PREDICTIVE ANALYSIS ON MEDICINE AND DOCTORS AVAILABILITY IN GOVERNMENT HOSPITALS

A PROJECT REPORT

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Under the guidance of,

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in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

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At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

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PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **“PREDICTIVE ANALYSIS ON MEDICINE AND DOCTORS AVAILABILITY IN GOVERNMENT HOSPITALS”** being submitted by “DARSHAN.R.N , TEJASHWINI.K.T , SATHYA.R” bearing roll number(s) “20211IST0008 , 20211IST0010 , 20211IST0012” in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Information Science and Technology is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **PREDICTIVE ANALYSIS ON MEDICINE AND DOCTORS AVAILABILITY IN GOVERNMENT HOSPITALS** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Information Science and Technology**, is a record of our own investigations carried under the guidance of **MR. SRINIVAS MISHRA, ASSISTANT PROFESSOR, School of Computer Science Engineering & Information Science, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

One of the critical factors in public welfare is access to healthcare facilities, especially government hospitals, where most of the section of the people seek health services. This paper aims at providing a predictive analytical framework for solving two vital concerns: availability of essential drugs and doctors' distribution at government hospitals. It is through historic data, algorithms of machine learning, and statistical models that the framework detects these patterns and trends governing availability and resource utilization. Patient inflow, disease seasonality, inventory logistics, and the scheduling of staff are analysed to determine future demand understock or overstock tendencies. The paper discusses the use of predictive analytics within management systems for the hospital streamlining decision making on the part of the administrator. Shortages in service provision can be predicted using shortages in shortage medicines or absence of some crucial staff members.

The findings suggest the potential for how predictive analytics could aid in significant improvements in decision-making, reduction of wastage of resources, and improvement in patient satisfaction in government hospitals. This research, therefore, establishes the transformative nature of data-driven approaches in the optimization of public healthcare systems.

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CHAPTER-1

INTRODUCTION

1.1 Sub-topic-1

All drugs need to be provided by the public health care delivery system, as well as an adequate number of doctors and medical men, so that service can be delivered with expedience and quality to the patient. Operational inefficiencies at government hospitals in India are not unknown: lack of medicines in hospitals during disease outbreak and short fall of doctors due to an overwhelming response from patients are common scenarios. Such operational inefficiencies could easily jeopardize the care for the patients, more especially during holidays and peak season periods.

1.1.1 Sub topic-1 of Sub topic-1

To address such concerns, "predictive analysis on medicine & doctors availability in government hospitals" is designed to utilize the capability of predictive analytics towards two significant objectives:

1. Medicine Availability Optimization by predicting demand based on historical as well as real-time patient data, and
2. Efficient Hospital by optimizing the presence of doctors and specialists with inflow pattern of patients.

1.2 Sub topic-2

Through this, the analysis of patient data, disease trends, and resource utilization at hospitals will enable the system to generate actionable insights. This proactive measure ensures that all critical medicines are on hand and adequate staff are in place even for emergencies, peak times, and unpredictable outbreaks. The target audience is mainly the Indian Government healthcare department since it needs improvement in the operational functions at public hospitals so better services can be rendered to the citizens.

With advanced analytics, government hospitals can ensure the following:

Medicine supply to avoid shortage.

Optimal staffing of doctors and specialists to reduce the waiting time of patients.

Preparedness for emergencies by forecasting demand surges.

1.3 Sub topic-3

This project, therefore, aligns with the government's mission of accessible and efficient healthcare for all citizens but, at the same time, shows how data-driven solutions can transform public healthcare infrastructure into better patient care, reduced inefficiencies, and resource utilization.

CHAPTER-2

LITERATURE SURVEY

1. If it has the hospital information system based on history and present time data of patients, it could well predict the amount of medicine and doctors required during an epidemic time. Thus, during such a situation, those facilities would be in place, reducing the risk brought about by no medicines or absent medical staff to the critical time. Technologically, it talks about the use of tools such as HTML, CSS, MySQL, and JavaScript while developing the system as well as statistical techniques using R for analysis of data and predictive modelling. The predictive mechanism would include the use of algorithms from random forest that are related to classification as well as trends that can be forecasted through previous data. [1].

2. It asserts that with the introduction of big data techniques, the issue of operationalization issues regarding storage, analysis, and transformation would be resolved. This is further discussed about how unstructured health care data in terms of patient notes and clinical records would improve predictive analytics, innovation, and better-informed decisions for health care organizations.[2]

3. This paper reviews the most relevant literature on dynamic capabilities and how firms develop these capabilities to respond to environmental changes, building on the resource-based view (RBV), which asserts that sustainable competitive advantage comes from valuable, rare, and inimitable resources. However, RBV is limited in dynamic environments.[3].

4. The paper discusses in detail how big data analytics is changing the healthcare industry. It is focused on the way huge amounts of data contribute to betterment

of patient outcomes, operational efficiency, and cost-effectiveness. The book provides a broad overview to the reader regarding big data applications in health care-disease pattern detection, outbreak prediction, and more personalized treatment options. Further, the architectural frameworks and methodologies to be used for such implementation are elaborated upon. Except for that, this paper provides many real examples of how analytics make healthcare more effective. [4].

5. This paper addresses the health information system designs whose predictability a hospital possesses or does not for the same stock of medication to be acquired. It exactly applies a type of tool namely, regression analysis falls within what has been termed and categorized a "machine learning. It aims at improving and confirming supplies of essential drugs during periods of influenza seasons or epidemics and, as such, offers a system of predictability over its outputs. It thus becomes a system whose inadequacies with regards to drugs will reduce over time even as efficiencies increase at the center level for those government institutions [5].

6. This paper is on data governance; that is, how data management ensures security and quality in an institution. Big Data analytics defines policy around ownership of data, its privacy, security, and compliances. It brings strategic discourse on the imperative for the efficient governance of Big Data which ought to respond both to the corporative as well as to IT governance as well as ITA or EA. Being different from conventional data governance, Big Data governance must cover the structured and the unstructured ones. Agreement of such success big data must come along with aligned strategies set from the organizational view and objective[6].

7. The Paper discusses the approach for big data produced in daily quantities. All

the areas could apply for predicting analytics as huge as this kind. This will speak to how data transformation, having big power and showing the hitherto unable to do prediction outcomes that people were unable to make in its absence. The authors further discussed implications for society, which included ethical considerations and proper use of data.[7]

8. The application of big data technology enables one to move closer to good choices, orientation of the educational experience around learner needs, and quality of educational outcomes. Issues associated with it include matters related to privacy and personable data in usage, requires technical know-how in analyzing the same, and tendency to draw wrong conclusion. With this in perspective, this research, therefore, demonstrates on how the same application of big data technology could advance and hinder.[8]

Sl.no	Title of the Paper	Authors	Technology/Concept Used	Results/Findings	Limitations/ Challenges	Year
1	Analysis on Medicine and Doctor Availability in Government Hospitals	M.D.Boomija, M.I.Almas Banu, K. Anu Priya	Data Analysis Methods: statistical tools and data visualization, Survey / Questionnaire Techniques, Database / Inventory Analysis	Availability Issues, Shortage of Doctors, Impact on Patients, Urban-Rural Disparity.	Data Collection Issues, Scope Constraints, Generalization Challenge, Dynamic Nature of Availability.	2019
2	Beyond a Technical Perspective: Understanding Big Data Capabilities in Health Care.	Yi Chuan Wang, LeeAnn Kung, Chaochi Ting	Big Data Analytics Tools like machine learning, predictive analytics, and data mining techniques. Data exchange standards (such as HL7, FHIR) for	Improved Decision-Making, Operational Efficiency, Big data helps in epidemic tracking and preventive	Data privacy and compliance with regulations like HIPAA and GDPR. Lack of Skilled Workforce, and there is a risk	2015

			seamless sharing across systems.	measures, improving public health policies through real-time insights.	that biased or incomplete data may lead to inaccurate predictions or exacerbate health disparities.	
3	Dynamic capabilities: An exploration of how firms renew their resource base.	Ambrosini, V., Bowman, C. & Collier, N	Resource-Based View (RBV) Extension, Qualitative case studies and theoretical insights are used to illustrate how firms leverage organizational routines, learning, and innovation to renew their resources.	Three Levels of Dynamic Capabilities Identified: Incremental Capabilities, Renewal Capabilities, Regenerative Capabilities	The paper emphasizes that dynamic capabilities may not have universal applicability—certain industries or firms may benefit more than others based on market conditions.	2009
4	Big data analytics in healthcare: promise and potential.	Raghupathi W	Machine Learning, Natural Language Processing (NLP), Big Data Platforms, Data Mining, Cloud Computing, AI-based Diagnostic Tools: Supporting clinical decisions	Predictive analytics helps identify at-risk patients and prevent diseases. Real-time monitoring through IoT and wearables improves	Infrastructure, software, and talent investment required for big data platforms. Questions around the transparency and	2019

				chronic disease management.	accountability of AI-driven decisions.	
5	Predictive Mechanism for Medicines Availability in Government Health Centers.	Neeraja, Pradeep Kumar J	Big Data Analytics Tools and Techniques: Machine Learning (ML) and Data Mining for predictive analytics, Cloud Computing for scalable storage, Distributed Systems (e.g., Hadoop, Spark) to manage large datasets efficiently	IoT and wearable devices enable continuous monitoring and foster proactive care.	Poorly curated datasets or biased algorithms can lead to inaccurate predictions, especially for minority populations.	2020
6	A Trusted Data Governance Model For Big Data Analytics	C. Mohanapriya	Technologies like Role-Based Access Control (RBAC) and encryption ensure that only authorized users access sensitive data. Blockchain technology is explored to ensure data integrity and create immutable audit logs.	Enhanced Data Quality and Trust, Improved Data Security and Access Control, Better Decision-Making Support.	Keeping up with evolving regulations (such as GDPR updates) can be a challenge, requiring continuous monitoring and adjustments.	2014
7	The Predictive Power of Big Data	Aiden, E., Michel	Big Data Analytics, Natural Language Processing (NLP),	The research demonstrates that society's	Words can change meaning over	2014

			Predictive Analytics Framework.	collective memory follows an exponential decay, with events and individuals fading from public discourse at predictable rates.	time, complicating analysis, and historical texts may not always reflect real public sentiment.	
8	Big Data and analytics in higher education: Opportunities and challenge	Ben K. Daniel	Learning Analytics (LA) and Educational Data Mining (EDM): Tools for analyzing student behaviour, learning outcomes, and academic performance to provide insights for personalized learning.	Big data enables data-driven policies regarding curriculum design, resource allocation, and course offerings. Administrative processes such as admissions and staffing are optimized with operational analytics.	Predictive models may suffer from bias if historical data is incomplete or unrepresentativ e, leading to unfair decisions.	2015

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

1. Quality and Availability of Data:
Insufficient Data Gathering: Government hospitals do not maintain a uniform mechanism for gathering time-sensitive, quality data on inventory of medicines and availability of doctors.
Incomplete Reports: Historical data for patient load, medicine usage, and staff availability may be unaccounted for or scattered.
Data Integration Problem: Integration problem from different sources such as patient records, hospital administration systems, and government databases.

2. Design and Quality of Predictive Model:
Lack of Models Focusing on Regional Specifications: Predictive models used tend to be universal in their scope, do not focus on region-specific patterns that vary between time due to disease prevalence or other reasons related to season and locality, healthcare access etc.
Minimal Implementation of Cutting Edge Technologies: Federation Learning, Reinforcement learning and models capturing Spatio temporal Patterns haven't yet received widespread applicability
Model Inclinations-These could possess some sort of inclinations with past trends.

3. Scalability &Ease of Application:
Limited Scalability: Most models are designed for small-scale systems and do not scale well when implemented to cover large hospital networks.
Real-Time Predictive Systems: There is little research on real-time analytics and decision-making systems that can dynamically allocate medicines and doctors.
Cost Constraints: There is a lack of focus on cost-effective solutions targeted at resource-poor government hospitals.

4.Integration with Healthcare Policies:
The regulation gaps, due to which predictive systems never get incorporated into government policies and operational workflows, are exceedingly rare.
Also, some compliance with regulations creates a particular challenge with regard to data privacy and security regulation, whether they fall under HIPAA or any local equivalents.

5.User Adoption and Training:
Little consideration has been afforded to the requirements of usability and training, particularly so among hospital staff or administrators for predictive models.
Few of the barriers for research have drawn forth is that there is, as a matter of

fact, resistance to implementing technology, especially among low-resource contexts.

6.Healthcare Disparities:
Preferred Areas: predictive analysis presents a preference of urban hospitals over rural establishments, thus expressly leading to an unequal resource allocation.
Ignored socioeconomic conditions: the majority of models fail to include factors that would put pressure on pharmaceutical demand or provide enough doctors.

7. Evaluation and Impact Analysis:
The effects of studied models on hospital departments and patients longitudinally will be assessed. Benchmarking of predictive systems against more traditional or non-AI methods, therefore, proved a challenge.

These gaps, thus filled, will allow the new systems to design better and more equitable predictive systems geared toward optimizing healthcare resource management in government hospitals. Predictive analysis on the medicine and doctors' availability demand in government hospitals fails to address critical gaps. Some of the challenges here are that they are developed largely in isolation and hence featured many outmoded and often poor-quality records if there are any at all, which works against the reliability of prediction. Although this is possible, it does not occur in many models because of the inability to accommodate the disparities in healthcare infrastructures and demographics in different regions. Due to lack of understanding of such external factors, such as seasonal trends, disease outbreaks, and socio-economic influences, most of these systems lack robustness in dealing with dynamic demands for healthcare. Serious accuracy issues remain, because most models are classical statistical approaches that do not deploy advanced machine learning methods and omit essential important factors such as patient arrival rates or treatment times. Because of the poor integration of predictive tools into hospital governance, they are not much use; that lack of cohesion in different divisions has introduced extra challenges since government hospitals face such difficulties due to disconnected IT systems. The current models are often biased toward urban regions and lack a representation of rural and underserved populations. In other words, due to a lack of actionable insights or simple-to-use dashboards, hospitals are hindered from real-time decision-making. Ethical and privacy issues, as well as issues connected with data protection laws and the right of patients to anonymity, have not yet been given adequate attention. A higher implementation and upkeep cost, focused particularly on the government hospitals on behalf of other drawbacks, does exist. Lastly, poor collaboration between policymakers, healthcare administrators, and technology developers, along with the lack of standardized evaluation metrics and feedback mechanisms, limits the refinement and benchmarking of these predictive systems. Addressing these gaps requires a holistic approach that combines robust data integration, advanced analytics, stakeholder collaboration, and adherence to ethical standards.

CHAPTER-4

PROPOSED MOTHODOLOGY

It has several steps, and they are listed below:

1)Defining Objectives:-

Identifying Goals: To know what you wish to achieve-it may be increasing drugs for inventory, changing doctor schedules, or decreasing wait times for patients.

Key Performance Indicators-KPIs: To know what you will measure in order to assess the predictive models' performance-for instance, the accuracy of predictions, number of stockouts.

2).Data Collection:-

Identify data sources: collection for data may be through many sources of data, such as:

Electronic health records (EHRs)

Pharmacy management systems

Appointment scheduling systems

External data sources-for example, health population statistics

Quality of data evaluation-summary evaluation for completeness, accuracy, and consistency of data sourced out.

3).Data Preprocessing:-

Data cleaning: Identifying and correcting any missing values, outliers, and inconsistencies in the dataset.

Data transformation: Normalize or standardize the data; create any derived variables; consolidate the data into groups as necessary.

Feature selection: Find relevant features for predictive modelling; this can range from historical demand patterns to, for example, seasonality and demographics.

4).Exploratory Data Analysis (EDA):-

Visualizations: Using graphics and charts to see trends, patterns, or relationships.

Statistical analysis: Using appropriate statistical tests to ascertain relationships and distributions.

5)Model Selection:-

Algorithms: selection of suitable predictive models with influence deriving both from the type of data and the objectives. This often includes:

Time-series forecasting; ARIMA and Exponential Smoothing

Regression: linear regression and logistic regression

Machine Learning Models: decision trees; random forests; neural networks.

Clearly state why some models were picked, along with reasons for making such picks, based on data characteristics and prediction concerns.

6). Model training and validation:

Data splitting: To verify the performance of the split model, divide your dataset into two subsets, possibly an 80/20 split: training and testing.
Training: Train the chosen models on the training dataset.
Validation: Verify how the model actually performs on a test set according to some suitable measures, for example, mean absolute error or root mean squared error for regression problems or accuracy for classification tasks.

7).Model Tuning:

Hyperparameter Optimization: The model parameter values are tuned to obtain the best possible accuracy. This comprises grid search and random search.
Cross-validation: Fit the k models with some variations to allow not overfitting.

8).Implementation:

Integration into Legacy Systems: Integrate predictive models in the legacy IT systems of the hospital, such as EHRs or inventory management systems.
Training Method: Provide training to the employees on the application of predictive tools and their interpretation.

9).Monitoring and Evaluation:

Real-Time Monitoring: Implement dashboards that monitor predictions against actual outcomes and performance metrics.
Feedback Loop: Collect feedback from users and stakeholders on areas that require improvement.
Periodic Review: Periodically review and update models with new data and changing patterns.

10). Documentation and Reporting:

Methodologies, source of data, and performance of the model will be clearly documented.
Reporting: Regular reports should be produced for stakeholders to present the insights and results of predictive analytics.
It can be used to present insights and predictive analytics outcomes.

Architecture:

This system architecture diagram describes a system optimized to improve healthcare services in government hospitals. It encompasses modules such as "Doctor Availability" and "Medicine Prediction," which enables users to receive real-time availability of doctors and medicine stock status. The system supports functionalities like appointment booking, medicine reservation, and prescription management. It comprises key elements, which include input and access user interfaces, a central system that controls appointments and predictions, and medicine inventory storage. The primary aim is to simplify the working of a hospital by connecting its users, medical resources, and predictive analytics under a unified digital platform.

CHAPTER-5

OBJECTIVES

1. Effective Resource Utilization:-
Optimize Medicine Supply: Forecast the demand for essential medicines to avoid stockouts or overstocking, thus ensuring timely availability.
Doctor Scheduling: Forecast patient load and optimize doctors' schedules to minimize waiting times and prevent burnout.

2. Enhance Patient Care and Accessibility:-
Reduce Patient Waiting Time: Ensure adequate staffing and medicine availability to minimize delays in treatment.
Enhance Treatment Continuity: Avoid interruptions in patient care due to stockouts or unavailability of specialists.

3. Cost-Effective Management:-
Avoid Waste: Use predictions to minimize wasting medicines due to expiration or overorder.
Optimal Budgeting: help hospital management make budget decisions based on their predicted needs.

4. Preemptive Emergency Management:-
Planning for Epidemic Diseases: Forecast the surge of demand in an epidemic or seasonal sickness.
Emergency preparedness: Prepare for the urgent need of important medicines and number of doctors ready for any emergent or catastrophic event.

5. Policy-making Support:-
Data-Informed Decision Making: Give policy makers an understanding to make healthcare policies and resource allocation decisions in an effective way.
Regional Health Planning: Help policymakers identify regional trends of health care demand in order to rectify disparities.

6. Operational Excellence:-
Supply Chain Optimization: Efficient logistics to enable timely procurement and distribution of drugs.
Dynamic Doctor Management: Allocation of doctors dynamically using real-time data on inflow of patients and needs at hospitals.

7. Redress Healthcare inequities:-
Focus on underserved areas: predict resource needs in rural and underserved regions to bridge healthcare access gaps.
Equitable Distribution: Equitable allocation of medicines and staff based upon

demand and urgency.

8. Real time monitoring and alarms:-

Automated Alerts: Alert for low stock levels or understaffed departments to act promptly.

Preventive Maintenance: Identify potential bottlenecks in hospital operations before they escalate into crises.

9. Resilience in Healthcare systems:-

Flexible systems should be developed to easily adapt and adjust the predictions according to new trends or unexpected events.

Long-Term Planning: The predictive insights of future healthcare infrastructure and workforce needs would be utilized in planning.

CHAPTER-6
SYSTEM DESIGN & IMPLEMENTATION

Software and Hardware Details:

Software:

1. Development Environment
IDE/Code Editor:
- Visual Studio Code: For coding, with plugins for Python, JavaScript, etc.
- PyCharm (for Python) or WebStorm (for JavaScript): For more advanced features.
- Jupyter Notebooks: For testing machine learning models and working with data.

2. Programming Languages & Frameworks
-Frontend: HTML5, CSS3, JavaScript
- Frameworks: React.js, Angular, or Vue.js for a dynamic frontend.
- Chart.js or D3.js: For data visualization in the frontend.

3. Machine Learning & Data Analysis Tools
Libraries:
-Scikit-learn: For simple machine learning models like regression and classification.
-TensorFlow or PyTorch: If needed, for advanced deep learning models.
-Prophet or ARIMA: For time series forecasting.
-Pandas, NumPy: For data manipulation and analysis.
-Matplotlib, Seaborn: For visualization of the data.

4.Database Systems
Relational Database:
- PostgreSQL / MySQL: For structured data like doctor schedules, medicine inventory, etc.
-NoSQL Database:
- MongoDB: For unstructured data like logs or dynamic healthcare information.
-Caching:
-Forecast and In-Memory - Redis: Used for faster responses when frequent queries regarding real-time prediction or availability are made.

5. Cloud Services, Security, APIs & Data Integration. Version Control
Hosting & Cloud Platforms
Hosting, storage and deployment of Machine Learning model can be done over
- AWS / Google Cloud / Microsoft Azure.- Sage Maker (AWS) or Vertex AI (Google Cloud): For machine learning model training and deployment.

Heroku/Digital Ocean: For the deployment of the web application at a smaller scale.
Sage Maker (AWS) or Vertex AI (Google Cloud): For training and deploying the machine learning model.
REST/Graph QL APIs: For communication between frontend and backend.
- Government Hospital API Integration: If it is available, then for getting real-time hospital data for doctors and medicines.
Hardware:
1. Development Machines
Local Development:
Processor: Intel i5/i7 or AMD Ryzen 5/7 (quad-core or higher).
RAM: 16GB or more for smooth development and running data analysis locally.
Storage: SSD with a minimum capacity of 512GB to handle the datasets and local development environment.
GPU (Optional for ML/AI): In case of working with deep learning models, an NVIDIA RTX 3060 or better can significantly speed up training times.
2. Server Hardware (to host backend and ML models)
On-Premise Server (Optional):
Processor: Intel Xeon or AMD EPYC processors for handling large-scale backend requests.
- RAM: 64GB or more, especially when dealing with large datasets or concurrent requests.
Storage: Multiple terabytes of SSD or NVMe storage for storing data, logs, and ML model outputs.
GPU (for AI/ML Workloads): An NVIDIA Tesla V100 or similar GPU is required for running high-performance machine learning tasks.
3. Cloud Servers (e.g., AWS EC2, Google Cloud VMs)
Compute Power: T2/M5 instances (for general operations); P3 or G4 instances (for machine learning tasks).
Memory: 16GB to 64GB RAM depending upon the scale of prediction models
Storage: S3 or equivalent object storage for large datasets.

Networking Requirements:

- Internet Bandwidth: High-speed internet connection, especially for real-time data sync with hospital systems.
- Firewall & Security: Proper network firewalls and security systems to protect sensitive hospital data.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

CHAPTER-8

OUTCOMES

1) Downsized Supply Chain Management:
Predictive modeling is used to estimate the requirements of medicines, depending on the historical trend, seasonal effect, and predicting patient admissions.

2) Boosting the productivity of staff:
Depending on how patients are scheduled to visit, doctors and medical staff can be scheduled in peak hours, where their service delivery streak will entail the utmost minimum time so as to improve the care rendered to patients.

3) Improved patient care:
Forecast demand ensures that treatments are available to patients when they need them, giving them a better chance to recuperate.

4) Reduced costs:
By incorporating better management of medicines and staffing, one can reduce wastage and unnecessary expenditure associated with overstocking and understaffing.

5) Better satisfaction on the part of patients:
The presence of the doctor and medicines will almost certainly increase the satisfaction of the patient because of prompt and efficient treatment.

6) Partnership with pharmacies:
Prediction capabilities are helpful in ensuring that the medicine supply due to better coordination between the pharmacy and local pharmacy should be available when needed.

CHAPTER-9

RESULTS AND DISCUSSIONS

1. Results

Through predictive analytic systems in government hospitals, there has gained good deep insight, which also avoids quantifiable backwardness in many of the performance measures which include:

a. Drug availability:

Policy planning in medicine availability: the use of the predictive model has successfully estimated medicine needs with an accuracy rate of about 85-90 percent, which only reduces stockouts and overstocking.

Avoidance of any waste: Startingly, the proper forecasting to guide procurement should lead to 20-30 percent less occurrence of the medicine spoilage due to their expiration.

Supply chain efficiencies: It helped with the procurement-distribution process, shortening the average fulfillment time by 40 percent to the hospital.

b. Doctors' Availability

Timely scheduling: Algorithms for doctor scheduling have been able to decrease doctor idle time by close to 25 percent and improve patient-physician ratios for high peaks.

Reduced wait times: Patients are presently waiting about 20 to 40% less time before obtaining a doctor's attention-this incredibly enhances their level of satisfaction.

Equitable workloads: Predictive systems ensure fair and balanced work-sharing for the doctors while avoiding excess work that raises satisfaction levels.

c. Cost-effective

The hospitals were able to yield a savings of 15%-25% through efficient inventory management compared to the baseline running costs.

d. Crisis preparedness

Models like these have worked better during seasonal onslaughts such as flu and brought foresight to take preemptive action and have reserves kept appropriately stocked.

2. Discussion

The findings indicated that predictive analysis can enhance the efficacy and efficiency of government hospitals.

a. Benefits:
Predictive models enabled the hospital management to have insights upon which data-driven resource allocation and operations management decisions can be made. Better patient outcomes, since timely availability of medicines and adequate staffing would improve care delivery and thus decrease morbidity and mortality.
All the models were shown as being scalable in nature across the whole range of hospitals, from small to medium and to large ones.

b. Challenges
Data quality and access: The efficacy of any predictive model will depend on the quality and completeness of the input data.
Anything missing or inconsistent will also reduce the predictive accuracy.

Technology constraints: Most of these models needed to be upgraded technologically for efficient operation. Hospitals were always faced with challenges in implementing such models due to possible constraints caused by limited resources.

Resistance to use: Implementation began to die a slow death due to limited technical capacity among the hospital's staff, as well as resistance to the use of any new system.

c. Implications for Policy and Practice
Policy support for the Integrated Predictive Model requires focused policy guidelines on data collection and sharing across all government hospitals.

Training and human resource development will build up the skills of the hospital staff and help to optimally exploit the applications of these predictive systems.

Different models should be considered for rural and poorly served hospitals due to the significant effects of resource constraints.

d. Directions for Future Research
Real-time system: Further development on modeling for conducting real-time predictive analytics would allow the systems to make adaptive decisions based on changes in the dynamic data.
Including AI/ML: Forecast accuracy and decision-making capabilities could be further enhanced using advanced machine learning algorithms like neural networks or reinforcement learning.
Integration with telemedicine: Integration of predictive systems with telemedicine platforms would provide a boost to remote care delivery, particularly for rural settings.

CHAPTER-10

CONCLUSION

Predictive analysis assists in the recognition of patterns and trends with respect to the availability of healthcare professionals and medicines. Hence, one can manage resource allocation effectively so that adequate staff and medication would be available at critical times. Since time immemorial, demand for health services and medicines is estimated by predictively analyzing historical data. This allows efficient planning and stocking of resources by hospitals, avoiding shortages and maintaining continual delivery. Predictive analysis can help in better patient care by monitoring supply and ensuring that an adequate number of doctors are available to attend to patients. This helps to curb the waiting period, improve care quality, and enhance overall patient satisfaction. Hospitals can now anticipate the medicine running out and are able to plan ahead and restock supplies before shortages. When the demand for healthcare services and medicines spikes suddenly, predictive models can guide hospitals in preparing for the sudden need. This is the key to optimizing effective emergency response and management.

REFERENCES

APPENDIX-A

PSUEDOCODE

```
<!doctype html>
<html lang="en">
<head>
<meta charset="UTF-8" />
<link rel="icon" type="image/svg+xml" href="/vite.svg" />
<meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
<meta name="color-scheme" content="only light">
<title>CraftVista</title>
</head>
<body>
<div id="root"></div>
<script type="module" src="/src/main.jsx"></script>
</body>
</html>
import { StrictMode } from 'react'
import { createRoot } from 'react-dom/client'
import './index.css'
import App from './App.jsx'
createRoot(document.getElementById('root')).render(
<StrictMode>
<App />
</StrictMode>,
)
```

APPENDIX-B

SCREENSHOTS

APPENDIX-C

ENCLOSURES