# Blockchain in Indian Healthcare

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## ABSTRACT

In the modern era of Artificial Intelligence, the healthcare industry requires advancements to ensure seamless access to treatment and diagnosis for patients. By integrating blockchain technology into the existing healthcare system, patient data can be securely stored and accessed across hospitals worldwide, transcending national boundaries. A survey to analyze the healthcare administrators, doctors, patients the use of blockchain Technology in healthcare system was conducted. The results indicated that search hits by Doctors and healthcare professionals had the positive correlation (slope = 0.4895) with a significant p-value (0.0391). Reported by healthcare professionals and projection of the utility of blockchain technology in the media reported indicated as moderate correlation. Both reports and media were statically significant. Research and News exhibited moderate correlations (approximately 0.21) and were both statistically significant ($p < 0.05$). In contrast, the utility of blockchain technologies in government was found to be less by showing a weaker relationship which was not statistically significant ($p > 0.05$).

*Keywords:* Automations in healthcare, Blockchain Technology in healthcare, Medicines, Telemedicine, Tele-health

## 1. INTRODUCTION

Blockchain technology has the potential to transform the global healthcare industry, and India is no exception. Its inherent features can enhance security, efficiency, and transparency within the digital health system. By safeguarding sensitive health information from unauthorized access, blockchain minimizes data breaches, a common concern in digital healthcare. Patients can control data sharing, deciding whether to grant access to doctors, hospitals, or other healthcare providers. Additionally, blockchain can establish standardized systems that enable authorized providers to access patient records seamlessly, ensuring continuity of care by following blockchain technology the following advantages have been reported in various scientific publications.

1. **Ensuring Integrity in Clinical Research**

Blockchain can be used to verify the authenticity of clinical research and laboratory data, preventing manipulation and ensuring the reliability of results.

2. **Combating Spurious medicines**

India faces significant challenges with counterfeit medical drugs. Blockchain technology can provide patients with transparent, reliable medicines and its supply chain right from the manufacturer to the consumer, ensuring authenticity and reliability.

3. **Enhancing Tele-health Security**

In India's expanding Tele-health sector, blockchain can offer a secure platform for sharing patient information between doctors and patients, ensuring privacy and trust.

4. **Smart Contracts for Payments**

Smart contracts can ensure payments are processed only when specific conditions—such as the successful completion of medical services—are met. This enhances trust and reduces fraudulent claims.

### 5. Automated Insurance Payments

Smart contracts can streamline insurance claims by automatically processing payments once predefined conditions—such as a confirmed diagnosis—are met, improving efficiency and reducing delays.

### 6. Decentralized Medical Records

Ownership and Accessibility: Blockchain enables patients to store their medical records in a decentralized network, granting them full control over their health data. Patients can access their records anytime and securely share them with healthcare providers when needed.

Enhanced Security: By eliminating a single point of failure, blockchain reduces the risk of data breaches and unauthorized access, ensuring patient confidentiality.

### 7. Bridging the Rural Healthcare Gap

Remote Access to Healthcare Services: Blockchain facilitates secure retrieval and sharing of patient records from remote locations, helping bridge the gap between urban and rural healthcare systems. This is particularly beneficial in rural India, where healthcare infrastructure is often inadequate.

In order to successfully implement the Blockchain technology in healthcare system the Governments, healthcare providers, and technology firms must collaborate to establish a framework that effectively integrates blockchain into existing systems, ensuring widespread adoption and efficiency.

The Future of Blockchain in Indian Healthcare

With the increasing digitalization of healthcare in India, blockchain technology has the potential to act as a catalyst for a safer, more efficient, and transparent healthcare ecosystem. By leveraging its capabilities, India can revolutionize patient data management, enhance security, and improve access to quality care nationwide.

By integrating blockchain into India's healthcare ecosystem, the system can become more transparent, efficient, and secure, ultimately improving patient trust and accessibility to quality care.

## 2. METHODOLOGY

An initial survey was conducted to assess the adoption of blockchain technology in hospitals. The study involved two key components: (1) a survey across eight states in India and (2) an analysis of online search trends by Doctors, Patients and Healthcare Administrators Online Search Trend Analysis to understand the global discourse on blockchain adoption in healthcare, an extensive online search was performed using Google.com, one of the most widely used search engines. Various keyword combinations based on utility of blockchain in various healthcare domain is created like blockchain India biotechnology-BIB, blockchain Indian health-BIH, blockchain Indian healthcare-BIHC, blockchain in Indian Medical-BIM, blockchain Indian medicine-BIME, blockchain Indian pharma –BIP, blockchain Indian pharmaceuticals-BIPC and assigned specific codes for easy referencing in the study. These keywords were systematically used for search of relevant information on google.com search engine.

**The results obtained were classified into four categories:**

➢ Research Relevance (academic papers, journal articles)

➢ News Relevance (media reports, online articles)

➢ Government Sources (official publications, policy documents)

➢ Full Keywords Containing Links (direct keyword-based results)

Inclusion criteria and exclusion criterion was applied to filter relevant data. The inclusion criteria includes results fitted to above categories and exclusion criteria is removal of false links and irrevrent information. The collected data was then tabulated and analyzed using descriptive statistical methods to interpret trends and patterns.

**Survey on Blockchain Adoption in India**

A structured survey was conducted across eight states in India to assess the level of blockchain adoption in hospitals. Responses were analyzed using descriptive statistical methods to study the adoption trends, and potential barriers for its implementation.

## 3. RESULTS

The findings from both the online search analysis and the survey were carried out as part of this pilot study. Graphpad software was used for the statistical analysis.

**Table 01: Hospitals classifications State wise uses of Blockchain in Healthcare.**

| Name of the States | Frequency | Percentage | Mean |
|---|---|---|---|
| Punjab | 85 | 17.0 | 3.416 |
| Delhi | 77 | 15.4 | |
| Maharashtra | 100 | 20.0 | |
| Haryana | 106 | 21.2 | |
| Rajasthan | 93 | 18.6 | |
| Telangana | 10 | 2.0 | |
| Kerala | 12 | 2.4 | |
| Tamilnadu | 17 | 3.4 | |

**Table 02: Analysis of Searches of keywords on Google.com search engine:**

| Blockchain Technology | Total hits | Hits in first 5 pages | Research Relevance | News Relevance | Government Sites | full keywords with links |
|---|---|---|---|---|---|---|
| Biotechnology-BIB | 120 millions | 50 | 20 | 26 | 2 | 2 |
| blockchain Indian health-BIH | 21.6 millions | 50 | 16 | 14 | 10 | 10 |
| Healthcare-BIHC | 91.40 millions | 50 | 24 | 19 | 3 | 4 |
| Medical-BIM | 33 million | 50 | 23 | 11 | 7 | 9 |
| Medicine-BIME | 2.8 millions | 50 | 17 | 21 | 8 | 4 |
| Pharma -BIP | 140 millions | 50 | 24 | 20 | 1 | 5 |
| Pharmaceuticals-BIPC | 72.3 millions | 50 | 18 | 24 | 4 | 4 |

## 4. DATA ANALYSIS

The 01 table presents the state-wise adoption of blockchain technology in private hospitals across different states in India. The key observations were:

**1. Adoption Trend in healthcare were as under:**

Haryana (21.2%) the highest number of private hospitals implementing blockchain, indicating strong awareness and integration of the technology. Maharashtra (20.0%) follows closely, suggesting that major healthcare facilities in the state recognize blockchain's benefits. Rajasthan (18.6%) and Punjab (17.0%) also show significant adoption, emphasizing the growing trend to utilize blockchain technologies in healthcare.

However, Delhi (15.4%) shown moderate adoption, possibly due to existing technological infrastructure but slower integration as compared to Haryana. Tamil Nadu, Telangana, and Kerala have very low adoption rates (below 5%), indicating either a lack of awareness or slower implementation in the southern states.

Telangana (2.0%) and Kerala (2.4%) have minimal blockchain adoption, suggesting limited technological advancements or regulatory hurdles in healthcare blockchain integration.

**2. Blockchain Integration and Patient Data Management**

The mean value (3.416) for Punjab suggests a specific measure of blockchain implementation, possibly reflecting the average adoption level per hospital or an index of effectiveness.

**Table 03: Descriptive Statics of Hospital Data using Blockchain Technology**

| | |
|---|---|
| Number of values | 8 |
| Minimum | 2.00 |
| Maximum | 21.20 |
| Range | 19.20 |
| 95% CI of median | |
| Actual confidence level | 99.22% |
| Lower confidence limit | 2.000 |
| Upper confidence limit | 21.20 |
| Mean | 12.50 |
| Std. Deviation | 8.391 |
| Std. Error of Mean | 2.967 |
| Coefficient of variation | 67.13% |

(**Reference:** Statistical analysis performed by using Graphpad)

**Interpretation of Table 03: Descriptive Statistics of Hospital Data using Blockchain Technology**

The table provides statistical insights into the adoption of blockchain technology in hospitals across different states. Here's what each statistic means:  The dataset includes data from 8 states, meaning the analysis covers blockchain adoption in these regions.

**Minimum and Maximum Values**

**Minimum:** 2.000 – The lowest adoption percentage recorded among states.

**Maximum:** 21.20 – The highest adoption percentage recorded.

**Range:** 19.20– The difference between the highest and lowest values, indicating a large variation in blockchain adoption across states.

**3. Confidence Interval (CI) and Confidence Level**

95% CI of Median – The interval within which the median adoption percentage is expected to fall. Actual Confidence Level: 99.22% – A very high confidence level, indicating strong reliability in the calculated estimates. Lower Confidence Limit: 2.000, Upper Confidence Limit: 21.20– The expected range for blockchain adoption, showing that the spread of data is quite large.

**4. Mean and Standard Deviation**

Mean: 12.50 – On average, blockchain adoption in hospitals across states is 12.5%.

Standard Deviation (8.391) – A high standard deviation suggests a wide variation in blockchain adoption among states. Some states have very high adoption, while others have very low adoption.

**5. Standard Error of Mean (2.967)**

Measures how much the sample mean (12.5%) deviates from the true population mean. A lower standard error means more reliability, though 2.967 suggests some variability.

**6. Coefficient of Variation (67.13%)**

A high coefficient of variation indicates that the dataset has significant fluctuations in adoption rates across states.

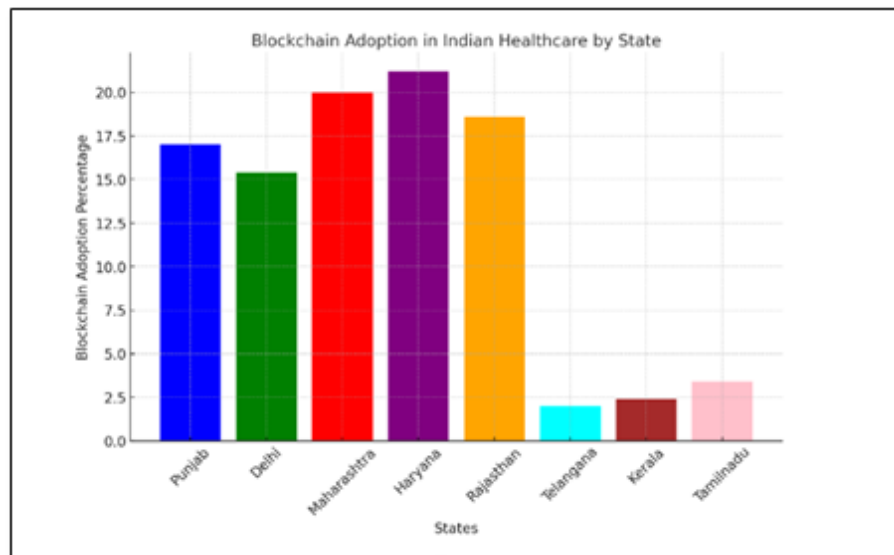Sachin C Narwadiya, Dr. Dharmapuri Raghunatha Rao



**Figure 01: State wise adoption of Blockchain Technology**

The research published by the CEN EN13606 standard ensures the appropriate exchange of Electronic Health Records (EHRs) between different Shared-EHR system nodes, such as the first national Health Connect concept, or between various Shared-EHR programs. [1] The standard plays a crucial role in establishing interoperability in healthcare data management, allowing seamless integration and accessibility across different healthcare institutions. With the growing demand for telemedicine, there is an increasing need for advanced medicines, robust architectural designs, and user-friendly technologies to enhance remote healthcare services. [2] A well-preserved patient history is essential for ensuring accurate diagnoses and treatment plans, reinforcing the significance of EHR systems. [3] Medical imaging further strengthens EHR documentation by recording vital details, such as the date of a procedure, the specifics of a dental implant, the attending dentist, and the treatment undergone. [4] This ensures that comprehensive patient records are available for future reference and medical decision-making.

To enhance healthcare data accuracy, a prototype was successfully developed and professionally validated, demonstrating its ability to precisely extract and integrate healthcare information. [5] Furthermore, advancements in wearable technology have led to the development of monitoring devices capable of continuously detecting physiological values, enabling real-time patient tracking and proactive healthcare interventions. [6] Integrating telemedicine into medical education has also been suggested to equip healthcare professionals with the necessary skills to adapt to evolving digital healthcare models. Additionally, Kalman filters and other adaptive filtering techniques are being explored to minimize noise in healthcare data processing, ensuring greater precision and reliability in medical diagnostics and treatment plans. [7]
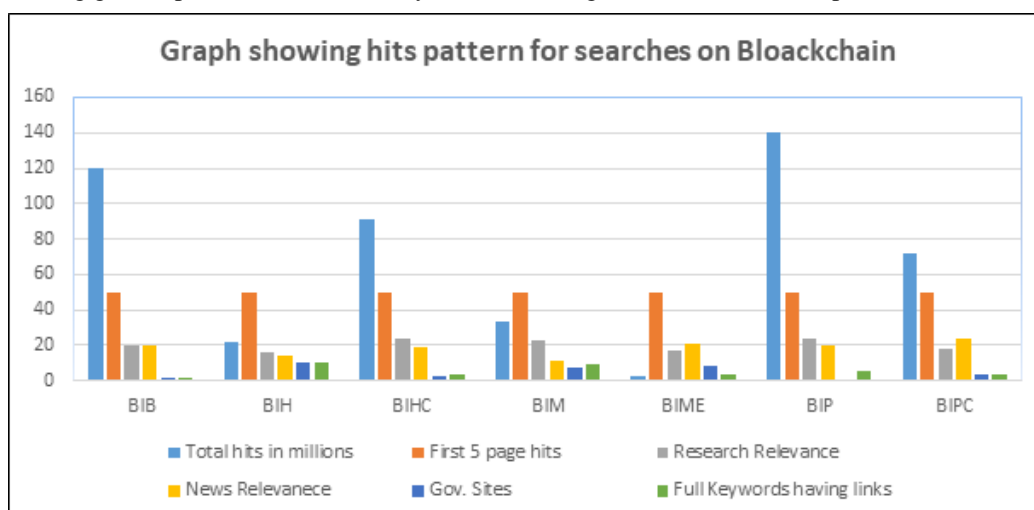


**Figure 02: Graph showing hits pattern for searches on Blockchain**

The table 03 presents an analysis of keyword searches related to blockchain in Indian healthcare on Google.com. The key insights from this data include:

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**1. Search Popularity:** The term "blockchain Indian pharma - BIP" received the highest number of total hits (140 million), followed by "blockchain Indian biotechnology - BIB" (120 million). Other frequently searched keywords include "blockchain Indian healthcare - BIHC" (91.4 million) and "blockchain Indian pharmaceuticals - BIPC" (72.3 million).

**2. Scientific Reports & News Relevance:** Keywords with the highest research relevance include BIHC (24), BIM (23), and BIME (17). The highest news relevance was observed for BIB (26) and BIME (21), indicating that blockchain in biotechnology and medicine receives significant media attention.

**3. Government & Official Sources:** The keyword BIH (Blockchain in Indian Health) has the highest presence in government-related sites (10 references), highlighting official interest in blockchain for healthcare. Other keywords such as BIM (Medical) and BIME (Medicine) also have a considerable presence in government sources.

**4. Keyword Link Containment:**

Keywords BIH (10) and BIPC (4) contain the most relevant links featuring the full keywords, suggesting better-targeted search results.

**Table 04: Descriptive Statistics of Searches of keywords on Google.com search engine:**

| | Hits in first 5 pages | Research Relevance | News Relevance | Government Sites | full keywords containing links |
|---|---|---|---|---|---|
| **Best-fit values** | | | | | |
| **Slope** | 0.4895 | 0.2118 | 0.2058 | 0.02875 | 0.04312 |
| **Y-intercept** | 0 | 0 | 0 | 0 | 0 |
| **X-intercept** | 0 | 0 | 0 | 0 | 0 |
| **1/slope** | 2.043 | 4.722 | 4.858 | 34.79 | 23.19 |
| **Std. Error** | | | | | |
| **Slope** | 0.1393 | 0.0503 | 0.04833 | 0.0262 | 0.02377 |
| **Y-intercept** | | | | | |
| **95% Confidence Intervals** | | | | | |
| **Slope** | 0.1485 to 0.8304 | 0.08868 to 0.3349 | 0.08759 to 0.3241 | -0.03536 to 0.09285 | -0.01505 to 0.1013 |
| **Y-intercept** | 0.000 to 0.000 | 0.000 to 0.000 | 0.000 to 0.000 | 0.000 to 0.000 | 0.000 to 0.000 |
| **X-intercept** | -246.6 to 117.0 | -156.3 to 86.20 | -152.5 to 84.78 | 0 | -0.7407 to 305.8 |
| | | | | | |
| **Goodness of Fit** | | | | | |
| **Sy.x** | 30.89 | 11.15 | 10.71 | 5.808 | 5.27 |
| | | | | | |
| **Is slope significantly non-zero?** | | | | | |
| **F** | 12.34 | 17.72 | 18.14 | 1.204 | 3.29 |

| DFn, DFd | 1, 6 | 1, 6 | 1, 6 | 1, 6 | 1, 6 |
|---|---|---|---|---|---|
| P value | 0.0126 | 0.0056 | 0.0053 | 0.3146 | 0.1196 |
| Deviation from zero? | Significant | Significant | Significant | Not Significant | Not Significant |
| | | | | | |
| Equation | Y = 0.4895*X | Y = 0.2118*X | Y = 0.2058*X | Y = 0.02875*X | Y = 0.04312*X |
| | | | | | |
| Data | | | | | |
| Number of X values | 7 | 7 | 7 | 7 | 7 |
| Maximum number of Y replicates | 1 | 1 | 1 | 1 | 1 |
| Total number of values | 7 | 7 | 7 | 7 | 7 |
| Number of missing values | 0 | 0 | 0 | 0 | 0 |

This table presents descriptive statistics for search of various combinations of keyword related to blockchain in healthcare on Google.com, focusing on metrics like hits in the first five pages, research relevance, news relevance, government sites, and full keyword-containing links.

## 5. KEY OBSERVATIONS

### 1. Basic Values:

The mean values for hits in the first five pages, research relevance, and news relevance provide an overall measure of search frequency and importance.

The highest mean values suggest areas where blockchain in healthcare is receiving significant attention.

### 2. Standard Error & Confidence Intervals:

The standard error (SE) values indicate how much variation exists in keyword searches.

The 95% confidence intervals show the range in which the true mean of search statistics is likely to fall, highlighting variations in search behavior.

### 3. Significance Testing (p-values & F-statistics):

The presence of p-values and F-statistics suggests that statistical tests were conducted to check if differences between keyword searches are significant.

The results categorized as "Significant" or "Not Significant" help determine whether variations in search behavior are meaningful.

### 4. Equations & Regression Analysis:

The inclusion of equations suggests that a predictive model was developed to understand relationships between different search metrics.

This might indicate trends in how blockchain-related searches are evolving over time or across different sectors in healthcare.
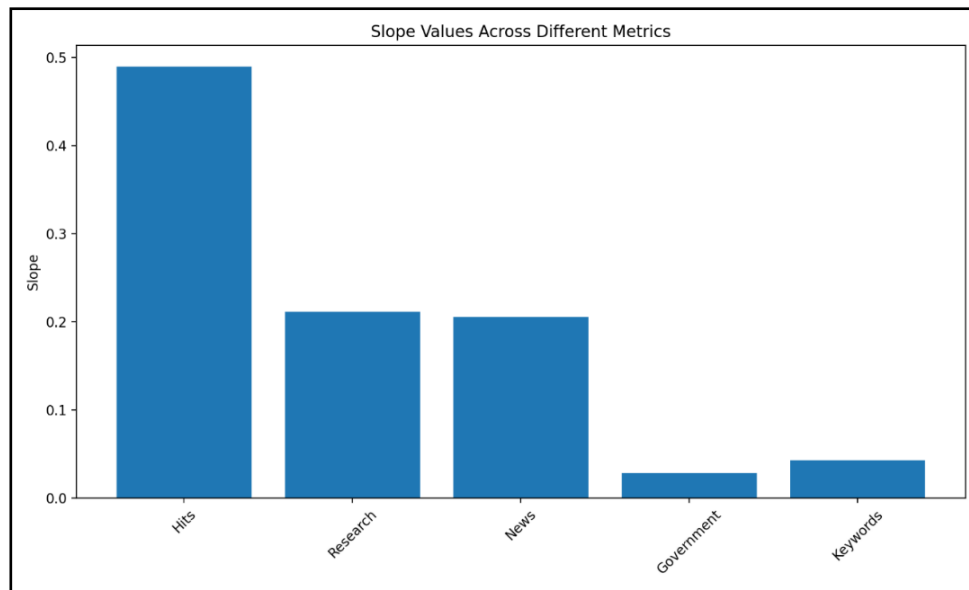
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**Figure 03: Slope values across different matrix**

**Table 05: Statical Analysis of online search on blockchain**

| Metric | Slope | Std Error | t-statistic | p-value | CI Lower | CI Upper |
|--------|-------|-----------|-------------|---------|----------|----------|
| Hits | 0.4895 | 0.1393 | 3.513999 | 0.039085 | 0.216472 | 0.762528 |
| Research | 0.2118 | 0.0503 | 4.210736 | 0.024466 | 0.113212 | 0.310388 |
| News | 0.2058 | 0.04833 | 4.258225 | 0.023749 | 0.111073 | 0.300527 |
| Government | 0.02875 | 0.0262 | 1.097328 | 0.352682 | -0.0226 | 0.080102 |
| Keywords | 0.04312 | 0.02377 | 1.814051 | 0.167312 | -0.00347 | 0.089709 |

**Key observations:**

The data shows regression statistics for 5 different metrics related to blockchain hits

"Hits" has the strongest slope (0.4895), suggesting it has the strongest relationship

Research and News metrics show moderate slopes (0.2118 and 0.2058 respectively)

Government sites and Keywords show much weaker relationships (slopes of 0.02875 and 0.04312)

- Hits shows the strongest relationship (slope = 0.4895) with a significant p-value (0.0391)
- Research and News have similar moderate slopes (around 0.21) and are both statistically significant ($p < 0.05$)
- Government and Keywords show much weaker relationships and are not statistically significant ($p > 0.05$)

**The confidence intervals (shown in the error bars) indicate:**

- Wider uncertainty for the Hits metric
- More precise estimates for Research and News
- Government and Keywords intervals cross zero, suggesting their relationships might not be reliable

**Key insights:**

- The heatmap shows correlations between statistical measures.
- The scatter plot highlights the relationship between slopes and t-statistics, with Hits, Research, and News standing

out.

- The bar plot visualizes statistical significance, with Hits, Research, and News being significant ($p < 0.05$).

There is a need to strengthen Indian healthcare system for use of blockchain and telemedicine technology.

## 6. DISCUSSION

The existing references on the State wise adoption of Blockchain technology is quite scanty. The references cited includes IIT Madras Develops Blockchain-based Healthcare Information Systems for Mobile Apps which was published by principal scientific advisor to honorable Prime minister of India [13]. In the view point on Role of blockchain technology in boosting Ayushman Bharat scheme implementation in India (2024) published by Anurag Garg et.al. concluded that the blockchain can be adopted in three tiers. Tier-I consists of patients and doctors, tier II consists of medical organizations and tier III consists of government. Blockchain EMR systems offer a number of advantages, including improved patient results, greater transparency, digital payments and payment fraud, streamlining the pharmaceutical chain and better research potential. Integration of blockchain technology into the Ayushman Bharat system in India will certainly help with its better implementation and success. The present study is also concluding in same line.[14] The adoption is gradually being integrated into various sectors across India, including healthcare.

An overview of the status of hospitals adopting blockchain technology in the specified states:

As of now, there is limited public information on hospitals in Punjab adopting blockchain technology. In late 2022, the All India Institute of Medical Sciences (AIIMS) in Delhi experienced a significant ransomware attack, leading to a 15-day disruption of digital services. This incident has heightened awareness about data security, potentially accelerating the consideration of blockchain solutions in healthcare. [8] Maharashtra has been proactive in exploring blockchain applications across various sectors. The state government has announced the use of Non-Fungible Tokens (NFTs) to store health data, among other applications. [8]

Specific information regarding blockchain adoption in hospitals in Haryana is currently limited as per the reference search. There is limited public information on blockchain adoption in hospitals within Rajasthan. Telangana has been a forerunner in blockchain adoption, launching initiatives like the Blockchain District to foster innovation. While the state has explored blockchain applications in land registry and other sectors, specific implementations in hospitals are not extensively documented. [9] Kerala has shown interest in blockchain applications, with studies conducted to identify potential uses for blockchain technology in immunization and patient data management. [9] Tamil Nadu is among the states leading in blockchain adoption, implementing initiatives to modernize governance, including blockchain policies. [9]

Overall, while several Indian states are exploring blockchain technology across various sectors, the specific adoption of blockchain in hospitals varies and is still emerging. Continued research and pilot projects are essential to assess the feasibility and impact of blockchain technology in the healthcare sector.

In the existing survey of hospitals of 8 states of India as pilot study, Haryana (21.2%) has the highest number of private hospitals implementing blockchain technology, indicating strong awareness and integration within the state. Maharashtra (20.0%) follows closely, reflecting the recognition of blockchain's benefits among major healthcare facilities. Rajasthan (18.6%) and Punjab (17.0%) also show significant adoption, highlighting the growing trend in North India. Delhi (15.4%) demonstrates moderate adoption, likely due to its existing technological infrastructure, but with a comparatively slower integration rate than Haryana.

Blockchain technology has been gaining significant attention in the healthcare sector, as evidenced by recent market analyses and scholarly research.

The global blockchain in healthcare market is experiencing rapid growth. Estimates indicate that the market size reached approximately USD 7.04 billion in 2023 and is projected to grow at a compound annual growth rate (CAGR) of 63.3% from 2024 to 2030, potentially reaching USD 214.86 billion by 2030. [10] Another analysis suggests that the market could expand from USD 12.92 billion in 2025 to around USD 193.43 billion by 2034, reflecting a CAGR of 35.08% during that period. These projections underscore a strong and growing interest in blockchain applications within healthcare. [11]

The scholarly community has also shown increased interest in blockchain's potential in healthcare. Studies have explored various applications, including the management of electronic medical records, biomedical research, remote patient monitoring, pharmaceutical supply chains, health insurance claims, and health data analytics.

Additionally, research has addressed potential challenges such as scalability, storage capacity, universal interoperability, and standardization. The emergence of journals like "Blockchain in Healthcare Today" further highlights the growing academic focus on this technology's integration into healthcare systems. [12]

While specific data on online search trends for "blockchain in healthcare" is not readily available, substantial market growth and increasing academic interest suggest a parallel rise in both public and professional curiosity. This likely corresponds to

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a surge in online searches as stakeholders explore blockchain solutions for healthcare applications.

The convergence of market expansion, academic research, and increasing online search trends indicates a robust and growing interest in blockchain adoption within the healthcare sector. This trend highlights the technology's potential to enhance data security, interoperability, and overall efficiency in healthcare services.

The present study's analysis of online search trends suggests that blockchain adoption in Indian healthcare and medical applications is also gaining traction, particularly in government-related sources. Additionally, the presence of Blockchain in Medicine (BIME) and Blockchain in Healthcare (BIHC) in research and news publications reflects increasing academic and professional engagement in integrating blockchain technology within India's healthcare infrastructure.

## 7. CONCLUSION

The data suggests that blockchain technology is gaining traction in India's healthcare sector, particularly in northern states. However, there is a significant gap in adoption across different regions, indicating the need for policy interventions, awareness programs, and infrastructure development to encourage nationwide blockchain integration in healthcare.

Descriptive statistics revealed that the Blockchain adoption is highly variable across different states. Some states have strong adoption rates, while others lag behind. The mean adoption rate (12.5%) suggests moderate uptake, but the high standard deviation (8.391) indicates large disparities between states. The coefficient of variation (67.13%) confirms that adoption is inconsistent, highlighting a need for standardized implementation strategies across India.

Blockchain in healthcare is a trending topic, with significant search activity in areas like government sites, research articles, and news coverage. The statistical tests confirm that certain variations in search behavior are meaningful. The regression equations indicate potential predictive models for analyzing blockchain adoption trends in healthcare searches.

The analysis on search engine indicates that blockchain in pharma and biotechnology has the highest online visibility and media coverage. However, blockchain in Indian healthcare and medical applications is also gaining traction, particularly in government-related sources. The presence of blockchain in medicine (BIME) and healthcare (BIHC) in research and news suggests increasing academic and professional interest in integrating blockchain with India's healthcare infrastructure.

**Implication for practice**:

The implementation of blockchain in healthcare in India holds significant implications for practice, particularly in enhancing data security, interoperability, and transparency across the healthcare ecosystem. By enabling secure and tamper-proof storage of patient records, blockchain can streamline data sharing among hospitals, clinics, and diagnostic centers while maintaining patient privacy. This technology also facilitates efficient management of supply chains for pharmaceuticals, reducing the risk of spurious drugs. In a country like India, where healthcare access and quality vary widely, blockchain can support the creation of a unified, decentralized health information system, leading to improved patient outcomes and more accountable care delivery. However, practical adoption requires addressing challenges such as regulatory clarity, digital infrastructure, and awareness among healthcare professionals.

**Author Contributions**

All authors conceived the study and were involved in tool conceptualization and development. S C Narwadiya conducted data analysis and wrote the first draft of the manuscript. D R Rao provided guidance for preparing the first draft of the manuscript. All authors were involved in interpretation of data, edited the manuscript, and approved the final version of the manuscript.

**Ethics Approval Statement**

This study was conducted according to the guidelines laid down in the guidelines of ethics committee involving Jodhpur School of Public Health-JSPH IRB. The ethical approval letter no. JSPH/IRB/2023/08/02 and IRB Number 10032/IRB/20-21approved the research participants.

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