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Artificial Intelligence Accelerated Transformation in The Healthcare Industry

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I. Abstract

The healthcare industry was a pioneer in the deployment of artificial intelligence (AI) technology. Due to the nature of the services and the vulnerability of a sizable portion of end users, there has been a significant amount of research and discussion on the concept of artificial intelligence. A mixed-method approach has been used to pinpoint the components of moral AI in the healthcare sector and look into how it affects value creation and market performance. Since AI technology is still developing in India, analysis is conducted in an Indian context. The understanding of how various AI components supported healthcare organisations and deliver better patient-centered care and evidence-based medicine was aided by these in-depth studies and analyses of the patient perspective.

KEYWORDS: Artificial Intelligence, Patient Engagement, Healthcare, Chatbots

II. INTRODUCTION

Artificial Intelligence has extended the wings in almost every domain in recent times, ranging from smart phones, watches, washing machines etc. to smart homes and even smart cities. Especially in the field of Healthcare, AI is significantly being used in past few years. It can be used in various diagnosis and treatments including patient monitoring, robot-assisted surgeries, patient data and risk analysis, drug discoveries and clinical trials, etc. AI technologies can be broadly classified as machine learning, computer vision, NLP, deep learning and context aware processing, which can be combined further to provide solutions for different sets of health care issues. The deep learning algorithms can diagnose diabetic retinopathy from eye scans with 90% accuracy (A.K. Triantafyllidis, A. Tsanas 2019). [1] An AI-powered control centre at John Hopkins allowed staff to assign emergency department (ED) patients to inpatient beds 30% faster (Walls, A.E. 2018). A detailed study of AI applications in healthcare was presented in a review paper by Rosenberg et. al (2010). According to the study, the first progressive research by Gunn was proposed in 1976 in which he investigated the possibility of diagnosing intense stomach pain with PC analysis (Rosenberg et. al 2010). [2][3] The organizations like Google and IBM are working on incorporating AI in healthcare. Most of the AI enabled healthcare programmes are using Google's Deep mind Health or Watson's IBM for diagnosing specific diseases after collecting the data from mobile applications (Powles, J., Hodson, H. 2017).[4]

The complexity of current medications, which need a vast amount of information to analyse, is directly tied to the rise of AI in the healthcare industry. Additionally, there

aren't enough researchers to meet the demand for study. Thus, AI applications have been leveraging cutting- edge computation to help researchers in hospitals get around the constraints of human intelligence in the realm of medicine. It offers various advantages including ease of complex computations, increased accuracy, analysis of data collected from various means, solving complex problems in lesser time, and effective decision making.

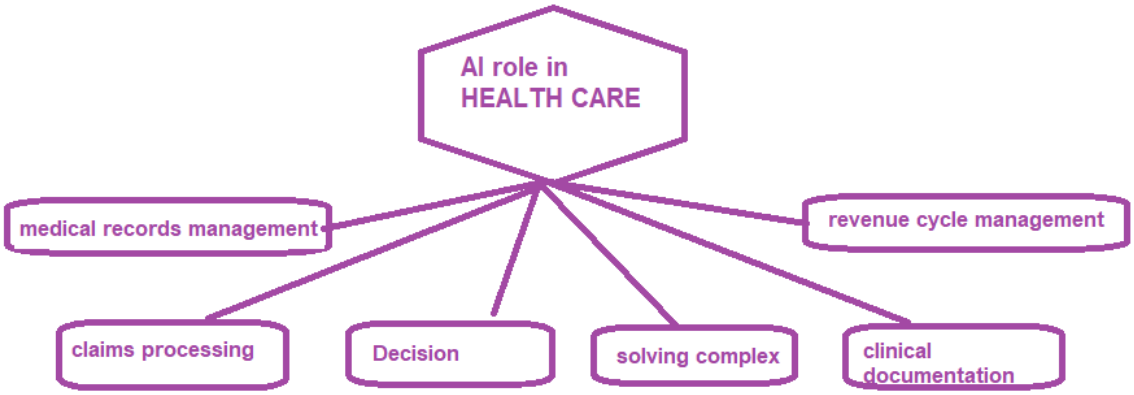

Figure 1: AI in Healthcare

AI algorithms are typically trained using a sizable amount of data collected from a variety of health activities. [7] Through learning from a large dataset, the algorithm will be able to identify comparable groups of items and connections between subject attributes and desired outcomes. Therefore, a medical dataset will contain a number of data types, such as demographic information, clinical laboratory data, images, and notes from physical examinations and medical devices.[11]AI software can be made available to end users on-premise or in the cloud. An end user can be a patient, a healthcare professional, a pharmaceutical or biotechnology company, an insurance provider, or another party.

III. LITERATURE REVIEW

Artificial intelligence refers to the idea and development of computer programmes that can carry out tasks and resolve problems that ordinarily require human intelligence. Regarding the employment of AI in healthcare, there are two conflicting perspectives. While some see it as detrimental or worthless, others think it is incredibly helpful. Furthermore, the employment of AI in the healthcare industry has long been a difficult topic since people are frightened of machines working on their bodies (Makda. A,2021).

AI will improve professional judgement, patient diagnosis, treatment, and prevention (A.K. Triantafyllidis, 2019). There is a lot of hope that AI will one day perform better than humans in the healthcare sector. AI may be able to improve disease prevention, detection, diagnosis, and treatment. Among the principal disorders for which AI techniques are utilised are those related to cancer, neurology, cardiology, and diabetes (Murali N.,2018). AI can also assist rural health facilities and promote recruitment and retention in rural areas. In the long run, this could contribute to the development of a more equitable global health care system (T.Q. Sun, 2019)

Practically speaking, AI technologies may not be able to completely replace human doctors in the medical field, but they may be able to help them provide better and more accurate outcomes (Manne. R & Sneha, 2021). AI is unlikely to be able to replace

human doctors due to psychological and psychosocial variables involved in a doctor-patient interaction, according to a study by Makda and Saifi (2021) on the influence of AI on the healthcare industry in the UAE.[12] not too soon. Furthermore, according to survey data included in this study report, 78% of respondents are receptive to the idea of adopting AI-based solutions in the healthcare industry. Furthermore, 86 percent of UAE doctors concur that AI will reduce their burden.[10]

40 people were questioned for a study by Lai et al. (2020) in France, including doctors, professionals, researchers, and representatives of regulatory authorities. The majority of the doctors polled had positive views of AI, its capabilities, and the benefits patients would receive in terms of time savings and prompt alerts. AI may improve patient safety, cost-effectiveness, and medical care delivery. While some physicians asserted that AI may totally revolutionise their fields of expertise and patient care, others asserted that it would just speed up recent developments in medical practise.

Among all medical specialties, radiology and radiation may apply AI technology at the most advanced level. 182 medical radiography technicians and healthcare workers were questioned by Giansanti et al. (2020) on their experiences with radiology infrastructure. According to 87% of respondents, AI will supplement human intelligence, 10% believed it would replace human judgement, and 3% said it had no future.

Gillan et al. (2018) surveyed four different categories of radiology professionals and discovered similar findings. The study looked at the use of AI in healthcare. Most agreed that AI would improve treatment. Efficiency, recent and readily available data, clinical decision-making utility, and gains in care complexity and precision were highlighted.[13]

The goal of artificial intelligence (AI) is to mimic human cognitive functions. The growing number of health records and the quick development of analytics methods are currently bringing about a significant revolution in healthcare. AI can process a range of healthcare data types (structured and unstructured). Natural language processing is a well-known AI technique for unstructured data. Machine learning methods like the traditional support vector machine and neural network as well as the more modern deep learning are employed for structured data. Cardiology, neurology, and cancer are the three main medical specialties that employ AI techniques (Jiang F, 2017).

Artificial intelligence has the potential to significantly improve patient care while lowering medical expenses. It is anticipated that the need for health services will rise as the population grows. To increase the effectiveness and efficiency of the health services sector without adding extra expenditures, innovative ways are needed (L.G Pee, 2019). In this case, technology can offer solutions. To help healthcare professionals in their diagnostic and decision-making processes, Google's Deep Mind Health Technology specifically builds an AI model of the human brain that incorporates machine learning and a neuroscientific system. 2020 (M. Ardan).

The ability of IBM's Watson to focus on precision medicine, notably cancer detection and treatment, has recently earned positive media attention. Artificial neural networks (ANN) classified CVD and diabetes with greater accuracy (Eren A, 2008)

There are several different AI technologies in use today by payers, healthcare providers, and life sciences companies. Among the primary application domains of AI are making recommendations for patient assessment and therapy, monitoring patient

involvement and compliance, and helping with administrative tasks (Davenport T, 2019). healthcare significantly benefits from AI technologies including robotic process automation, deep learning, natural language processing, surgical robots, and neural networks.

Machine learning is a statistical method that involves "teaching" computers with data and "learning" by fitting the model to that data. Precision medicine, which evaluates which therapeutic options are most likely to be successful for a patient based on a range of patient characteristics as well as the context of the therapy, is where traditional machine learning techniques are used in healthcare the most frequently. (Lee SI, 2018).

The neural network is a more advanced form of machine learning. This technology, which has been around since the 1960s, has been used extensively in medical research for a very long period. It is helpful for categorization jobs like figuring out whether a patient might get a specific disease. (Sordo, 2002).

Deep learning, which uses neural network models to predict outcomes using multiple layers of input or variables, is one of the more difficult types of machine learning. The medical industry frequently uses deep learning to spot possibly malignant tumours in radiography images. (R. Fakoor, 2013) [14]

In radiomics, which entails the detection of clinically significant patterns in mri scans that are invisible to the human eye, deep learning is increasingly being used. (Vial A, 2018). Oncology is the field where deep learning and radiomics are used in image analysis the most. When compared to the preceding generation of automated image analysis techniques known as computer-aided detection or CAD, their combination seems to promise enhanced diagnostic accuracy. (Ted Davenport, 2019)

Natural language processing (NLP), a component of deep learning, is used for speech recognition. The generation, comprehension, and classification of published research and clinical data are the key applications of NLP in the healthcare sector. Conversational AI can be performed by an NLP system, which can also generate reports (for instance, on radiological examinations), assess unstructured clinical notes on patients, and capture patient interactions (Davenport, 2019).

Surgical robots, another AI technology, improved doctors' vision, their capacity to carry out precise and less invasive procedures, their capacity to treat wounds, and other similar functions. They were first approved in the United States in 2000. (2002) Davenport T Head and neck surgery, prostate surgery, and gynaecologic surgery are some of the most frequent procedures performed with a robotic arm.

Another AI tool used to carry out administrative activities in the healthcare industry that call for information systems is robotic process automation (RPA) technology. [6] These tasks are organised as though they were being carried out by a human user who was following a set of rules or guidelines. Compared to other forms of AI, RPA technology is more transparent, less expensive, and easier to programme. For regular tasks like billing, prior authorization, and patient record changes, it is used in the healthcare sector. It has the potential to extract information from faxed photographs and input it into transactional systems when paired with specific other technologies like image recognition. (2014) (Hussain A).[8]

Electronic health records are essential to the healthcare sector in order to enhance various treatment methods, drug use, and disease management. By facilitating data analysis [15].

They have a wealth of knowledge that they can impart, from the past to the present. The records can be interpreted by artificial intelligence, which can then give the doctors new information. A disease's tendency can be predicted by algorithms using EHR based on historical data and family medical history. (Eren A, 2008)

IV. RESEARCH METHODOLOGY

A mixed-method study that uses both a qualitative and quantitative strategy and collects samples from both ends is recommended by existing literature in the fields of information systems development, artificial intelligence, and chatbots in order to get more trustworthy conclusions (Venkatesh et al., 2013). Given the complexity of healthcare delivery, this study argues that a mixed-method approach has the potential to enhance comprehension of the phenomena being studied. [16] Therefore, the study's aim of shedding light on the dynamics of influence of AI and chatbots and other related technologies in the healthcare industry is consistent with the usage of a variety of methodologies. As seen in Figure 2, this study used a two-stage sequential design.

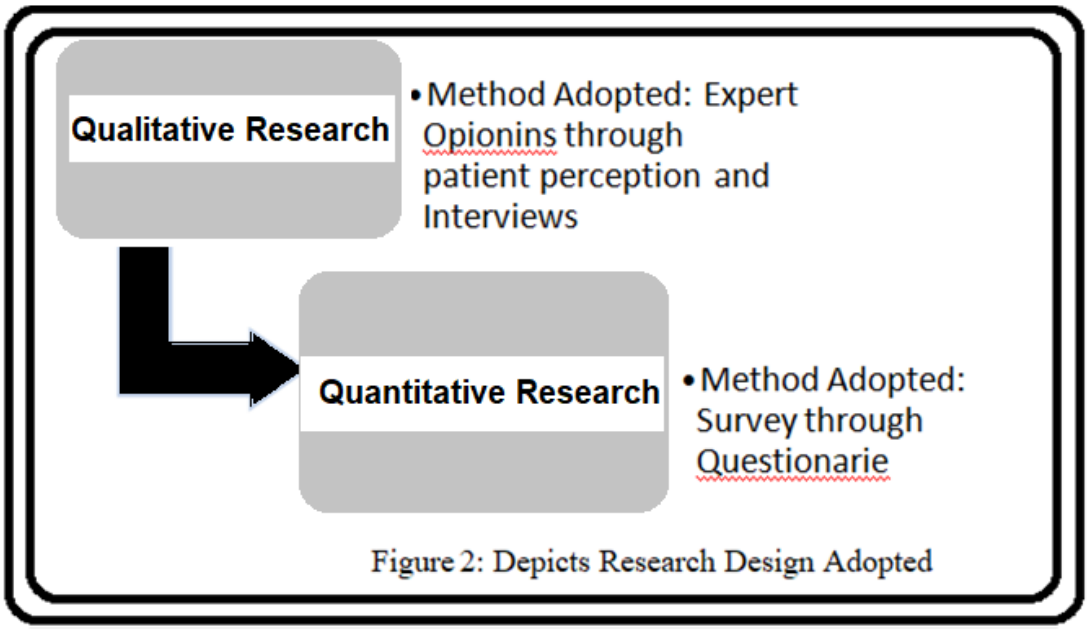

Figure 2: Depicts Research Design Adopted

V. ANALYSIS

A. Qualitative Study

To understand the patient's perspective, an exploratory qualitative study involving in-depth questioning was conducted in the first step (case1). A purposive sample technique was used to identify the study's respondents. To comprehend the consequences and evaluate the use of AI and chatbots in healthcare, the sampling criteria included health professionals consisting of doctors, administrative employees, and hospital IT workers. The candidates for the questionnaire included medical professionals employed by various important public and private hospitals in Delhi and the NCR. The exploratory response, which included a number of open-ended questions mentioned in Appendix 1, underlined the implications of AI and chatbots in hospitals.

B. Quantitative Study

- To better understand and evaluate the effects of AI and chatbots in hospitals from the perspective of practitioners, the research is conducting a quantitative study.
- The study answers the following research questions: What is the reach of AI powered services and chatbots in Delhi and NCR hospitals?
- What effect do chatbots and AI-enabled services have on practitioners' operational effectiveness?
- What effect do chatbots and AI-enabled services have on raising patient satisfaction levels?

C. Based on the qualitative and extensive literature review

The study to access the impact of AI enabled services and chatbots in hospitals is hypothesized as:

H1: AI enabled services and chatbots have a positive influence on operational efficiency of practitioners.

H2: AI enabled services and chatbots have a positive influence on enhancing the customer satisfaction.

The proposed conceptual model of the study is:

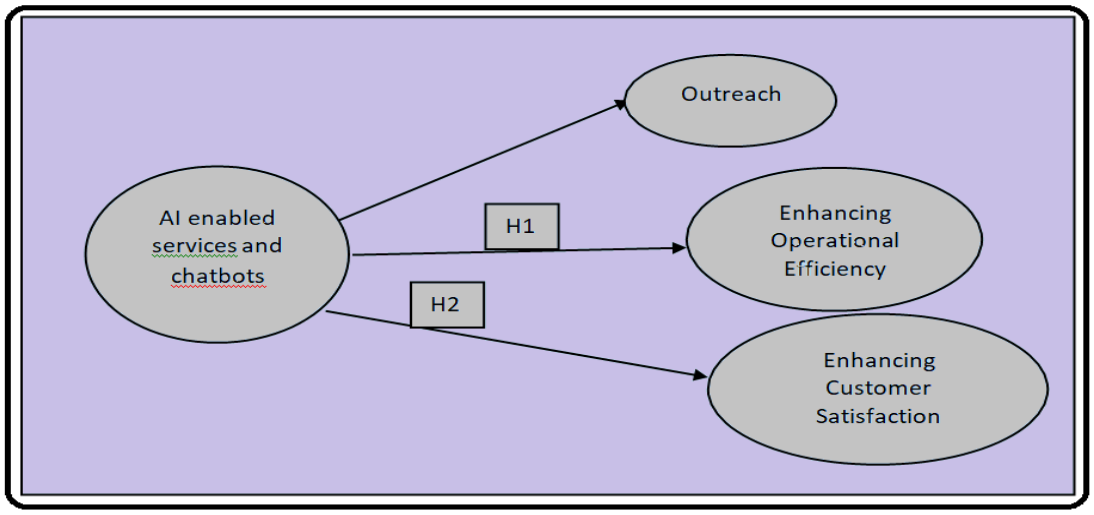

Figure 3: Proposed Conceptual Model.

Figure 3: Proposed Conceptual Model

A measurement scale was designed for the quantitative assessment of the suggested model. The three topics, namely the reach of AI-enabled services and chatbots, their effects on practitioners' operational effectiveness, and finally their effects on customers' satisfaction, were the outcomes of a qualitative analysis and literature review. The survey tool was pre-tested on numerous academicians to evaluate the questionnaire's content validity.

The sample characteristics of the respondents is summarized in the table

Table 1: Demographic Characteristics

Demographic variable	**Frequency**	**Percentage (%)**
Gender		
Male	52	39%
Female	91	61%
Department Wise Distribution		
Doctors	40	30%
Administrators	25	15%
Nurses and Paramedical Staff	40	37%
Others	15	18%
Hospital Type		
Govt. Hospital	70	40%
Private Hospital	95	70%
Age of the Practitioner		
20-30 years	15	8%
30-40 years	40	20%
40-50 years	55	40%
50-60 years	35	20%
Above 60 years	12	12%

Model Specifications of different SEM Models

Regression Weights

Table 2: Regression Weights of Different Variables

			Estimate	S.E.	C.R.	P	Label
AI	<---	Outreach	.169	.042	3.265	----	
AI	<---	Operational Efficiency	.630	.053	8.655	----	
AI	<---	Customer Satisfaction	.075	.051	1.649	----	

Model Fit summary

Table 3: CMIN Model Results

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	16	381.54	7	.000	55.62
Saturated model	25	.000	0		
Independence model	7	502.98	16	.000	31.45

Baseline Comparison

Table 4: Baseline Comparison Model Results.

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.553	-.711	.320	-.662	.33
Saturated model	1.000		1.000		1.000

VI. OBSERVATION

A. Consequences of the Data's Demographic Analysis

- This serves to highlight the main points of the data. In addition to simple graphic analysis, this builds the groundwork for essentially quantitative data analysis. According to the gender breakdown of the study's respondents, women make up the majority (57%), while men account for 43%. [5] By offering a centralised picture of patient demographic data, standardising and streamlining operations, and enabling proactive communication, AI enabled devices and chatbot installation can help healthcare firms boost overall patient happiness. The high level of patient satisfaction will also increase the likelihood that routine preventive healthcare will continue to be a primary focus. 2009's Hag Land.
- Out of 150 respondents, 60% frequently attend private hospitals for medical care, while 40% prefer to receive it at a government hospital, according to distribution studies on the basis of hospital type. Improved communication channels, fast and reliable data, and the accumulation of inferred knowledge that fundamentally improves people's comprehension without wasting time are all advantages of AI. The main "marketing" objective that a private for-profit healthcare institution may expect is to deploy AI enabled devices and chatbots, which is the logical progression of observation building. However, corporate influence and manufactured demand marketing methods don't actually have any impact on healthcare (Vardasca and Martins, 2011; Oinas-Kukkonen et al., 2008).
- The majority of the respondents, as indicated by their age distribution, are between the ages of 30 and 50. The analysis makes it evident that older people require medical treatment from a healthcare organisation. Therefore, taking care of them aids the company in maintaining its elderly clients, who are its main source of income. A framework for AI can also enhance medical care by helping hospitals to comprehend patients' needs better and by enhancing communication by monitoring systems (Mohiuddin, 2019).

B. Consequences of the Qualitative Study

- Emerging trends include growing service demand, a shift in focus toward total wellbeing, and rising costs of high-quality care are driving the usage of new technology in the healthcare sector. By using the technology, medical institutions are altering the guidelines for patient contact.
- Conversational AI's power. The development and use of different AI solutions in the healthcare sector is undoubtedly developing quickly.
- Chatbots for medicine or healthcare can be used for a range of purposes, from enhancing patient experiences and supporting medical staff to streamlining healthcare procedures and providing insightful data. One of the most sophisticated and significant AI-powered healthcare technologies to date, medical chatbots have the potential to completely change how payers, healthcare professionals, and patients interact with one another.
- There is little question that the relevancy and accuracy of these chatbots will increase as well, according to the practitioners. However, much more will be required if the use of healthcare chatbots is to be successful. A careful balancing act between human empathy and artificial intelligence will be required to develop chatbot solutions that can tackle the problems now plaguing the healthcare industry. Based on the results of a qualitative investigation, a questionnaire was created and analyzed in order to determine how AI and chatbots might improve patient satisfaction by helping practitioners in hospitals operate more efficiently.

C. Consequences of the quantitative study

Healthcare AI is growing swiftly, and it's projected that this pattern will continue. Thanks to ready-to-use conversational AI in healthcare modules, the AI can handle the complete healthcare portfolio. In the healthcare sector, chatbot technology enables doctors to continuously provide rapid responses, notifications, and reminders. [15] Less time is spent waiting for patients, and they receive care right away. AI-enabled chatbots can recognize patients' faces and analyze their behavior to deliver a personalized response that improves patient satisfaction. [16] The research has identified several important advantages of AI-enabled gadgets and chatbots, including Improved and enhanced patient access. Some of them are:

- Patient encounters that are more scalable.
- Raising brand awareness, increase operational effectiveness
- Better Analyses of disease and symptoms
- Information of Remedial medicines
- Information of Substitute medicines
- Automate deployment of data
- Money saving

However artificial intelligence in healthcare is still a relatively recent development, these instruments cannot be entirely held accountable for patients' engagement outside of client service and other essential tasks.

VII. CONCLUSION

This study used a mixed-methods strategy that combined quantitative research using a survey and expert opinions with qualitative research utilising expert opinions. According to the report, installing chatbots and AI-enabled services might increase overall patient satisfaction in the healthcare sector by centralising and streamlining patient data and so enabling proactive communication. By paying attention to the medical demands of persons in the 30- to 50-year-old age range, it can further help the healthcare sector to increase their revenue. The use of AI in healthcare is growing quickly, particularly with chatbot technology, which allows doctors to respond to patient questions quickly and reminds patients to come in for appointments. Similar to this, patients gain from shorter wait times and personalised solutions that increase their satisfaction and happiness. In addition to these advantages, chatbots and AI-enabled gadgets in the healthcare sector increase operational effectiveness and patient satisfaction.

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