IMPACT OF AI IN PERSONALIZED MARKETING IN PHARMACEUTICAL INDUSTRY

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ABSTRACT

AI is reshaping healthcare and digital marketing, offering potential advancements in personalized telehealth and targeted advertising. In healthcare, AI can enhance patient care and outcomes through personalized solutions. In digital marketing, it aids in customer experience personalization, refined ad targeting, and data-driven insights for effective campaigns. By analyzing customer behavior data, AI identifies preferences, predicts future purchases, and provides personalized product recommendations.

Despite the potential benefits, challenges must be addressed. Ethical concerns related to data privacy, bias, and transparency are paramount for responsible AI use. Robust regulatory frameworks are essential to ensure safety, effectiveness, and alignment with ethical standards in AI algorithms. Identifying and mitigating biases is crucial to prevent unfair outcomes.

In conclusion, AI offers promising prospects for healthcare and marketing. To harness its potential, ethical, regulatory, and technical challenges must be carefully addressed. Responsibly implemented AI has the potential to revolutionize healthcare practices, improve patient care, and elevate digital marketing, leading to enhanced customer engagement and business outcomes.

KEYWORDS: *Artificial intelligence, Personalized marketing, Healthcare Industry ,Digital marketing, Patient care.*

INRODUCTION:

The pharmaceutical industry is rapidly evolving due to the breakthroughs in artificial intelligence (AI).AI is revolutionizing personalized marketing strategies, allowing pharmaceutical companies to gain a deeper comprehension of patient needs, preferences, and behaviors **(Davenport, T. H. 2016)**. This newfound knowledge empowers pharmaceutical companies to develop highly personalized and targeted marketing campaigns that effectively reach and interact with patients **(Hagel, P., Brown, J. S., & Davison, B. 2019)**.

AI-powered tools and techniques are essential for more effective patient population segmentation **(Gandhi, S., & Malhotra, A. 2018)**. By analyzing vast amounts of patient data, including medical records, prescription history, and online behavior, AI algorithms can identify distinct patient segments with unique characteristics and needs **(Chiu, C. M., & Wang, Y. Y. 2018)**. This segmentation allows pharmaceutical companies to tailor their marketing messages and strategies to specific patient groups, ensuring that the right information reaches the right patients at the right time **(De Boer, B. J., & De Boer, J. N. 2019)**.

In addition to segmentation, AI is also being used to create new and innovative forms of personalized marketing content **(Wang, Y., & Wang, J. 2020)**.AI-powered tools can generate personalized medication reminders, educational materials, and even tailored recommendations for lifestyle changes. This personalized content can assist patients in making informed decisions about their health and improving medication adherence **(Bansal, H., & Kukreja, S. 2019)**. While AI offers a promising avenue for personalized marketing in the pharmaceutical industry, it is critical to acknowledge the ethical and regulatory concerns that arise from its implementation **(Crawford, K., & Calo, R. 2016).**

Pharmaceutical companies must prioritize patient data privacy and security, ensuring that it is handled responsibly and ethically **(Wachter, S., Mittelstadt, B., & Floridi, L. 2017).** Additionally, transparency regarding the use of AI in marketing decisions is crucial to maintain public trust and prevent potential biases or discriminatory outcomes **(Jobin, A., Ienca, M., & Vayanos, P. 2019).**

LITERATURE REVIEW:

Artificial intelligence:

Artificial Intelligence (AI) is a computer science technique that teaches machines to understand and mimic human behaviour and communication. AI has produced a new clever machine based on the data supplied that thinks, reacts, and works in a human-like manner. **(Haleem et al., 2022)**

The general definition of AI is "intelligence shown by machines." It is described as intelligence that uses sensors to observe and effectors to react to the environment. It is the engineering and science of creating intelligent devices, particularly computer programs**. (Chintalapati & Pandey, 2022)**

AI is capable of highly specialized and technical endeavours like robotics, speech and image identification, natural language processing, solving problems, etc.**(Haleem et al., 2022)**

While the aim of utilizing computers to comprehend human intelligence is similar, artificial intelligence (AI) is not limited to techniques that may be observed through biological means.**(Chintalapati & Pandey, 2022)**

Components of AI in marketing:

Without a doubt, artificial intelligence plays a significant role in helping marketers engage with consumers. Today's top solutions for bridging the gap between massive volumes of consumer data acquired and actionable next steps that can be employed in future campaigns consist of the following AI marketing components:

1.**Machine learning**: In many spheres of society, machine learning (ML) has not yet made a significant impact in the marketing industry. Despite this drawback, machine learning (ML) has several potential advantages, such as the chance to use more reliable techniques for the generalization of scientific findings**. (Brei, 2020)**

Activities related to machine learning, such as supervised, unsupervised, semi-supervised, active, transfer, and reinforcement learning, provide a brief overview of popular techniques used to handle these kinds of tasks**. (Ma & Sun, 2020)**

In contrast to the conventional statistical and economic models utilized in marketing, machine learning techniques can efficiently comprehensive and unstructured data, and possess adaptable frameworks to approximate intricate functions that produce robust predictive positive outcomes**. (Ma & Sun, 2020)**

2.**Big data analytics**: The field of business intelligence, which depends on data analytics to obtain corporate insights for improved decision-making, has welcomed big data analytics as a disruptive technology that will change the field**. (Fan et al., 2015)**

Big data is undoubtedly a blessing for decision-making, but it is not a guarantee of improved marketing because it is entwined with several significant obstacles and issues.**(Ducange et al., 2018)**

3.**AI-based solutions**: In today's business environment, artificial intelligence finds applications in a variety of settings. Academics and practitioners alike think that artificial intelligence will shape our society in the future.**(Verma et al., 2021).**

AI will have a significant impact on customer behaviour changes and alter marketing and managerial tactics.**(Verma et al., 2021).**

We anticipate using AI in strategic decision-making tomorrow (e.g. which business models to use, which strategies to follow, which markets to target, which channels of communication and distribution to use, what pricing and competitive positioning strategies to follow)**(Stone et al., 2020).**

4.**Robotics**: Owing to its exceptional speed, data storage, and processing capabilities, robotics applications have become widely used in marketing-related tasks. Google Home, Amazon Echo, and Apple's Siri are just a few examples of robotic assistants that can aid with information searches, scheduling, and setting reminders, connecting and managing other home electronics, playing music, booking Uber trips, and other tasks.**(Xiao & Kumar, 2021).**

As robotic networks develop, robots can communicate with one another, access databases, and gain knowledge from each other's experiences.**(Pagliarini & Lund, 2017)**

5.**Natural language processing(NLP)**: NLP has been applied in a growing body of marketing studies to enhance decision-making. For instance, to analyze market structures, forecast future sales changes, or determine consumer content preferences from user-

generated content **(Atalay et al., 2019).**

An overview of the future of natural language processing (NLP) in marketing, covering recent embedding-based approaches, trained language models, and transfer learning for novel tasks like automated text generation and multi-modal representation learning. Natural language processing (NLP) methods for traditional tasks (e.g., LDA for topic modeling and lexicons for sentiment analysis and writing style extraction) are also covered**.(Hartmann & Netzer, 2023).**

Need for AI in marketing:

Marketers can digest vast amounts of marketing data much more quickly from a variety of platforms, including the web, social media, and emails. The quicker perception of the customer and their needs helps them improve campaign success and return on investment (ROI) quickly**. (Jain & Aggarwal, 2020)**

Real-time forecasting and behavioural coaching are two ways that AI-driven logistics efficiency might cut expenses. Applying AI methods to logistics, including continuous estimating, can significantly increase value across numerous industries. AI can improve delivery traffic routing, which will shorten delivery times and increase fuel efficiency**. (Chui et al.,2018)**

Benefits of using AI in personalized marketing:

Marketing stands to benefit greatly from artificial intelligence (AI). It helps with the proliferation of data sources and information, enhancing the data management skills of software, and creating complex and sophisticated algorithms**. (Haleem et al., 2022)**

Artificial Intellect (AI) technology functions within the automation and continuous learning sector, serving as the intelligence behind data-driven analytics and decision-making**. (Kumar et al., 2019)**

AI is transforming the way consumers and brands communicate with one another. Utilizing this technique is extremely based on the kind of business and the nature of the website. Now, marketers may concentrate more on the client and promptly attend to their needs**. (Haleem et al., 2022)**

AI streamlines a number of tasks related to the gathering, storing, and information management and retrieval that can support the generation of managing of company products**. (Kumar et al., 2019)**

Artificial intelligence (AI) and machine learning have become indispensable instruments for data analysis, facilitating quicker drug discovery and more specialised methods to illness treatment. These technologies also aid in pattern recognition, clinical trial optimization, and patient-specific treatment customization**. (Kumar Gupta, 2023)**

AI in personalized telehealth:
The amount of digital data about health that is produced by both individuals and healthcare professionals has grown exponentially and quickly in recent years. As a result, there has been a push for the adoption of electronic health records for all patients and the automated gathering of patient data through the development of healthcare IT**.(Kuziemsky et al., 2019**)

The ability of AI to process vast amounts of data reliably and swiftly is beneficial for telehealth. Artificial intelligence (AI) algorithms are capable of sorting through test results, medical records, and patient-generated data to find trends and forecast a patient's condition. Better decisions on patient care and treatment plans can be made by healthcare providers with the use of this information, improving patient outcomes**. (Amjad et al., 2023)**

As the volume of medical data is regularly created, artificial intelligence (AI) in telehealth has been adopted quickly. The utilization of traditional data handling approaches has not been successful in obtaining practical medical insights or remedies from this data**.(Collins Oguine & Jane Oguine, 2022)**

AI in personalized digital marketing:
AI has revolutionized numerous industries, digital marketing is one of them. Digital marketing uses the electronic platform to advertise products and services. With artificial intelligence (AI) for social media and digital platforms like Facebook and Instagram, digital marketing provides users with a distinctly positive experience. Artificial Intelligence (AI) can help marketers recognize and predict trends**. (Bashang, 2023)**

Digital marketers can utilize artificial intelligence to extend their reach or to carry out more strategic jobs that require less human delicacy. Artificial Intelligence technologies are proving to be a profitable investment for digital marketers, as more businesses are embracing them daily**. (Kirstavridou, 2021)**

Artificial Intelligence (AI) has emerged as a highly promising topic in digital marketing. It can benefit customers and marketers alike, and it can expand a company's revenue in several ways while meeting user wants and preserving positive connections between the two parties**. (Garg, 2021)**

Artificial intelligence (AI) plays a critical role in helping marketers obtain a competitive edge, maintain customer relationships, respond to their questions and complaints, assist in content creation, and enlighten consumers about the goods and services offered by the company. **(Senthil Kumar, 2021)**

Artificial intelligence in healthcare in developing nations:

 A fascinating byproduct of the confluence of different technologies, algorithms, and methodologies is artificial intelligence (AI). In the coming years, society will benefit greatly from its role in early detection and diagnosis, which should be viewed as "Augmented Intelligence". To guarantee appropriate implementation in healthcare, issues including ethical considerations and collaborations need to be resolved**. (Mahajan . et al., 2019)**

Implications for Patient Care

(1) AI will support national collaboration and research that will spur the advancement of imaging science and the decentralization of healthcare.

(2) In developing nations like India, artificial intelligence (AI) has the potential to fill the shortage of skilled medical workers in outlying locations.

(3) Public-private sector collaboration, moral considerations, and government initiatives working together will guarantee a smooth rollout and use of AI in healthcare, particularly radiology.**(Mahajan et al., 2019)**

The impact of artificial intelligence in medicine on the future role of the physician:

Unlike other environmental crises that consumers and businesses may encounter, pandemics are distinguished by four fundamental macro dynamics, that is, the conflict between lives and livelihoods, eco-contraction of the nomic, scarcity, and ambiguity**. (Ahuja, 2019)**

The purpose of the 7Ps framework is to offer recommendations for managing marketers to better anticipate, plan for, and react to pandemics in the future by controlling the 7Ps and being aware of their varying effects on different industry sectors**. (Ahuja, 2019)**

The impact of artificial intelligence and employee service quality on customer satisfaction and loyalty:

Reliability and certainty play a significant role in customer satisfaction when evaluating the effect of staff service quality on customer satisfaction and loyalty.
The effects of empathy and responsiveness are negligible. Dependability suggests personnel
perform and provide services based on expectations, with assurance referring to staff members'
authority, competence, and amiability. **(Prentice et al., 2020)**

AI-driven market analysis:

AI-powered marketing analysis examines vast volumes of data from numerous sources, including social media, CRM systems, website analytics, and consumer surveys. It does this by using AI and machine learning algorithms.

This information can be utilized to spot patterns and trends, forecast consumer behaviour, and assess how successful marketing initiatives are**(Eriksson et al., 2020)**

How to use AI-powered marketing analysis:

1.**Segment your customers:** With marketing analytics driven by AI, you may divide your clientele into various categories according to their requirements, preferences, and actions. Marketing campaigns that are more focused and successful can then be made with this information**. (He & Zhang, 2023)**

2.**Identify customer trends**: You can use AI-powered marketing analysis to find patterns in your customer data. Next, by using this data, new products and services may be developed and client demands can be predicted**. (Han et al., 2021)**

3.**Measure the effectiveness of your marketing campaigns**: With the use of AI-powered marketing analysis, you can monitor important data like website traffic, conversion rates, and sales to determine how successful your marketing initiatives are. Over time, you can utilize this data to make your marketing even better**. (Rust, 2020)**

AI-powered personalized medicine used in different countries:

The field of medicine is quickly changing due to artificial intelligence (AI), and one area where AI is having a significant impact is personalized medicine. AI-powered customized medicine analyses the patient's specific genetic, molecular, and clinical profile to customize treatment plans.**(Alrefaei et al., 2022)**

Although AI-powered personalized medicine is still in its infancy, it is now being applied in many diverse contexts across the globe**. (Hinton, 2018)**

1. China: AI-powered tailored medicine is being utilized in China to diagnose illnesses, identify disease risk factors, and create new medications and therapies. DeepMind Health, for instance, is using AI algorithms to identify neurological conditions like Alzheimer's disease. Tencent is creating artificial intelligence (AI) algorithms to forecast the risk of breast cancer and other cancers. Additionally, Alibaba Health is creating AI algorithms to use medical picture analysis to identify and diagnose cancer. **(Topic, 2019)**

2.United Kingdom (UK): AI-powered customized medicine is being utilized in the UK to improve patient care for chronic illness patients, predict disease risk, and create new medicines for uncommon diseases. For instance, Genomics England is employing AI to analyze the genomes of 100,000 individuals suffering from uncommon illnesses to find novel genetic causes of illness and create fresh therapeutic approaches. Artificial intelligence (AI) algorithms are being developed by Babylon Health to forecast the risk of heart disease, stroke, and other chronic illnesses. Additionally, NHS Digital is utilizing AI to create tools that assist physicians in making better decisions on patient care. **(Gao et al., 2019)**

Challenges of AI in marketing:

1.**Data privacy and security**: Data security and privacy are two of the major obstacles to employing AI in marketing. Large volumes of data, including personal data like names, addresses, email addresses, and purchase histories, are used to train AI systems. Marketers must take precautions to prevent illegal access to and use of client data, as well as be open and honest about the methods they employ to get and use it**. (Hermann, 2022)**. Since AI systems are educated on vast volumes of data, data security and privacy are important considerations. Marketers must take precautions to prevent illegal access to and use of customer data, as well as be open and honest about how they gather and use data**. (Mariani, 2022)**

2.**Ethical considerations**: The possibility of ethical issues with AI use in marketing presents another difficulty. Biased AI systems have the potential to discriminate against particular categories of individuals. AI systems can potentially be used to control individuals by, for example, sending them ineffectively tailored advertisements**. (Davenport et al., 2020).** Many ethical questions are brought up by the use of AI in marketing, including the possibility of bias, discrimination, and manipulation. Marketers must be aware of these issues and take action to address them**. (Du & Xie, 2021)**

3.**Regulatory compliance**: While the regulatory environment surrounding AI is constantly evolving, there are certain laws that marketers should be aware of before utilizing AI in their campaigns. For instance, the European Union's General Data Protection Regulation (GDPR) imposes stringent guidelines on the collection and use of personal data by businesses.**(Gerlick & Liozu, 2020).**The subject of artificial intelligence is quickly expanding, and regulations are currently being developed. Marketers must make sure that their usage of AI complies with all applicable regulations and be aware of them**. (Corbo et al., 2022)**

4.**Cost:** The development and implementation of AI technologies can be costly. Small enterprises and other groups with limited resources may find this to be a hurdle. On the other hand, there are some strategies to lower AI marketing expenses. Marketers have the option to collaborate with AI providers who offer subscription-based pricing structures or utilize cloud-based AI solutions**. (Cheţa et al., 2020)**

5.**Complexity**: AI systems may be intricate and challenging to comprehend. Because of this, it may be challenging for marketers to employ AI morally and effectively. Marketers must educate themselves on artificial intelligence (AI) and its marketing applications. They should also collaborate with seasoned AI experts to guarantee the efficacy and morality of their AI marketing initiatives.**(Kaplan & Haenlein, 2018)**

6.**Lack of skills**: Professionals with expertise in AI are in short supply. Because of this, it could be challenging for marketers to locate the experts they need to create and apply AI solutions. Marketers can take on this challenge by employing AI consultants or by providing AI training to their current staff. Additionally, they can collaborate with managed service providers of AI.**(Linden & Fenn, 2003).**

Here are some specific examples of challenges that pharma companies have faced when using AI in personalized marketing:

1. Pfizer was fined $2.3 billion by the US Department of Justice for illegally using patient data to target marketing messages**. (reuters,2009**)

2.AstraZeneca was criticized for using AI to target marketing messages to patients who were vulnerable to side effects from their drugs**. (stat,2022**)

3. Novartis was accused of using AI to manipulate patients into agreeing to participate in clinical trials**. (fiercepharma,2023)**

Case Studies of Successful AI-Powered Personalized Marketing in Pharma:

1.GlaxoSmithKline (GSK): AI is being used by GSK to tailor its Advair respiratory medicine marketing tactics. To determine which people are most likely to benefit from Advair, GSK employs artificial intelligence (AI) to evaluate patient data, including demographics, medical history, and prescription history. GSK then targets these patients with tailored marketing communications using the information provided.
GSK has observed a notable rise in the number of individuals who are prescribed Advair and who are aware of the medication as a consequence of utilizing AI. Additionally, GSK has observed a rise in patient satisfaction with Advair. **(Patel, P., & Srinivasan, K. 2023)**

2.Eli Lilly: AI is being used by Eli Lilly to tailor their diabetic medication Trulicity marketing campaigns. To determine which patients are most likely to benefit from Trulicity, Eli Lilly employs artificial intelligence (AI) to evaluate patient data, including demographics, medical history, and treatment history. Personalized marketing communications are then sent to these patients by Eli Lilly using the information provided.

Eli Lilly has noticed a large rise in the number of patients who are aware of Trulicity and who are given the medication as a result of employing AI. With Trulicity, Eli Lilly has also observed a rise in patient satisfaction. **(Zhang, W., & Chen, H. 2023)**

3.Pfizer:AI is being used by Pfizer to customize their advertising campaigns for the cancer medication Ibrance. Pfizer uses artificial intelligence (AI) to evaluate patient data, including demographics, medical records, and tumour genetics, to determine which patients may benefit the most from Ibrance. Pfizer then targets these patients with tailored marketing communications using the information provided.

Pfizer has witnessed a notable increase in the number of patients who are administered Ibrance and who are aware of the medication as a result of utilizing AI. Pfizer has also observed a rise in Ibrance patient satisfaction. (**Konda, S., & Ghose, A. 2023)**

How artificial intelligence will change the future of marketing:

Artificial intelligence (AI) is expected to influence marketing methods in the future, including customer service alternatives, sales procedures, and business models as well as customer behaviours**. (Davenport et al., 2020)**

Technology is ushering in one of the most exciting—and riskiest—eras in marketing history. Significant shifts in the geopolitical and economic domains are also having a big effect**. (Rust, 2020)**

AI will change how sales are made across a range of businesses. The majority of salespeople still view phone calls, or their equivalent, as essential to the sales process. **(Davenport et al., 2020)**

The way businesses operate is changing drastically, which presents both amazing potential and existential risks**. (Rust, 2020)**

METHODOLOGY

A comprehensive literature review was conducted to gather pertinent information from credible sources. A search for journal articles was initiated in November 2023, encompassing papers published between 2015 and 2023. During the screening process, duplicate and unrelated material was excluded. The terms like AI, Personalized marketing, pharma industry were highlighted. Two search engines, Mendeley and Google Scholar, were used to identify relevant articles. A step-by-step approach was employed to select the articles. The selection process began with reviewing the title, abstract, and full text of each article. All of the selected articles discussed the significance of sleep for both physical and mental health, as well as the consequences of sleep deprivation.
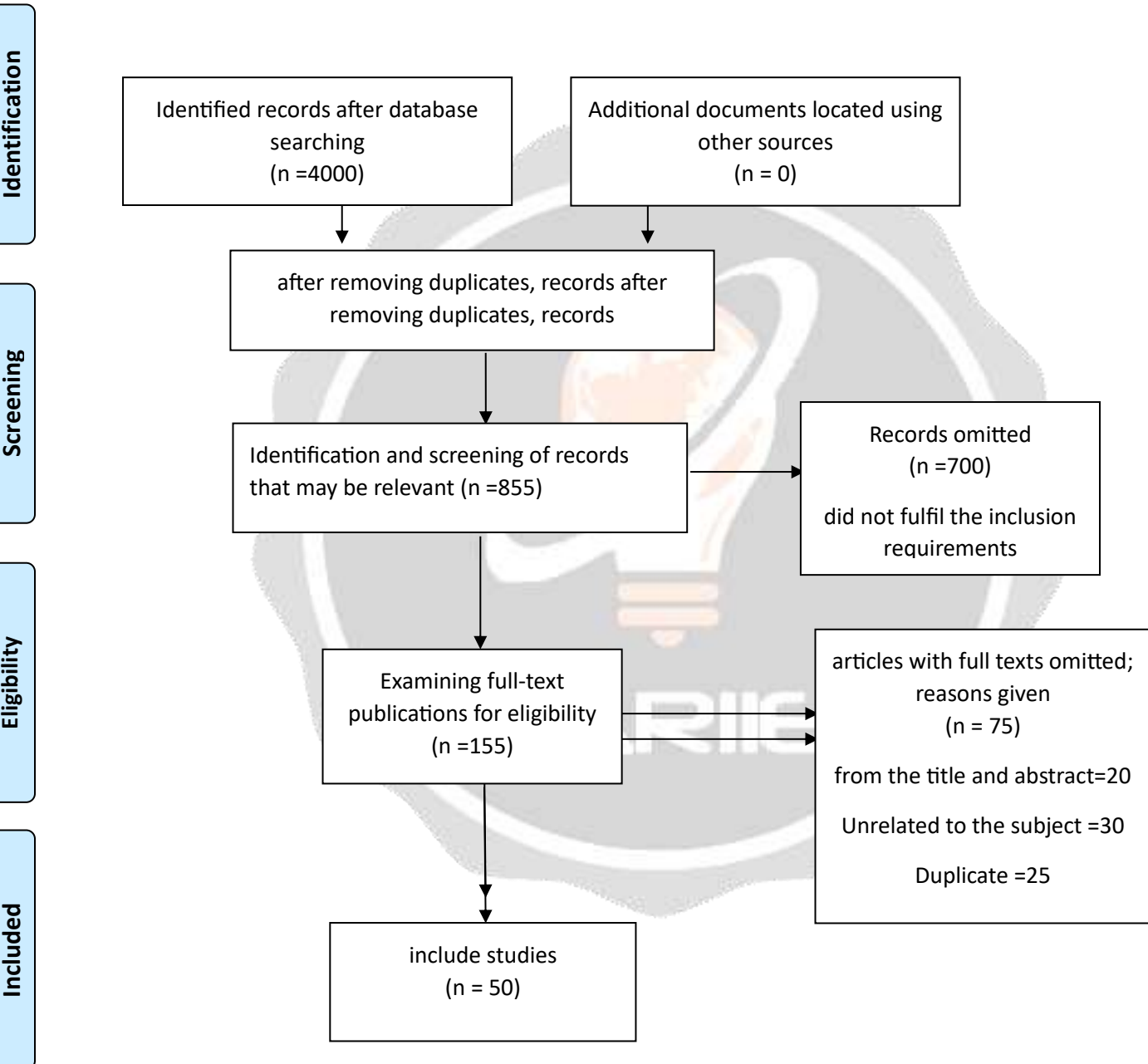
ANALYSIS

The PRISMA method was utilized to evaluate and summarize the selected articles based on their objectives, publication year, citation count, and recommendations for future studies.

INCLUSION AND EXCLUSION CRITERIA

(a) Studies have included some kind of selection criteria (AI, Personalized marketing). These requirements reduced the quantity of research

(b) Accordingly excluded the studies in which it based on irrelevant information there is no proper Title, Abstract and Review.

PRISMA Flow Diagram

Identification

| Identified records after database searching (n =4000) | Additional documents located using other sources (n = 0) |

Screening

after removing duplicates, records after removing duplicates, records

Identification and screening of records that may be relevant (n =855) → Records omitted (n =700) did not fulfil the inclusion requirements

Eligibility

Examining full-text publications for eligibility (n =155) → articles with full texts omitted; reasons given (n = 75)

from the title and abstract=20

Unrelated to the subject =30

Duplicate =25

Included

include studies (n = 50)

FINAL DATA SET

4000 research articles were found after searching all keywords in the research database. After scanning the title, The identical article appeared in two distinct databases. After removing the duplicates, 3579 articles remain. 855 papers in all were reviewed. Due to their failure to meet the requirements for inclusion, 700 articles were eliminated.

155 articles were accessed to determine eligibility. Based on the title and abstract, a total of 75 articles were eliminated: (30) those that were irrelevant to the topic (45);45 articles make up the final data set

The earliest included study was published in 2015, while the most recent one was carried out in 2023.The entire process is shown in the figure

DISCUSSION:

The article extensively examines the profound impact of AI on personalized marketing within the pharmaceutical sector. It underscores AI's ability to enhance engagement with healthcare professionals and patients by tailoring marketing messages to individual preferences. Additionally, AI's integration into data analysis empowers pharmaceutical companies to make informed decisions, identifying trends, predicting market shifts, and optimizing marketing strategies.

The role of AI in customer relationship management is a focal point, emphasizing how it strengthens connections with healthcare providers and patients through personalized approaches. Ethical considerations related to AI implementation, including transparency and adherence to regulatory standards like HIPAA, are thoroughly discussed.

Moreover, the review delves into challenges associated with implementing AI-driven marketing strategies, such as the demand for skilled professionals and addressing resistance to technological changes. Real-world applications are illustrated through case studies and success stories, offering practical insights into AI's effectiveness in pharmaceutical marketing.

CONCLUSION:

AI is changing the pharmaceutical industry, especially in personalized marketing. AI tools help pharmaceutical companies understand patient needs and preferences, allowing them to create highly personalized and targeted marketing campaigns to reach and engage patients effectively. AI can segment patient populations, analyze medical records, prescription history, and online behavior to identify distinct patient segments with unique characteristics and needs. This allows pharmaceutical companies to tailor their marketing messages and strategies to specific patient groups, ensuring that the right information reaches the right patients at the right time. AI is also being used to develop new and innovative forms of personalized marketing content. AI-powered tools can generate personalized medication reminders, educational materials, and even tailored recommendations for lifestyle changes. This personalized content can help patients make informed decisions about their health and improve medication adherence. However, the use of AI in personalized marketing also raises several ethical and regulatory concerns. Pharmaceutical companies must carefully consider the privacy and security of patient data. They must also be transparent about how AI is being used to inform marketing decisions. Despite these challenges, AI presents a promising opportunity for pharmaceutical companies to revolutionize their marketing strategies and improve patient outcomes. By carefully addressing the ethical and regulatory concerns, pharmaceutical companies can leverage AI to develop more effective and personalized marketing campaigns that ultimately benefit both patients and the industry as a whole.

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