Dissertation Training

at

International Institute of Health Management Research New Delhi

Unlocking Healthcare Insights: Harnessing Big Data Analytics for Enhanced Patient Care and Clinical Decision Making

By

Dr. Shrdha Karan

PG/22/116

Under the guidance of

Dr Mukesh Ravi Raushan

Assistant Professor, IIHMR, New Delhi

PGDM (Hospital and Health Management)

2022-2024

International Institute of Health Management Research, New Delhi

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International Institute of Health Management Research, New Delhi

Completion of Dissertation from IIHMR, Delhi

The certificate is awarded to

Dr.Shrdha Karan

In recognition of having successfully completed
Her dissertation

At IIHMR, Delhi

And has successfully completed her Project on

Unlocking Healthcare Insights: Harnessing Big Data Analytics for Enhanced Patient Care and Clinical Decision Making

Date- 03 March 2024 to 03 june 2024

International Institute of Health Management Research, New Delhi

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning.

We wish her all the best for future endeavors.

Training & Development

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Shrdha Karan student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone internship training at IIHMR, New Delhi from 03/03/2024 to 03/06/2024.

The Candidate has successfully carried out the study designated to him during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his/her future endeavors.

Dr. Sumesh Kumar Mentor

Associate Dean, Academic and Student Affairs

IIHMR, New Delhi IIHMR, New Delhi

Certificate of Approval

The following dissertation titled **"Unlocking the insights: Harnessing Big data Analytics in Healthcare for Enhanced Patient care and Clinical Decision Making"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

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July 17, 2024

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This is to certify that **Dr. Shrdha Karan**, a graduate student of the PGDM (Hospital & Health Management) has worked under our guidance and supervision. She is submitting this dissertation titled "**Unlocking the insights: Harnessing Big Data Analytics in Healthcare for Enhanced Patient Care and Clinical Decision Making**" at "**IIHMR Delhi**" in partial fulfilment of the requirements for the award of the PGDM (Hospital & Health Management).

This dissertation has the requisite standard and to the best of our knowledge, no part of it has been reproduced from any other dissertation, monograph, report or book.

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **"Unlocking the insights: Harnessing Big Data Analytics in Healthcare for Enhanced Patient Care and Clinical Decision Making"** and submitted by **Dr. Shrdha Karan, Enrolment No. PG/22/116** under the supervision of **Dr. Mukesh Ravi Raushan (Assistant Professor)** for award of PGDM (Hospital & Health Management) from **International Institute of Health Management Research [IIHMR], Delhi, India** carried out during the period from **March 03, 2024 to June 03, 2024** embodies my original work and has not formed the basis for the award of any other degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Shrdha Karan

Signature

Dr. Shrdha Karan

Place: New Delhi, India

Date: 22/07/24

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Area of Summer Internship: Health Information Technology: Big Data Analytics, Artificial Intelligence.

Attendance: Perfect adherence to dissertation norms

Objectives met: The student understood the details of the concept, worked on the literature review, and participated in the data analysis using PRISMA, Advanced Excel

Deliverables: Literature Review, Data Management, Statistical Analysis of Secondary Data, Microsoft Word and Excel.

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Enrollment/Roll No.	PG/22/116	Batch Year 2022-24.	
Course Specialization (Choose one)	Hospital Management	Health Management	Healthcare IT ✓
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Title of the Dissertation/Summer Assignment	"unlocking the insights: Harnessing Big Data analytics in Healthcare for Enhanced Patient care and clinical decision making"		
Plagiarism detect software used	"TURNITIN"		
Similar contents acceptable (%)	Up to 15 Percent as per policy		
Total words and % of similar contents Identified	15%		
Date of validation (DD/MM/YYYY)	22/07/2024.		

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ABSTRACT

INTRODUCTION: The advent of big data analytics in healthcare has revolutionized patient care and clinical decision-making. This paper explores the transformative impact of big data technologies in healthcare, focusing on their ability to unlock valuable insights from vast and complex datasets. By integrating diverse sources of health information, such as electronic health records (EHRs), genomic data, and real-time patient monitoring, big data analytics provides a comprehensive understanding of patient health and disease patterns. The utilization of advanced analytical techniques, including machine learning and predictive modeling, facilitates personalized treatment plans, early diagnosis, and proactive intervention, ultimately enhancing patient outcomes. Furthermore, big data analytics supports evidence-based clinical decisions by identifying trends, optimizing resource allocation, and improving operational efficiencies. The challenges of data privacy, integration, and the need for interdisciplinary collaboration are also discussed. This paper underscores the potential of big data analytics to transform healthcare delivery, emphasizing the importance of continued innovation and ethical considerations in harnessing these technologies for the betterment of patient care.

METHODOLOGY: This is a secondary literature review of relevant literature from different sources like Science direct, Pub med and Jstor . Various keywords used are: "Need of Big data analytics", "Need of Big data analytics in clinical decision making Patient based", "Big data analytics in clinical decision making for improved Patient care ", "Framework of Big data analytics for taking informed decisions for patient care" , "Potential of big data analytics for clinical decision making for patient care", "Challenges of big data analytics in clinical decision making for Human Healthcare", "Barriers in big data analytics in clinical decision making", "Future aspects of big data analytics in clinical decision making in healthcare", "Trends of Big data analytics in clinical decision making for patient care in India . The search was limited to studies published in English from the past decade (2014-2024) to ensure relevance of the literature. Also, we acknowledge that important healthcare components such vital signs, illnesses, patient-specific issues and diseases, and hospital manageability are not reviewed in this study

RESULTS: Big data analytics offers a potent toolkit for turning enormous volumes of data into useful insights, which promotes better educated and efficient healthcare decision-making. The following are the main ways that big data analytics improves healthcare decision-making processes:

1. Cost management: By using analytics to pinpoint areas of wasteful spending and inefficiencies, healthcare organisations can reduce costs without sacrificing the quality of service they provide. The financial aspects within the healthcare system are highlighted by components like Determination of Copayment Rates, Prevention of Fraud and Abuse, and Prevention of Claims Rejection. The goal of including these elements into the framework is to guarantee effective claims handling, fraud detection, and financial planning.

2. Fraud Detection: Big data assists in the detection and prevention of fraudulent activity, saving healthcare providers and insurers a substantial amount of money by looking for trends and abnormalities in billing and claims data. People can find gaps, inefficiencies, and areas for improvement by looking at data patterns and trends. This realisation may spark creative thinking, process improvements, and the development of new goods and services.

3. Research and Development: In clinical Trials big data analytics speeds up the process of finding qualified participants for clinical trials and the evaluation of trial outcomes, which speeds up the creation of novel therapies. In Medical research the researchers are able to innovate medical treatments and technology by analysing large datasets to uncover new information about disease mechanisms, treatment efficacy, and patient outcomes.

DISCUSSION: The integration of big data analytics into healthcare represents a paradigm shift, with profound implications for patient care and clinical decision-making. By harnessing the power of big data, healthcare providers can now access a more holistic and nuanced view of patient health, allowing for more personalized and effective treatments. This discussion explores the multifaceted impact of big data analytics, the challenges encountered, and the future prospects of this technological advancement.

Big data analytics enables the synthesis of information from diverse sources such as electronic health records (EHRs), wearable devices, and genomic data, which collectively provide a comprehensive picture of patient health. This integration facilitates personalized medicine, where treatment plans are tailored to the individual characteristics of each patient. Predictive analytics, for instance, can identify patients at risk of developing chronic conditions, enabling early interventions that can prevent disease progression and improve quality of life.

Acknowledgment

I would like to take this opportunity to express my heartfelt gratitude to all those who have contributed to the completion of this dissertation. Without their unwavering support, guidance, and encouragement, this research project would not have been possible. I would like to express my deepest gratitude and appreciation to all those who have contributed to the successful completion of my dissertation on the topic "Double Burden of Malnutrition Among Adolescent Women in India." This research would not have been possible without the support and guidance of several individuals, and I would like to take this opportunity to acknowledge their invaluable contributions.

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Last but not the least, I thank the almighty for keeping me cheerful and rooted throughout the work.

Date:

Place: New Delhi **Dr. Shrdha Karan**

Contents

List of Tables and Figures

Abbreviations

1. BDA - Big Data Analytics

2. EHR - Electronic Health Records

3. CDM - Clinical Decision Making

4. PPC - Personalized Patient Care

5. RTDA - Real-Time Data Access

6. CDSS - Clinical Decision Support Systems

About IIHMR Delhi

The International Institute of Health Management Research (IIHMR), New Delhi is allied to the "Society for Indian Institute of Health Management Research" which was established in October 1984 under the Societies Registration Act-1958. IIHMR-Delhi was setup in 2008 in response to the growing needs of sustainable management and administration solutions critical to the optimal function of healthcare sector both in India and in the Asia-Pacific region.

We are a leading institute of higher that promotes and conducts research in health and hospital management; lends technical expertise to policy analysis and formulation; develops effective strategies and facilitates efficient implementation; enhances human and institutional capacity to build a competent and responsive healthcare sector. Our multi-dimensional approach to capacity building is not limited to academic programs but offers management development programs, knowledge and skills-based training courses, seminars/webinars, workshops, and research studies. Our four core activities are:

- Academic courses at master's and doctoral level in health and hospital management to meet the growing need of skilled healthcare professionals.
- Research that has high relevance to health policies and programs at national and global level.
- Continued education through management development programs and executive programs for working professionals to help them upgrade their knowledge and skills in response to the emerging needs of the industry.

- Technical consultation to the national and state-level flagship programs to address the gaps in planning as well as implementation.

Over the years IIHMR-Delhi has emerged as an institute of repute both nationally and globally for producing socially conscious, skilled and vibrant top-class health care management professionals. Our graduates are well-matched for the ever-changing health care sector and evolving social milieu. The institute has progressed as a leader in research, teaching, training, community extension programmes and policy advocacy in the field of health care. IIHMR has carved out a niche for itself through its cutting-edge academic curriculum, infrastructure, accomplished multi-disciplinary faculty and research.

The Institute as an autonomous body of international stature has been developing leaders for several years to shape tomorrow's healthcare by equipping the students in the fields of health, hospital, and health information technology. The Institute's dynamic health care research programmes provide rigorous training in management, health systems, hospital administration, health care financing, economics, and information technology.

Commitment to Inclusive Excellence

As an institute, IIHMR-Delhi is committed to creating an environment of higher learning that can serve as the model for the kind of society it strives to build – one of equity, social justice and mutual support. We have also made a concerted effort to promote the ethos and philosophies amongst today's students and nurture them into growing as effective managers, to think both critically and ethically, to learn to cope with ethical dilemmas and apply systems-thinking approaches to serious and complex societal problems. Our internationally renowned faculty lead multidisciplinary health research in multifarious areas such as public health, health services, health economics, hospital management, social determinants of health, mental Health and other topics of global and national interest.

The IIHMR is invited by various governmental and civil society organizations to provide technical support for capacity building and policy research needs that culminates in developing innovative and equitable health care strategies and provide advocacy support for health policy and planning. The institute also responds to the global health threats, natural disasters, conflict and related humanitarian crisis. In addition to the master's and doctoral level programs, IIHMR-D also offers several highly specialized and popular Management Development Programs (MDP) to wide range of health professional in the country and overseas which largely addresses educational needs amongst in-service aspirants.

Chapter 1 Introduction

1.1 Background:

In the field of Healthcare record keeping, compliance, regulatory requirements, and patient care have historically created significant volumes of data(1),(2),(3) like clinical data from CPOE(computerized physician order entry) and clinical decision support systems, such as written notes and prescriptions from doctors, information from medical imaging, lab, pharmacy, insurance, and patient data in electronic patient records (EPRs), as well as less patient-specific information from news feeds, emergency care data, and articles in medical journals, are all included. Machine-generated and sensor data is also included, such as information from monitoring vital signs, and social media posts, including blogs, Twitter feeds, Facebook status updates, and web pages. The data may be structured, semi structured or un structured in the form of flat files, relational tables, or other multiform files, spread across multiple sites, including different healthcare providers' locations(4),(5). Geographic Information Systems (GIS) and big data technologies have been instrumental in the fight against Covid-19 in a number of ways, including the quick aggregation of big data from multiple sources, the quick visualisation of epidemic information, the spatial tracking of confirmed cases, the prediction of regional transmission and the management of the supply and demand of material resources(6),(2).

An overview of big data analytics in the healthcare industry as a developing field is given in this article. We start by defining big data analytics in healthcare and going over its many uses, characteristics, and challenges. After that, we go over the data and methodology. Third, discuss the reasons behind the necessity to switch to big data and the ways in which it can improve

clinical decision-making and patient care. Fourth, we discuss the difficulties of using big data in the medical field. Finally, we provide conclusions, discussion, and suggestions based on the literature.

1.1.1 Understanding Big Data:

"Large volumes of complex, high velocity, and variable data that require advanced techniques and technologies to enable the capture, memory, distribution, management, and analysis of the information" is what big data refers to(7),(8). Big data in healthcare is heterogeneous vast and produced at fast pace. Big data Analytics is considered one of the important tool to gain insights from the centralized databases and can help in improving patient-centered care at reduced cost, early disease detection and epidemic detection, fresh insights into disease causes, quality monitoring in healthcare institutions and the development of more effective treatment strategies(9),(10),(11).

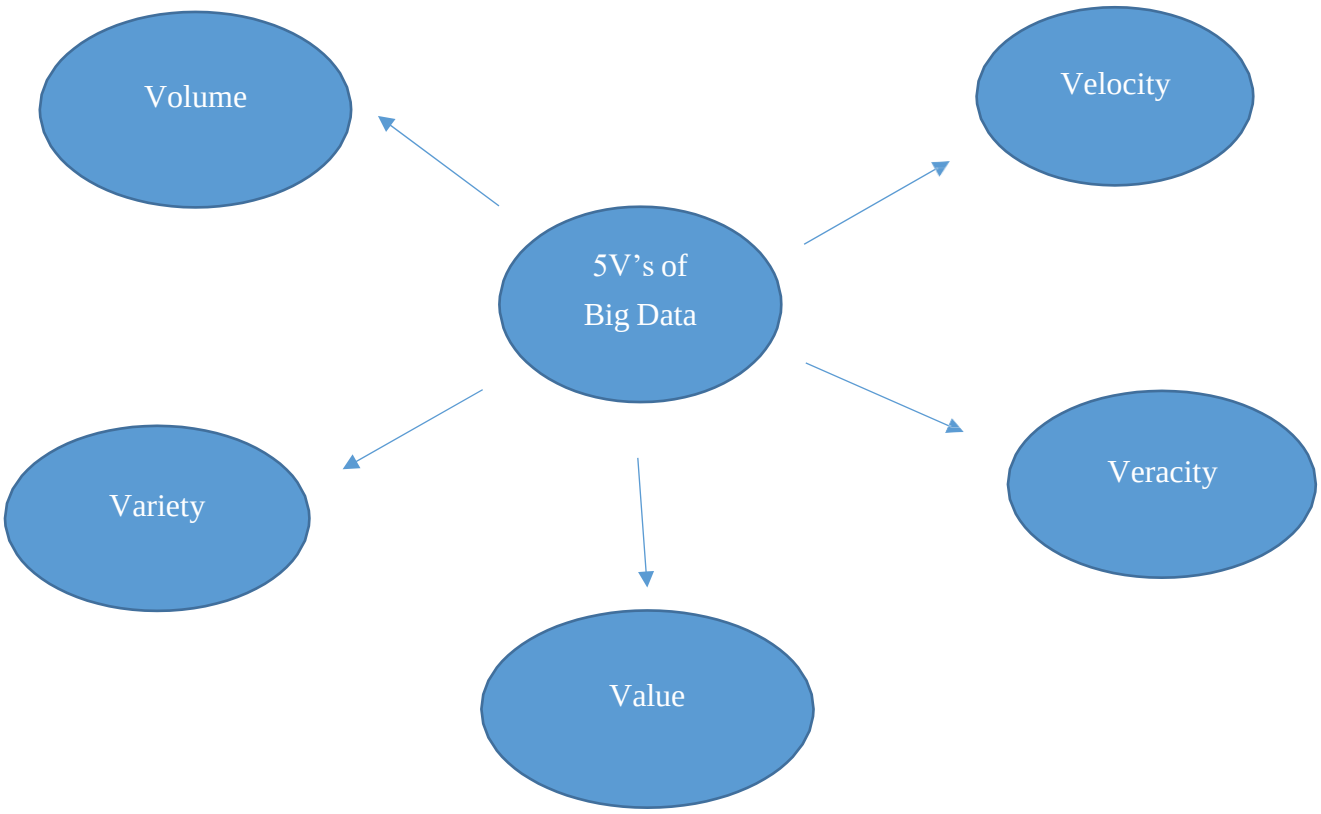

Figure 1: 5 v's of Big Data

Big data can be defined based on its volume, velocity, variety, veracity and value(1), (12),(13). Volume of big data in healthcare pertains to the sheer amount of data produced by the healthcare sector, which has experienced a rapid increase in the last few years as estimated by 2020, the healthcare data will dramatically increase to 35 Z Bytes which is 43 times more than that in 2009(12). These huge volume of data are usually stored in the form of petabyte, Exabyte, zettabyte or yottabyte(9). Velocity refers to the speed of data collection and making it ready for further analysis(14).Variety is different kind of health data produced in the form of images, audio and videos from various sources like hospital information system and various medical devices exists in structured, semi structured and non-structured format(12),(10),(15). In addition to the

non-structured data it usually requires real time analysis(10). Veracity describes the quality and reliability of data, taking into account elements like consistency, accuracy, and reliability(10), (13). Lastly, Value refers to the valuable information received by analyzing the healthcare big data (10),(12).

1.2 Review of Literature:

1.2.1 Big Data Analytics Past and Present:

In the late 1990s, Michael Cox and David Ellsworth proposed the idea of Big Data and identified visualization as one of its challenges(16). The evolution of big data took place between 2001 and 2008. Following the initialization of big data in terms of its volume, velocity, and variety called as 3v's, more advanced software were created to meet the demands of managing the information explosion. Early in 2009, big data analytics moved into a revolutionary phase. In addition to big data computing turned into a game-changing innovation for business intelligence, researchers also forecasted that data management and related techniques would soon move from handling structured data to handling unstructured data and from a terminal environment to a cloud-based environment(17).

The usage of cloud computing in conjunction with data has become a need in big data analytics. As according to the United Nations world population prospects 2019, the global population is

expected to reach 8.5 billion by 2030, 9.7 billion by 2050 and 10.9 billion by 2100 which will ultimately lead to increase in health data(3). Businesses are adopting more and more "big data in the cloud" solutions, like software-as-a-service (SaaS), which provides a more appealing and affordable option. The growth of home healthcare services has increased with time thus, the volume of data collected by sensors and other electronic devices has also increased and with the help of this more accurate analysis and prediction could be done which will ultimately improve the quality of the healthcare services(17).

1.2.2 Need of Big Data in Healthcare:

Modern analytics gives possibilities not only to have insight in historical data, but also to have information necessary to generate insight into what may happen in the future. Even when it comes to prediction of evidence-based actions.(18). Also, in order to better understand how certain types of viruses are spreading within a particular population and take proactive steps to stop their spread. Perhaps the most well-known example of using big data to improve healthcare is Google's flu trend (19). Another example is of the neo-natal intensive care unit at Toronto's Hospital for Sick Children’s, which shows how health analytics is being used in practice. Every hour, nurses record a baby's heart rate there.

1.2.3 Healthcare –Big data Life Cycle:

The following phases are commonly included in the healthcare data life- cycle; they may vary depending on the needs. (10),(20),(21) ,(22) The data gathering phase of the life cycle often comes first, then processing to clean, transform, and organize the data. The next step in the data

analysis process is to use methods like machine learning or statistics to find trends or insights in the data. In the following phase, known as data interpretation, judgements and conclusions are made in light of the analysis. Presenting the results in an understandable and practical manner to stakeholders or end users concludes the data delivery stage.

1.2.4 Application of Big Data Analytics in Healthcare:

Big Data Analytics (BDA) in health care can be used for improved decision-making that can ultimately lead to enhanced patient care. BDA can be used for pre care as well as post care. Pre care mostly include prevention, diagnosis, treatment and discovery of drugs. It helps in forecasting and understanding long-term health risks, reduces cost and increases the operational efficiency. Post care provides understanding on health insurance and recovery(11),(23). Big Data also holds the potential of advancements like the tracking of diseases in real time, the prediction of disease outbreaks, and the creation of genuinely personalized health care(15).

Chapter 2 Data and Method

2.1 Introduction:

The integration of big data analytics is causing an unparalleled revolution in the healthcare sector. The need of big data analytics in healthcare and method is examined in this chapter, along with how it can transform patient care, increase operational effectiveness, and promote medical research. Massive volumes of data have been produced by the quick spread of digital health data, which is a result of wearable technology, medical imaging, and electronic health records (EHRs). Healthcare data earlier used to be small, organized, and mostly gathered via electronic health records. However, there is an increase in unstructured and multimodal data due to wearable technologies and IT improvements. The healthcare industry has both opportunities and difficulties because of this data boom. In contrast to other fields, big data analytics has gained significant attention in the healthcare sector in recent years due to its promising nature. Clinicians are using these data to take more evidence-based decisions, which means they are depending less on their professional judgement and education and more on vast amounts of research and clinical data(24). Japan has already started using Big Data technologies to improve medical treatment and healthcare for elderly people. Big Data analytics can be used to achieve valuable information from large and complicated datasets via data mining process. As the world is moving towards digitalization that has created enormous amount of data and the traditional methods could not be used for gaining the insights from these complex data sets here comes the

need for big data analytics. There are many problems involved like computing difficulties, information security, and computational methods, as well as tools how to analyze big data. For instance, a lot of statistical techniques that work well with small data sets don't scale well with large ones. Similar to this, analysing large amounts of data presents considerable hurdles for many computational techniques that work well with small data. So here comes the need why big data analytics is important and how it helps in improving the quality of care and taking informed decisions.

2.2 Need for Study:

The study aims to address the need for leveraging big data analytics in healthcare to unlock valuable insights that can enhance quality of patient care, support clinical decision-making, and address the challenges faced in modern healthcare systems.

2.2.1 Big data analytics is essential in healthcare for several reasons that includes:

- Improving Patient Outcomes: Healthcare professionals can spot patterns and trends in sizable datasets that are not visible in smaller ones. This makes early diagnosis, predictive analytics, and personalized therapy possible, all of which have the potential to greatly enhance patient outcomes. With the advent of imaging modalities like ultrasound, x-rays, computed tomography scanning (CT-scan), magnetic resonance imaging (MRI), and PET scans, the accuracy of diagnostic services has significantly increased. Medical image processing and imaging informatics have transformed the aspects of disease screening and diagnosis in the healthcare sector.

- Operational Efficiency: Big data analytics aids in cost reduction, resource allocation improvement, and operational optimization for hospitals. Data-driven insights can be utilized to accomplish many goals, such as staff scheduling efficiency and predictive maintenance of medical equipment.
- Medical Research: By integrating and analysing massive databases, medical research can be improved and new treatments and therapies can be discovered. It enables scientists to carry out extensive investigations and find the relationships and causes that propel scientific breakthroughs.

Also Big data can be used for disease surveillance and population health management by collecting epidemiological data to study how frequently diseases occur in a particular age group and geographical area and prepare for the intervention of the disease. With an emphasis on computational analysis of biological datasets including genomics, proteomics, transcriptomic, metabolomics, and pharmacogenomics, bioinformatics is an interdisciplinary field encompassing molecular biology, computer science, mathematics, and statistics. Understanding disease processes at the molecular level through the area of bioinformatics has proven to be highly beneficial in developing tailored treatment plans, anticipating patient response to therapeutic interventions, and facilitating disease risk stratification and early identification. Big data analytics has the potential to revolutionize healthcare by advancing medical research, improving patient outcomes, and streamlining operations.

2.2.2 Major Challenges in applying big data analytics in Healthcare:

There are number of major challenges pertaining to security, privacy, data quality, and talent shortages must be addressed for the treatment to be more efficient, effective and patient centered.

- Data Quality and Standardization: Healthcare data is often incomplete, inconsistent, and non-standardized, making it difficult to integrate and analyze. Ensuring data quality and standardization is critical for accurate analytics.
- Privacy and Security: Protecting patient privacy and securing data is paramount. Regulations such as HIPAA impose stringent requirements, but balancing data accessibility with privacy concerns remains a challenge.
- Interoperability: Healthcare data is generated by diverse systems that often do not communicate with each other effectively. Improving interoperability is essential for comprehensive data analysis.
- Talent Shortage: There is a significant shortage of professionals with the skills required to analyze big data effectively. Bridging this talent gap is crucial for harnessing the full potential of big data analytics.

2.2.3 Despite these challenges, there are substantial opportunities:

- Innovation in Healthcare Delivery: Big data analytics can drive innovations in how healthcare services are delivered, leading to more efficient and effective care. By leveraging vast amounts of data from diverse sources, healthcare providers can enhance patient care, optimize operations, and drive medical research. In addition, wearable devices and remote sensors generate continuous data streams that can be analyzed in real-time. This enables proactive monitoring and timely interventions, reducing hospital admissions and enhancing patient care.
- Improved Decision-Making: Data-driven insights can enhance clinical decision-making, operational planning, and policy formulation. Advanced algorithms can predict disease

onset and progression by analyzing historical data and patient trends. This allows for early intervention and preventive measures, significantly improving patient outcomes.

- Cost Reduction: By optimizing resource use and improving operational efficiencies, big data analytics can contribute to significant cost savings in healthcare.

2.3 Research Questions:

1. What is the need for big data analytics in healthcare?
2. How can big data analytics revolutionize healthcare by optimizing patient care?
3. What are the challenges and opportunities of applying big data analytics in healthcare?
4. What are the conclusion and future directions related to big data analytics?

2.4 Objectives:

Broadly, the study i s trying to investigate about the need of big data analytics in healthcare, challenges involved and its future aspects. Also focuses on how big data analytics helps in taking informed and improve patient care. The specific objective of the study are:

1. To understand the need of big data analytics in Healthcare.

2. To understand how big data help in taking informed decisions in healthcare.

3. To study and understand challenges and support in using big data analytics in the Healthcare.

4. To learn about the future aspects of big data analytics in the Healthcare.

2.5 Data Sources and Methods:

2.5.1. Data Sources: This study consists of articles from various sources like:

- Science Direct
- Pub med
- Jstor

2.5.2. Method:

This is a secondary literature review of relevant literature from different sources like Science direct, Pub med and Jstor . Various keywords used are: "Need of Big data analytics", "Need of Big data analytics in clinical decision making Patient based", "Big data analytics in clinical decision making for improved Patient care ", "Framework of Big data analytics for taking informed decisions for patient care" , "Potential of big data analytics for clinical decision making for patient care", "Challenges of big data analytics in clinical decision making for Human

Healthcare", "Barriers in big data analytics in clinical decision making", "Future aspects of big data analytics in clinical decision making in healthcare", "Trends of Big data analytics in clinical decision making for patient care in India . The search was limited to studies published in English from the past decade (2014-2024) to ensure relevance of the literature. Also, we acknowledge that important healthcare components such vital signs, illnesses, patient-specific issues and diseases, and hospital manageability are not reviewed in this study

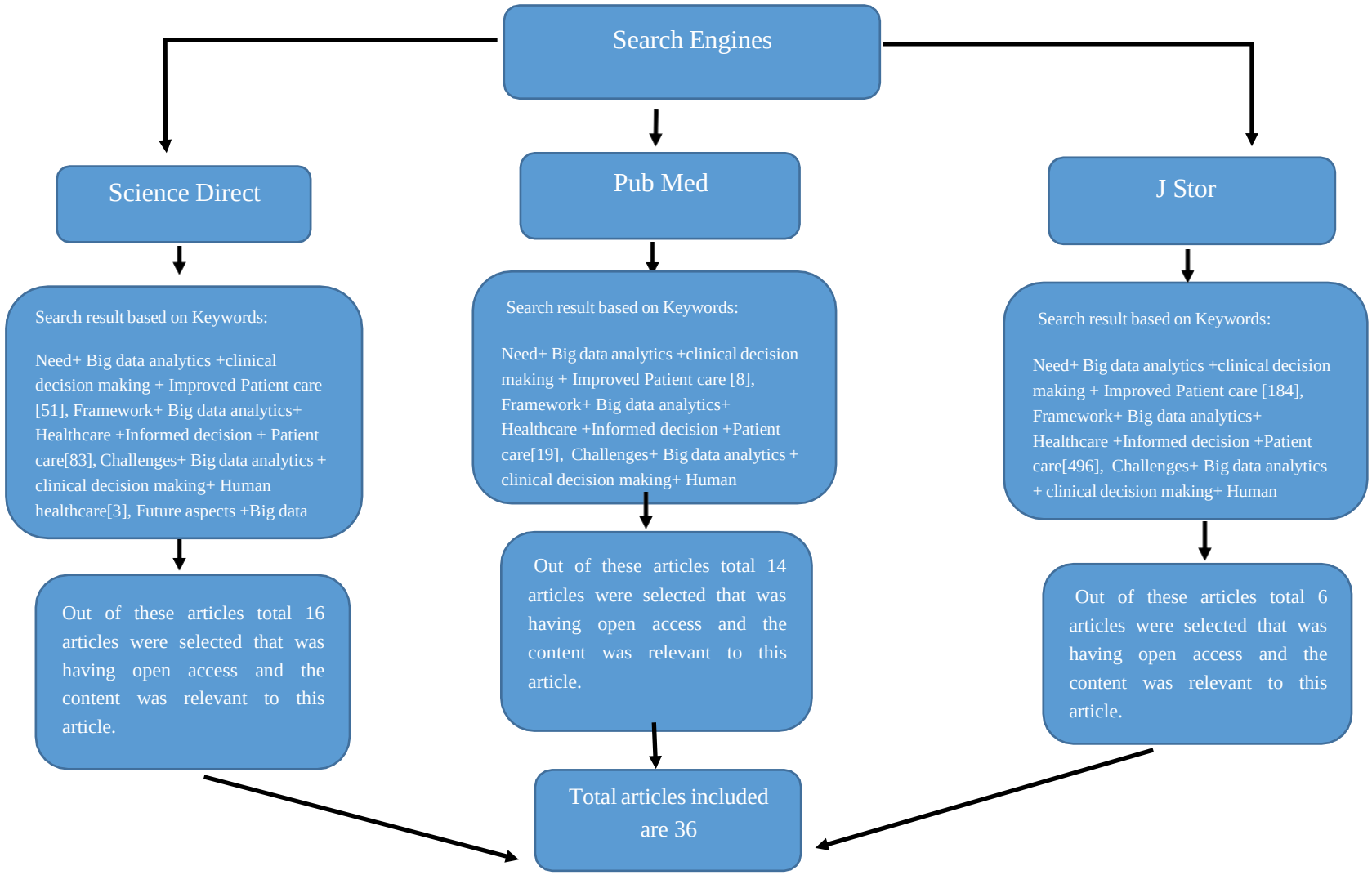

Figure 2: Flow chart showing selection of articles

Table 1: Table showing search process of article selection

Reference Year: 2014-2024											
Search Engine								Number of research articles			
Science Direct		1	2	3	4	5	6	7	8	9	10
Objectives 1											
I	Need	Big data/analytics									1683
			clinical decision making								271

		s		Patient Based								44
II	Need	Big data/analytics	clinical decision making									266
				Improved Patient care								51
III	Utilizing	Big data/analytics										
			Healthcare									352
				Improved Patient care								59
Objectives 2												
I	Framework	big data/analytics										10,431

			Healthcare									3,258
				Informed Decision								428
					Patient care							83
II	Potential	big data analytics										10,983
			clinical decision making									276
				Patient care								157
Objectives 3												
I	Challenges	big data/analytics										12,237

			clinical decision making									1,082
				Human Health Care								3
II	Barriers	Clinical Decision Making	Clinical Decision Making									117
				Health Care								98
Objective 4												
I	Future Aspects	Big data Analytics										36
			Healthcare									21
				clinical decision making								12

II	Trends	Big data analytics										7,861
			Healthcare									2,463
				Decision making								1,781
						Patient care						296
							India					112
Pubmed												
Objective 1												
I	Need	bigdata /analytics										327

			Clinical decision making									51
				Patient based								10
II	Need	Bigdata/ analytics	Clinical decision making									25
				Improved Patient care								8
III	Utilizing	Big data/analytics										846
			Healthcare									242
				Improved Patient care								44

Objectives 2												
I	Framework	big data/analytics										348
			Healthcare									107
				Informed decision								23
					Patient care							14
II	Potential	Big data /Anaytics										913
			clinical decision making									47
				Patient care								19

Objectives 3												
I	Challenges	Big data/Analytics										673
			Clinical decision making									39
				Human Healthcare								17
II	Barriers	Using Big data/Analytics	clinical decision making									105
				Healthcare								62
Objective 4												

I	Future Aspects	Big data Analytics										39
			Healthcare									11
				clinical decision making								1
II	Trends	Big data/analytics										344
			Healthcare									99
				Decision making								16
J stor					Patient care							6
Objective 1						India						0
I	Need	Big data/analytics										9,054

			clinical decision making									952
				Patient								581
II	Need	big data analytics										9,054
			clinical decision making									952
				improved patient care								368
III	Utilizing	big data analytics										192
			Healthcare									54
				Improved Patient care								20

Objectives 2												
I	Frame work											
		Big data analytics										3,017
			Healthcare									615
				Informed decision								305
					Patient care							184
II	Potential	Big data analytics										8,345

			Clinical decision making									936
				Patient care								496
Objectives 3												
I	Challenges	Big data Analytics										6,628
			Human Healthcare									1,114
II	Barriers	Using Big data Analytics	Clinical decision making									198
				Healthcare								119

Objective 4												
I	Future aspects	Big data analytics										4,322
			Healthcare									866
				Clinical decision making								338
II	Trends	Big data Analytics										4,562
			Healthcare									883
				Decision making								682
					Patient care							315
						India						139

Search and selection procedure:

- In Science Direct search was carried out using various keywords: For objective 1 like "Need of Big data Analytics in clinical decision making Patient based", " Need of big data analytics in clinical decision making for improved patient care", "Utilizing Big data analytics in healthcare for Improved Patient care", For objective 2 Key words used were "Framework of Big data analytics in healthcare for taking informed decision for patient care", "Potential of Big data analytics in clinical decision making for patient care" For objective 3 keywords used were "Challenges in Big data analytics in clinical decision making for human healthcare", "Barriers in clinical decision making using Big data analytics in Healthcare. And Lastly to answer objective 4 Key words used are "Future aspects of Big data analytics in healthcare for decision making", "Trends in Big data analytics in healthcare for decision making for patient care in India". Overall details of the articles are mentioned in the table above out of which 16 articles are taken from science direct that was relevant and have open access.
- In Pub med search was carried out using various keywords: For objective 1 like "Need of Big data Analytics in clinical decision making Patient based", " Need of big data analytics in clinical decision making for improved patient care", "Utilizing Big data analytics in healthcare for Improved Patient care", For objective 2 Key words used were "Framework of Big data analytics in healthcare for taking informed decision for patient care", "Potential of Big data analytics in clinical decision making for patient care" For objective 3 keywords used were "Challenges in Big data analytics in clinical decision making for human healthcare", "Barriers in clinical decision making using Big data analytics in Healthcare. And Lastly to answer objective 4 Key words used are "Future

aspects of Big data analytics in healthcare for decision making", "Trends in Big data analytics in healthcare for decision making for patient care in India". Overall details of the articles are mentioned in the table above out of which 14 articles are taken from PubMed that was relevant and have open access.

- In Jstor search was carried out using various keywords: For objective 1 "Need of Big data Analytics in clinical decision making Patient based", " Need of big data analytics in clinical decision making for improved patient care", "Utilizing Big data analytics in healthcare for Improved Patient care", For objective 2 Key words used were "Framework of Big data analytics in healthcare for taking informed decision for patient care", "Potential of Big data analytics in clinical decision making for patient care" For objective 3 keywords used were "Challenges in Big data analytics in clinical decision making for human healthcare", "Barriers in clinical decision making using Big data analytics in Healthcare. Lastly, to answer objective 4 Key words used are "Future aspects of Big data analytics in healthcare for decision making", "Trends in Big data analytics in healthcare for decision making for patient care in India". Overall details of the articles are mentioned in the table above out of which 6 articles are taken from Jstor that was relevant and have open access.

  Total of 36 articles were selected overall.

Chapter 3 Taking Informed Decisions using big data analytics

3.1 Introduction:

Big data analytics has the enormous potential to completely transform the healthcare industry by delivering major gains in patient outcomes, operational effectiveness, and scientific discoveries. However, there are a number of significant loopholes that prevent big data from being used effectively in the healthcare industry. These limitations make it more difficult to integrate, analyse, and use healthcare data in a way that improves patient care and its utilization in clinical decision making . Mostly concerns arises about data quality, standardisation, privacy, security, interoperability, and the lack of qualified personnel(1),(25). Big data analytics in healthcare must be packaged to be transparent, and user-friendly in order to be successful. Big data in real time analytics are a crucial component of healthcare(1). Also, big data analytics converts enormous volumes of data into useful insights, which helps healthcare decision-makers make well-informed decisions. Improved patient care, streamlined processes, population health management, clinical decision support, patient engagement, risk mitigation, and research and innovation are all fueled by these data. Healthcare practitioners can provide more effective, efficient, and patient-centered care by utilising big data(24).

The objective of this study is to thoroughly identify and examine these gaps, investigating their root causes and effects on the provision of healthcare. Through the use of literature review techniques, this study aims to provide practical approaches and creative fixes to close these gaps. The results will give policymakers, software developers, and healthcare organisations insightful

information that will help them fully utilise big data analytics to improve healthcare outcomes and procedures.

Big data undergoes several phases after which the meaningful insights are gained from the healthcare data. The life cycle of big data analytics includes data collection phase, data storage phase, data processing and analysing and knowledge creation phase(26).

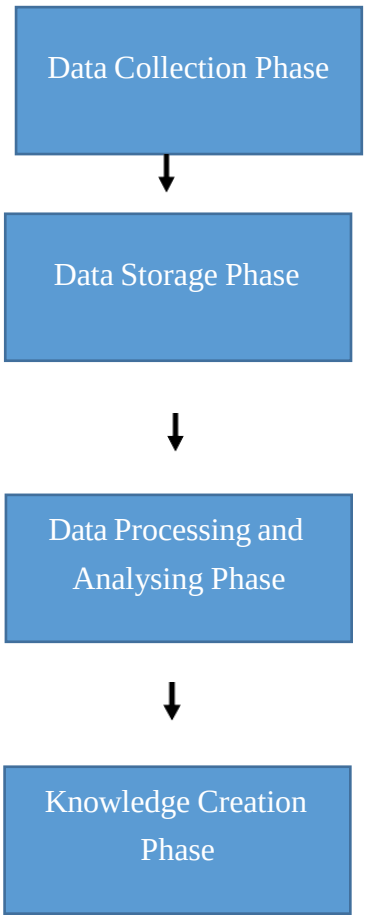

Figure 3: Flow chart showing phases of Big data life cycle

Phases of Big data Life cycle

1. Data Gathering Stage:

Gathering data in several formats from diverse sources is the first step. It is vulnerable to spoofing, spamming, and phishing, among other assaults.

Administrative guidelines should be a part of security measures in order to avoid collecting dangerous or superfluous data and to guarantee that patient privacy is maintained while data is obtained from reliable sources. Sensitive data must be encrypted before being gathered, and all data systems must be secured against theft, loss, misuse, alteration, disclosure, duplication, diversion, and unauthorised access(26),(27).

2. Phase of Data Storage:

Data must be securely stored after it has been gathered to prevent breaches and unwanted access. This calls for the use of encryption and safe storage options.

The long-term security of stored data is ensured by routine audits and security protocol updates.

3. Phase of Data Processing and Analysis:

To extract actionable insights, data is processed and analysed at this phase. Security protocols need to safeguard the data while it's being processed to avoid unwanted access or alteration. Maintaining the reliability of the analytical results depends on maintaining the confidentiality and integrity of the data throughout processing(27).

4. Phase of Knowledge Creation:

The last stage entails turning processed data into knowledge that can be put to use. Security protocols have to guarantee that the insights obtained are distributed safely and only to systems or people that are authorized.

This stage highlights how crucial it is to protect data security and privacy even after it has been examined and turned into knowledge.

3.2 How Big Data Helps in Taking Informed Decisions in Healthcare?

Big data analytics offers a potent toolkit for turning enormous volumes of data into useful insights, which promotes better educated and efficient healthcare decision-making. The following are the main ways that big data analytics improves healthcare decision-making processes:

1. Disease Prevention and Prediction: By examining trends in huge datasets, predictive analytics can identify high-risk patients and predict when diseases will manifest. Timely intervention and preventive care are made possible by early detection. Also Healthcare practitioners can lower hospital readmission rates by identifying patients who are at high risk of readmission and providing focused follow-up care and support(1),(28),(29).

2. Evidence-Based recommendations: By giving physicians data-driven insights and evidence-based suggestions, advanced analytics improve the precision of diagnosis and effectiveness of treatment(24),(30).

3. Real-Time Monitoring: By analysing continuous data from wearables, EHRs, and Internet of Things health monitors in real-time, patient treatment plans can be immediately modified in response to the patient's current state of health(24),(28),(30).

4. Cost management: By using analytics to pinpoint areas of wasteful spending and inefficiencies, healthcare organisations can reduce costs without sacrificing the quality of service they provide. The financial aspects within the healthcare system are highlighted by components like Determination of Copayment Rates, Prevention of Fraud and Abuse, and Prevention of Claims Rejection. The goal of including these elements into the framework is to guarantee effective claims handling, fraud detection, and financial planning(29),(30).

5. Fraud Detection: Big data assists in the detection and prevention of fraudulent activity, saving healthcare providers and insurers a substantial amount of money by looking for trends and abnormalities in billing and claims data(24),(30). People can find gaps, inefficiencies, and areas for improvement by looking at data patterns and trends. This realisation may spark creative thinking, process improvements, and the development of new goods and services(30).

6. Research and Development: In clinical Trials big data analytics speeds up the process of finding qualified participants for clinical trials and the evaluation of trial outcomes, which speeds up the creation of novel therapies. In Medical research the researchers are able to innovate medical treatments and technology by analysing large datasets to uncover new information about disease mechanisms, treatment efficacy, and patient outcomes(28).

7. Enhancing both Performance and Quality: Healthcare companies can discover areas for development and put best practices into effect by benchmarking their performance against peer institutions and industry standards. Also, by carefully examining treatment results, medical professionals can improve clinical guidelines and protocols and raise the standard of care for patients as a whole(29).

Chapter 4 Challenges Utilizing Big data Analytics in Healthcare

2.1 Introduction:

The application of big data analytics in the medical field poses major challenges. Massive volumes of information require extensive analysis, storing, and retrieval due to the increasing growth of healthcare data. Healthcare have generated enormous amount of data from various sources like patient records, medical imaging, genomic data, and real-time patient monitoring. With that much data, traditional database systems are frequently insufficient. Analysis and integration are made more difficult by the fact that a sizable amount of this data is unstructured and includes handwritten notes and natural language. It's hard enough for healthcare organisations to share structured data, but it's considerably harder to share unstructured data but The integration and analysis of this data is required to transform healthcare delivery, improve patient outcomes by contributing to the better clinical decision making. The application of big data analytics in the healthcare industry has the capacity to transform patient care, improve operational effectiveness, and stimulate creative inquiry. Its implementation, though, faces a number of enormous challenges. These encompass matters concerning data integration and compatibility, guaranteeing data accuracy and comprehensiveness, upholding confidentiality and safety, and overseeing expansion and efficiency(25). Additionally, data processing speed is crucial, especially when a patient's health rapidly deteriorates and real-time applications like cloud computing are required. Developing and implementing predictive models and advanced analytics, filling in the skill gaps in the healthcare industry, and handling ethical and social issues are further difficulties. However, these applications

also pose privacy and security concerns regarding data. Strategic planning, strong technology solutions, and ongoing stakeholder engagement are needed to overcome these obstacles(31). The healthcare sector continues to face economic difficulties due to its heavy reliance on paid services, which can delay technological progress. Finally, the quality of data is paramount, with issues such as data heterogeneity, lack of structure, and noise adding to the complexity of healthcare analytics. It will take a multifaceted strategy that includes workforce development, legislative changes, technology breakthroughs, and strategic partnerships to close the gaps in big data analytics in the healthcare industry.

2.2 Barriers in Integrating Big Data Analytics to Healthcare:

Utilizing big data analytics in healthcare comes with several significant challenges that need to be addressed to fully leverage its potential for improving patient care, operational efficiency, and research. Here are the key challenges:

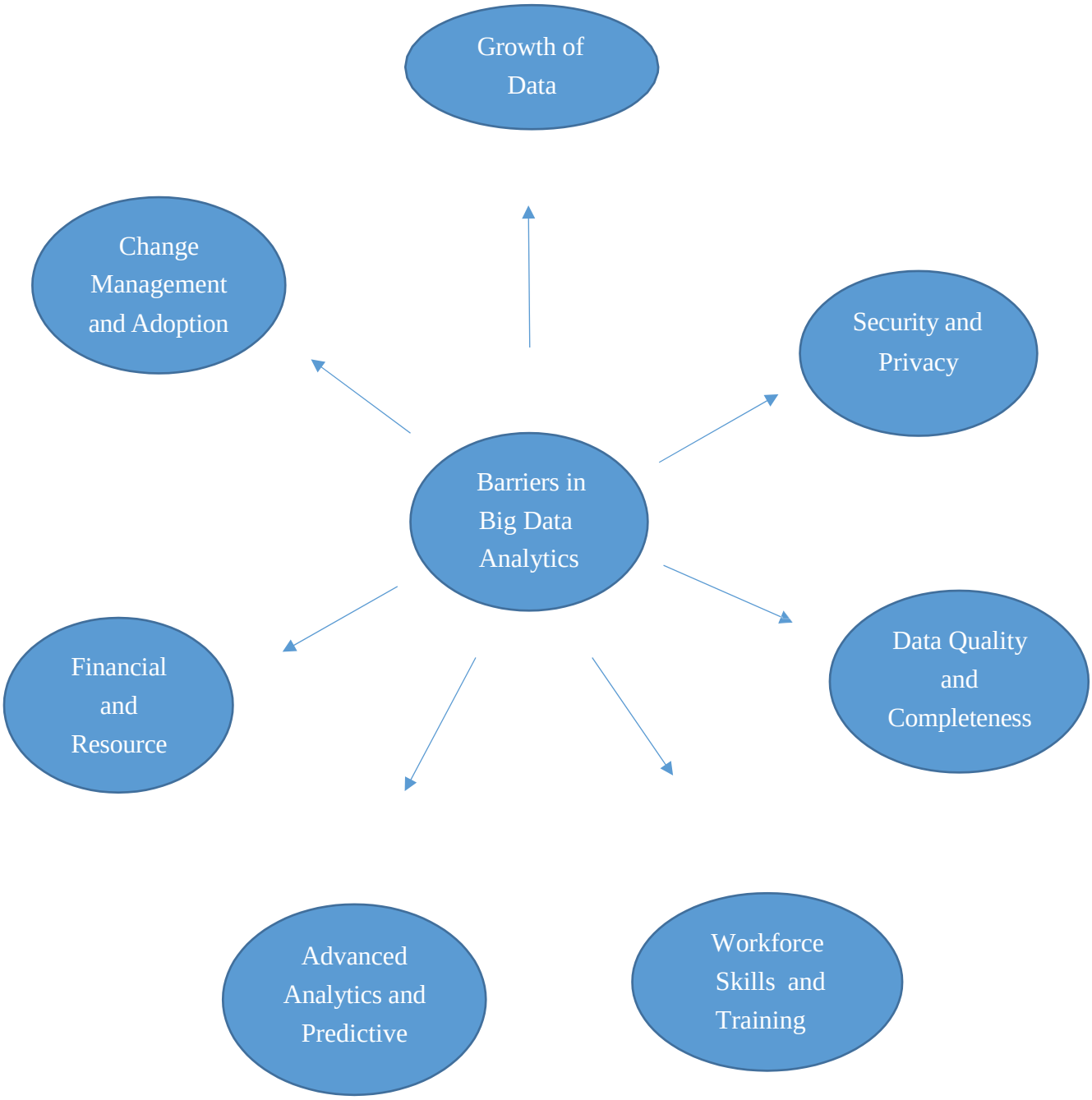

Figure 4: Barriers in Big data Analytics

2.2.1 Growth of Data Exponentially:

The rapid expansion of healthcare data poses significant challenges to the analysis, archiving, and retrieval of significant quantities of data. Such large datasets cannot be processed by traditional database systems. The rapid and unceasing expansion of healthcare data from various sources like (e.g., clinical data, genomic data) poses obstacles to the processing, retention, and retrieval of substantial data sets. Conventional database systems are not capable of managing this volume of data(31)(28). Thus advanced management techniques are required in order the gain insights from the data to improve the quality of healthcare.

2.2.2 Security and Privacy:

The application of big data analytics in the healthcare industry raises a number of security and privacy issues. The main source of security issues is the vulnerability of healthcare databases to cyberattacks. These hazards are increased by the integration of several medical Internet of Things (MIoT) devices, as these devices frequently have weak security protections and are readily targeted by hackers. Because of this expanded attack surface, healthcare systems are now more susceptible to denial-of-service (DoS) attacks and unauthorized access. Strong security methods that are lightweight and scalable must be created to guard MIoT devices and guarantee the safe transfer of data in order to reduce these dangers(32). Network security and patient data protection can be achieved with the use of solutions like block chain and encrypted data transmission(32). It is critical to protect sensitive healthcare data's privacy and security. A major worry is the possibility of illegal access and data breaches, especially when using cloud computing for data processing. Ensuring that only authorized personnel have access to sensitive

information is the goal of data security, which entails monitoring data access throughout its lifecycle. The incident covered by Forbes magazine highlights the significance of privacy considerations in big data analytics. The incident involved Target Corporation sending baby care coupons to an adolescent girl without her parents' knowledge. This incident emphasizes how important it is for developers to make sure that, even when privacy laws and applications change, sensitive data is protected and that their apps follow privacy agreements(33),(34),(31). Healthcare organisations need to be aware of the risks and legal obligations that come with handling personal data, particularly in relation to the complex and expanding set of data privacy regulations. The rules and policies pertaining to data privacy vary throughout nations, which further complicates the handling of medical data. Based on the basic privacy laws, governments pass additional laws, policies, and regulations to protect personal health care information, such as HIPAA in the US, Health Records and Information Privacy Act 2002 in Australia, and Medical Privacy Act and Healthcare Insurance Act in France(28). In India IT Act and IT (Amendment) Act focuses on the implementation of appropriate security measures for sensitive personal data or information. Also, offers compensation to anyone affected by unjustified loss or gain and provides imprisonment and/or fine to any individual who discloses another person's personal information while performing services(33)(28).

2.2.3 Data Quality and Completeness:

Ensuring the quality and completeness of healthcare data is made more difficult by its various format, which includes unstructured, semi-structured, and structured data. Patient data, test results, and billing data are examples of structured data that adhere to predetermined conventions

and are comparatively simpler to handle. However, because of their various and frequently irregular formats, semi-structured data from sensors and devices as well as unstructured data like clinical notes and biological literature provide substantial hurdles(24),(31). Addressing problems with the data, such as errors, inconsistencies, and incompleteness, is necessary to ensure data quality. These problems can have several causes, such as inaccuracies in manual data entry, disparities in data from multiple sources, and incomplete information. The stakes are especially high in the healthcare industry since low-quality data can result in inaccurate diagnosis, ineffective treatments, and ultimately harm to patients. The degree to which all necessary data is available and accounted for is referred to as data completeness. This is frequently troublesome in the healthcare industry because of disjointed data systems and the vast amount of data produced. It might be challenging to provide comprehensive care and make well-informed clinical judgements when there are gaps in patient records caused by incomplete data.

To overcome these obstacles, advanced data curation methods are needed to convert unprocessed data into knowledge that can be put to use. This entails reducing the complexity of the data, finding relationships between health characteristics, and choosing relevant target attributes for research. To ensure that healthcare data is accurate, comprehensive, and dependable for use in analytics and decision-making processes, sophisticated big data tools and technologies are required to manage these duties efficiently.

2.2.4 Workforce Skills and Training: Work force training is one of the major problem in big data analytics. Different systems often use incompatible formats and standards, making it difficult to achieve a unified approach to data management and analysis so the working professionals need to be trained accordingly and that require huge amount of time, money and human labor(28).

2.2.5 Advanced Analytics and Predictive Modeling:

Large amounts of healthcare data cannot be stored or analysed due to a lack of suitable infrastructure. This covers both the hardware needed for successful data processing and analysis as well as the computational power needed(31). In healthcare, timely data processing is very important and critical, especially in situations where patient conditions can change rapidly. The need for real-time analytics places additional demands on data infrastructure, requiring fast and efficient data handling capabilities(25). Usually advanced analytical process is required to analyze larger data sets and to gain insights out of it.

2.2.6 Financial and Resource Constraints:

Healthcare organizations need to commit significant financial resources and human capital to the implementation of digital technology and big data analytics. Many nations may find it difficult to integrate the required technical developments into their healthcare systems, especially those with low resources(34). For many healthcare organizations, the hefty costs of implementing and maintaining big data analytics systems—which include expenditures in infrastructure, software, and training—can be unaffordable. The costs associated with adopting and maintaining big data technologies can be prohibitive for many healthcare providers, impacting the overall advancement of technology in the sector(34),(28).

2.2.7 Change Management and Adoption:

Companies thinking about implementing BDAs faces a number of obstacles, including a lack of knowledge, worry, reluctance to change, and the limitations of the technology itself.

Organizations and healthcare personnel may be reluctant to accept new technology because they are uneasy about the changes, untrained, or doubtful about their advantages. Proving the worth of big data analytics and implementing efficient change management techniques are necessary to overcome this reluctance(34).

These challenges highlight the complexity of integrating big data analytics into healthcare and underscore the need for ongoing research and development to address these issues effectively.

Chapter 5: Conclusion

The conclusion stresses the importance of managing the data life cycle to optimize data utilization in healthcare. It identifies key challenges such as data collection, security, privacy, EHR integration, and real-time data availability. Despite the challenges of storing, searching, capturing, sharing, and analyzing data, as well as issues related to real-time processing, data quality, privacy, security, and heterogeneous data, big data analytics has shown promising improvements in healthcare industry decisions. Effective data life cycle management leads to better data quality, reduced risks, and improved consistency, ultimately supporting enhanced decision-making in healthcare. The integration of big data analytics into healthcare systems presents a transformative opportunity to enhance patient care and clinical decision-making. By harnessing the vast amounts of data generated within healthcare, big data analytics can provide valuable insights that lead to more informed, data-driven decisions. This not only improves the quality of care but also optimizes operational efficiencies and outcomes. However, the implementation of big data analytics comes with challenges, including data privacy, security, and the need for advanced tools and frameworks. Overcoming these challenges requires a concerted effort to develop scalable, efficient, and secure data management practices. Ultimately, the successful adoption of big data analytics in healthcare will revolutionize the industry, paving the way for more personalized, precise, and effective healthcare solutions.

Also, considering about the future Artificial intelligence (AI) plays a major role in improving the quality of healthcare. The use of big data analytics in healthcare appears to have a bright future. The capabilities of data analytics will be further improved by emerging technologies like artificial

intelligence, machine learning, and the Internet of Things, which will result in ever more accurate and customized healthcare treatments. Better collaboration between healthcare providers will be facilitated by interoperability and data standardization, which will enable smooth data sharing and integration.

REFERENCES

1. Raghupathi W, Raghupathi V. Big data analytics in healthcare: Promise and potential. Heal Inf Sci Syst. 2014;2(1):1–10.

2. Dicuonzo G, Galeone G, Shini M, Massari A. Towards the Use of Big Data in Healthcare: A Literature Review. Healthc. 2022;10(7).

3. Ahmad I, Asghar Z, Kumar T, Li G, Manzoor A, Mikhaylov K, et al. Emerging Technologies for Next Generation Remote Health Care and Assisted Living. IEEE Access. 2022;10(March):56094–132.

4. Cavanillas JM, Curry E, Wahlster W. New Horizons for a Data-Driven Economy: A Roadmap for Usage and Exploitation of Big Data in Europe. New Horizons a Data-Driven Econ A Roadmap Usage Exploit Big Data Eur. 2016;1–303.

5. Patgiri R, Ahmed A. Big Data: The V's of the Game Changer Paradigm. Proc - 18th IEEE Int Conf High Perform Comput Commun 14th IEEE Int Conf Smart City 2nd IEEE Int Conf Data Sci Syst HPCC/SmartCity/DSS 2016. 2017;(April):17–24.

6. Zhou C, Su F, Pei T, Zhang A, Du Y, Luo B. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information . 2020;(January).

7. Fatima T, Jyothi S. Big data analytics in health care. Adv Intell Syst Comput. 2020;1054(4):377–87.

8. Saranya P, Asha P. Survey on Big Data Analytics in Health Care. Proc 2nd Int Conf Smart Syst Inven Technol ICSSIT 2019. 2019;5(4):46–51.

9. Muhunzi D, Kitambala L, Mashauri H. Big Data Analytics in the Healthcare Sector : Opportunities and

Challenges in Developing Countries . A Literature Review. 2023;1–17.

10. Ahmed A, Xi R, Hou M, Shah SA, Hameed S. Harnessing Big Data Analytics for Healthcare: A Comprehensive Review of Frameworks, Implications, Applications, and Impacts. IEEE Access. 2023;11(October):112891–928.

11. ALEXANDRU AG, RADU IM, BIZON ML. Big Data in Healthcare - Opportunities and Challenges. Inform Econ. 2018;22(2/2018):43–54.

12. Gui H, Zheng R, Ma C, Fan H, Xu L. An architecture for healthcare big datamanagement and analysis. Lect Notes Comput Sci (including Subser Lect Notes Artif Intell Lect Notes Bioinformatics). 2016;10038 LNCS(February):154–60.

13. Viceconti M, Hunter P, Hose R. Big Data, Big Knowledge: Big Data for Personalized Healthcare. IEEE J Biomed Heal Informatics. 2015;19(4):1209–15.

14. Dash S, Shakyawar SK, Sharma M, Kaushik S. Big data in healthcare: management, analysis and future prospects. J Big Data [Internet]. 2019;6(1). Available from: https://doi.org/10.1186/s40537-019-0217-0

15. Stylianou A, Talias MA. Big data in healthcare: a discussion on the big challenges. Health Technol (Berl) [Internet]. 2017;7(1):97–107. Available from: http://dx.doi.org/10.1007/s12553-016-0152-4

16. Cox M, Ellsworth D. Application-controlled demand paging for out-of-core visualization. Proc IEEE Vis Conf. 1997;235–44.

17. Wang Y, Kung L, Ting C, Byrd TA. Beyond a technical perspective: Understanding big data capabilities in health care. Proc Annu Hawaii Int Conf Syst Sci. 2015;2015-March(January):3044–53.

18. Batko K, Ślęzak A. The use of Big Data Analytics in healthcare. J Big Data [Internet]. 2022;9(1). Available from: https://doi.org/10.1186/s40537-021-00553-4

19. Bouhriz M, Chaoui H. Big data privacy in healthcare moroccan context. Procedia Comput Sci [Internet]. 2015;63(December 2015):575–80. Available from: http://dx.doi.org/10.1016/j.procs.2015.08.387

20. Islam MS, Hasan MM, Wang X, Germack HD, Noor-E-alam M. A systematic review on healthcare analytics: Application and theoretical perspective of data mining. Healthc. 2018;6(2).

21. Galetsi P, Katsaliaki K, Kumar S. Values, challenges and future directions of big data analytics in healthcare: A systematic review. Soc Sci Med [Internet]. 2019;241(July):112533. Available from: https://doi.org/10.1016/j.socscimed.2019.112533

22. Khanra S, Dhir A, Islam N, Mäntymäki M. Big data analytics in healthcare: a systematic literature review. Enterp Inf Syst [Internet]. 2020;14(7):878–912. Available from: https://doi.org/10.1080/17517575.2020.1812005

23. Nopany S, Manonmani S P. Applications of Big Data Analytics in Healthcare Management Systems. J Univ Shanghai Sci Technol. 2021;23(06):1167–82.

24. Palanisamy V, Thirunavukarasu R. Implications of big data analytics in developing healthcare frameworks – A review. J King Saud Univ - Comput Inf Sci [Internet]. 2019;31(4):415–25. Available from: https://doi.org/10.1016/j.jksuci.2017.12.007

25. Awrahman BJ, Aziz Fatah C, Hamaamin MY. A Review of the Role and Challenges of Big Data in Healthcare Informatics and Analytics. Comput Intell Neurosci. 2022;2022.

26. Khaloufi H, Abouelmehdi K, Beni-Hssane A, Saadi M. Security model for big healthcare data lifecycle. Procedia Comput Sci [Internet]. 2018;141:294–301. Available from: https://doi.org/10.1016/j.procs.2018.10.199

27. Rahul K, Kumar R. ScienceDirect ScienceDirect Data Life Cycle Management in Big Data Analytics.

Procedia Comput Sci [Internet]. 2020;173(2019):364–71. Available from: https://doi.org/10.1016/j.procs.2020.06.042

28. Hong L, Luo M, Wang R, Lu P, Lu W, Lu L. Big Data in Health Care: Applications and Challenges. Data Inf Manag [Internet]. 2018;2(3):175–97. Available from: http://dx.doi.org/10.2478/dim-2018-0014

29. Jabbar MA, Kumar S, Kumar A, Shandilya S. Applications of cognitive internet of medical things in modern healthcare. Comput Electr Eng [Internet]. 2022;102(July):108276. Available from: https://doi.org/10.1016/j.compeleceng.2022.108276

30. Ramalingam S, Subramanian M, Sreevallabha A, Tarakaramu N, Khan MI, Abdullaev S, et al. Exploring business intelligence applications in the healthcare industry : A comprehensive analysis. Egypt Informatics J [Internet]. 2024;25(September 2023):100438. Available from: https://doi.org/10.1016/j.eij.2024.100438

31. Pastorino R, De Vito C, Migliara G, Glocker K, Binenbaum I, Ricciardi W, et al. Benefits and challenges of Big Data in healthcare: An overview of the European initiatives. Eur J Public Health. 2019;29:23–7.

32. Siriwardhana Y, Gür G, Ylianttila M, Liyanage M. The role of 5G for digital healthcare against COVID-19 pandemic: Opportunities and challenges. ICT Express [Internet]. 2021;7(2):244–52. Available from: https://doi.org/10.1016/j.icte.2020.10.002

33. Abouelmehdi K, Beni-Hssane A, Khaloufi H, Saadi M. Big data security and privacy in healthcare: A Review. Procedia Comput Sci [Internet]. 2017;113:73–80. Available from: http://dx.doi.org/10.1016/j.procs.2017.08.292

34. Monferdini L, Pini B, Bigliardi B, Bottani E. Challenges and opportunities of digitalization in the healthcare supply chain: A literature review. Procedia Comput Sci [Internet]. 2024;232(2023):2220–9. Available from: https://doi.org/10.1016/j.procs.2024.02.041

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