-informed, quicker decisions along the path from molecule to market. There are various pharmaceutical companies like Pfizer, GSK, Novartis, Lundbeck, Takeda, AstraZeneca, and Teva are employing artificial intelligence to improve marketing efforts for existing and new products. A Report by Eularis stated that the implementation of sales messages customized with the help of Artificial intelligence analytics has shown an increase in prescribing by 43% forsales representatives who used those insights as compared to those who did

not. JLABS' Dr. Merton, stated that "AI will be able to better process stakeholder aligned information to the customer enabling more targeted dissemination of information to the customer." He also stated that marketing costs should decline soon [17].

Bjarni-Kornbech, VP, Marketing & Communications at Agnitio stated that the desire of physicians for greater online engagement is a proven fact now. He also stated that the rapidly growing channel is the remote channel. A survey done by eyeforpharma revealed that one major constraint that holds back marketers from adopting the new technology is the ability to demonstrate the value and return on investment on the technology adopted. It is needed that the sales team should be trained to use CRM systems. However, very few companies are putting in the effort to train their sales team in this manner. Bjarni-Kornbech also stated that In his experience, to add real value it is required to tie customer engagement data into the CRM and ideally also couple the data from the marketing engine. After that, it is needed to make all that available to the field force in one place [19].

Earlier and even in today's time, marketing and sales teams send out numerous messages to physicians across various channels who was likely to write their product. The technique was unproductive for the marketing of a product and it leads to overutilization of financial and human resources. By the use of analytics, machine learning in commercial applications helped create a more sophisticated and well-inclined brand strategy and sales approach. Health care providers are now getting more driven towards digital ventures that support healthcare. Around 70% of Physicians are now alpha geek. Pharma sales must adapt according to the changing needs and desires of physicians. Doctors now are tailing off face to face interaction with medical representatives and at the same time, they are getting more inclined towards online solutions

Machine learning can be used by brand teams to make most out of such brief meetings, by analyzing every customer's preferred mode of communication, for example, call, text, email, webinar, face to face meeting, etc. as well as it could also be determined to what tone they will respond. Machine learning and analytics provide brand teams with the power to deploy more targeted multi-channel marketing campaigns so that they can engage more in digital mode [20].

4. WHY AI?

In the past years, Pharma data has increased enormously. It is now generating in the form of petabytes due to improvement in devices like sensors, image capturing devices, mobile phones, genome data collection, e-consultation, etc. [21]. Now the pharmaceutical industry is not only about being a drug development agency, it now includes a conglomeration of various disciplines like academicians, mathematicians, business intelligence, and research & development. The data generated by the pharma industry is unstructured. It may contain data related to patient prescriptions, medical image reports, doctor notes, history, and many more. The patient history is considered and evaluated at 360 degrees and then his treatment is planned. To handle all such unstructured data [21, 22] the assistance of many analytical tools and methods is required. Such tools can be used for data processing, data extraction, and visualization [23].There are many open-source tools for handling pharma data and these open source tools have their advantages and limitations. There is a gap between data collection and processing and that needs to be solved [24]. Healthcare due to the increasing number of patients faces a lot of information overload. By using machine learning the overwhelming volumes of patient data can be utilized for evidence-based practice [25].

With the evolution in marketing strategies and technologies at a global level in over last decade,the pharmaceutical industry has also developed in a way similar to other profit-driven industries. This industry too is untouched to maximize profits. Pharmaceutical marketers engage with a healthcare professional at a large scale [26, 27] and often it is difficult for pharma marketers to engage with them. They engage in with the help of multi-million dollar marketing campaigns and they utilize all the methods of promotion.A lot of money is spent by pharma companies not only on developing and protecting their brand but also to compete with their components drug at an international level. Various studies [28-30] showed that the tendency of doctors to write a drug and their receipt of goodies /gifts/non-related payments, etc. are strongly correlated. Some other studies [31-33] brought out the impact of gifts have on physicians prescribing practice.

5. GROWTH OF AI/ML/E-HEALTH MARKET

It is estimated that the worldwide eHealth market will reach USD 308.0 billion by 2022, as reported by Grand view research Inc. The transition of the healthcare industry into the digital healthcare system for the analysis and management of the patient is expected to be the key driver of the market [34]. In outer countries especially in

Europe, the European Commission has launched an eHealth action plan 2012-2020, that is providing a path to empower health workers and patients to link up devices and technologies. It also suggests investing in research to develop personalized medicine.

According to a report from Accenture's Technology vision 2017, it states that annual economic growth can rise to its twice by 2035 with the help of AI .

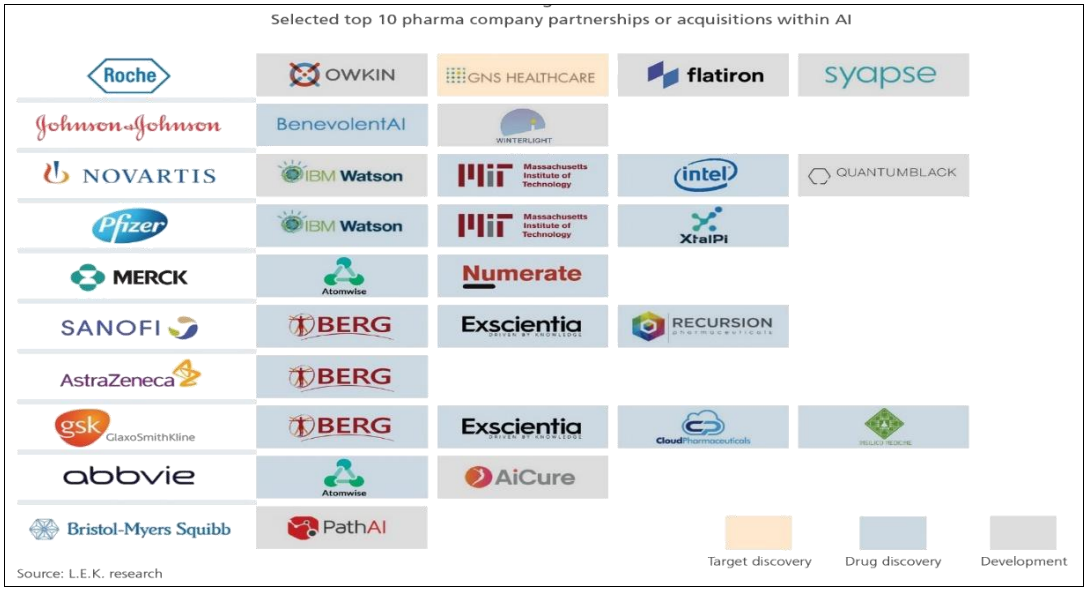

Fig. 3: Selected Top 10 Pharma Companies Partnerships or Acquisitions within AI, L.E.K. Research

6. LIMITATIONS OF ARTIFICIAL INTELLIGENCE

Empathy and compassion are two human qualities that are lacking in machines and therefore patients should know and understand that digital consultants are being led by human physicians only. Also, it should not be expected from the patient that they will trust AI immediately, as it is a technology that is wrapped by enveloped of mistrust [37, 38]. That's why artificial intelligence is mostly employed to handle routine tasks and that leaves the prime responsibility of patient care with the human physician only. Back in 2008, google attempted to predict the seasonal frequency of influenza by using only keywords or trending search terms into its search engine. A Person's search habit changes significantly with each year, that model was so poorly designed that it failed to deliver the future predictions and thus it was quickly discontinued [37, 39]. Artificial intelligent technologies are catching eyes in medical research however its real-life implementation is facing various hurdles. The first obstacle comes from the aspect of the regulation. Present-day regulations lack standards that can measure the safety and success of AI systems. To surpass this difficulty, US FDA tried to provide a guideline for evaluating AI systems [40, 41]. The first guideline distinguished the AI systems to be the "General Wellness Product". The second guideline justified making use of real-world data to evaluate the efficiency of AI systems and the Last guideline provided the regulation for compatible designs in clinical trials and after the disclosure of policies [40, 42].

Another major obstacle is data exchange. To make AI systems run efficiently, it is required to train them continuously by data input from clinical studies. However, once they have been trained with all the historical data, it is required to keep adding such data into the systems for further improvement and development of the system [40, 43]. Another challenge for using Artificial intelligence will be that it should be transparent and in harmony with the public interest while driving and stimulating invention in the sector [44].

Chatbots are functional for some time now. Many consumers know that talking to chatbots means communicating with a computer which leaves them with a sense of being neglected and not being taken seriously by the company. Such chatbots should only be used in case if the audience will acknowledge it positively and you have human assistance to back you up. An organization should use AI only to support their sales

team, but if it is driving a wedge between you and your customer, your strategy may backfire [45].

Artificial intelligence is heterogeneous and it takes certain considerable efforts in its implementation. Also,the majority of marketing academics are not skilled and trained to understand the concepts and theories of machine learning and artificial intelligence. The main use of AI in marketing until now are neural nets, expert systems, and case-based reasoning [46]. Artificial intelligence is seen to be having a short term impact on pharmaceutical marketing and sales practice as well as long term effects on the marketing scenario.

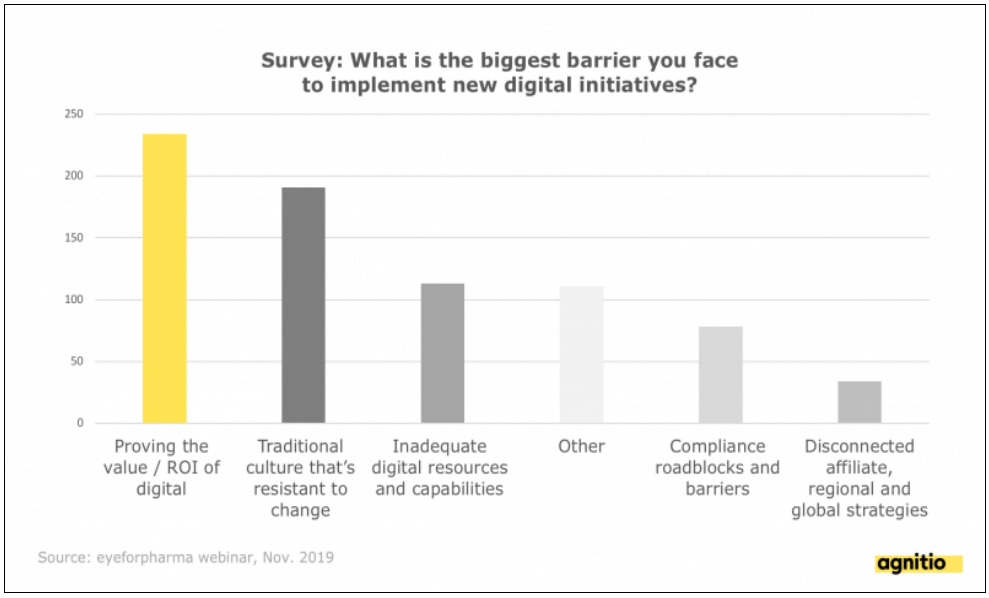

Fig. 4: Eyeforpharma webinar, Nov. 2019

7. FUTURE SCOPE OF ARTIFICIAL INTELLIGENCE IN PHARMA MARKETING

The use of computer science whether or not it's the sector of medication, production, R & D, or sales, employment is growing fleetly. Healthcare AI projects in 2016 received more funding than any other AI project in any other domain [47].However, among the thrill, there is a lack of conviction due to some failed expectations [48].

Artificial intelligence has shown capability in evaluating various types of image data involving radiographs [49], retinal scans [50], and ultrasounds [48]. A large number of such pictures can be captured economically because of AI. Combining these systems with clinical practice helps in building a requited relationship between clinicians and artificial intelligent systems. They both work better when they work together.

The worldwide pharmaceutical industry spends a fortune in the R&D sector. As per a recent survey by Global Data, revealed that artificial intelligence can be seen at the forefront in improving productivity and effectiveness of R&D. The survey also brought out the fact that AI and big data can distort and transform the pharma organizations in the coming next two years [51].

Day by day Artificial intelligence is becoming more functional in improving the techniques of marketing.By employing AI, a company can chart the journey the customer goes through. This will enable the organization to identify the customers individually and enroll them for their marketing campaign [52]. It is likely that that in future AI systems will become more evolved and advanced and will be capable of carrying out a wide variety of tasks without having human involvement [53].

8. CONCLUSION

Artificial intelligence works as a supportive function in routine tasks and provides better insights. It adds efficiency and provides marketing function with deeper insights and valid data which make the selling easier. AI offers uniformity, cost- efficiency, solve complex problems, and make a judgment and AI control data from getting lost.

Every technology comes with a set of its pros and cons; similar is the case with AI, so before implementing AI into sales, marketing, or any other aspect it should be thoroughly evaluated [45]. It should be focused that future AI research should be in line with needs and trends coming soon.

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