Data Analytics and Sentiment Analysis for Monitoring and Improving Patient Satisfaction and Engagement

Gaurav Kumar Sinha

Cognizant Technology Solutions
Email: gaurav.sinha3@cognizant.com

Abstract In modern healthcare environments, ensuring and elevating the levels of patient contentment and involvement is crucial for the provision of superior healthcare and the enhancement of health outcomes globally. This paper delves into the employment of data analysis and the study of patient sentiments to effectively meet these ends. By leveraging a variety of data inputs, which includes reviews from patients, digital patient records, and interactions on social media platforms, providers in the healthcare sector can unlock meaningful insights regarding the feelings, choices, and experiences of patients. These insights allow for the initiation of proactive steps, care that is customized to individual needs, and the implementation of targeted initiatives aimed at addressing the varied requirements of the patient population. Techniques in sentiment analysis offer the capability to automatically examine text-based data, offering immediate insights into levels of patient satisfaction and pinpointing opportunities for the advancement of healthcare offerings. Through the lens of case studies and examples, this document showcases the concrete uses of data analysis and sentiment assessment in observing and elevating patient contentment and engagement across diverse medical environments. It also covers the hurdles and ethical concerns tied to the deployment of these methods, highlighting the necessity for the respecting of data privacy, the upholding of transparency, and the prioritization of care that is centered around the patient. In conclusion, the application of data analytics and sentiment analysis in the realm of healthcare presents significant prospects for the adoption of practices focused on the patient, the elevation of the quality of healthcare services, and the realization of more positive experiences for patients.

Keywords Data Analytics, Sentiment Analysis, Patient Satisfaction, Patient Engagement, Healthcare, Monitoring, Improvement, Electronic Health Records (EHRs), Feedback, Personalized Care, Proactive Interventions, Healthcare Quality, Patient Experience, Data Privacy, Transparency, Patient-Centered Care

Introduction

Today's healthcare environment places a significant effectively cater to the needs of patient's emphasis on ensuring patients' happiness and active participation, with medical professionals relentlessly Furthermore, the adoption of sentiment analysis working to provide care that is tailored to the unique methodologies significantly boosts this capability, by desires and necessities of each patient. At the heart of facilitating the automatic scrutiny of text-based data, such these efforts is the application of cutting-edge data as comments and reviews from patients, to assess analytics and the analysis of emotions derived from emotions and pinpoint regions of concern or satisfaction. patient feedback, which yields critical insights into their Utilizing these insights enables healthcare organizations to experiences and level of satisfaction. By tapping into tackle issues proactively, customize the provision of care various data sources, such as feedback from patients, and nurture increased patient involvement. Electronic Health Records (EHRs), and interactions on social media platforms, healthcare practitioners are Delving into the concrete applications of data analytics equipped to obtain a holistic view of

what patients think and sentiment analysis within healthcare settings, the and prefer. paper highlights case studies and examples that demonstrate their role in promoting superior patient

This paper examines how data analytics and sentiment experiences and outcomes. It also addresses the hurdles analysis can be utilized within the realm of healthcare, and factors to consider when deploying these with a focus on observing and enhancing the satisfaction technologies, including concerns related to data privacy, and involvement of patients. By conducting a methodical the necessity for transparency, and ethical dilemmas, evaluation of the information obtained from patients, medical providers can detect trends, patterns, and areas

Problem Statement

Amidst the shift towards patient-focused care within healthcare systems, numerous providers are encountering obstacles in monitoring and enhancing patient contentment and involvement effectively. Conventional feedback collection techniques, like questionnaires and discussion groups, tend to be labor-intensive, confined in their reach, and might not reflect the wide range of patient perspectives.

In addition, healthcare institutions find it difficult to process and obtain practical insights from the massive datasets produced by patients, which include electronic health records (EHRs), feedback documents, and interactions on social media platforms. Lacking advanced data analysis capabilities, providers could overlook crucial chances to pinpoint trends, patterns, and areas needing improvement in the realm of patient care.

Absent of sophisticated sentiment analysis methods, providers might find it challenging to grasp patient perceptions, preferences, and experiences, which impedes the customization of interventions and services.

The absence of proficient data analytics and sentiment analysis tools constitutes a considerable obstacle for healthcare organizations striving to achieve patient focused care and elevate patient satisfaction and involvement. Confronting these challenges necessitates innovative strategies and technologies that empower providers to leverage data effectively, fostering significant enhancements in the quality of healthcare and patient experiences.

Solution

To address the challenges outlined in the problem statement and enable effective monitoring and improvement of patient satisfaction and engagement, healthcare organizations can leverage various Amazon Web Services (AWS) components. This solution architecture is designed to provide scalable, secure, and efficient data analytics and sentiment analysis capabilities. Below are the key components of the solution:

1. Gathering and Keeping Data:

Amazon S3 (Simple Storage Service)

Acts as a universal data repository to store a variety of data types, such as patient responses, electronic health records (EHRs), and interactions on social media platforms. AWS Data Pipeline:

Facilitates the automated transfer and preliminary processing of data from numerous sources, ensuring the data's uniformity and dependability.

2. Analyzing Data:

Amazon Redshift:

Provides a data warehousing solution for the storage and examination of structured data coming from EHRs and various operational systems.

Amazon Athena:

Allows for on-the-fly data querying and analysis within Amazon S3 through standard SQL, offering effortless and swift data investigation.

Amazon QuickSight:

Offers tools for visualizing data and discovering insights via interactive dashboards and visual representations, aiding in decision-making and fostering collaboration among parties involved in healthcare.

3. Examining Sentiments:

Amazon Comprehend:

Utilizes natural language processing (NLP) technology for conducting sentiment analysis on text-based data, like patient feedback and comments on social media, to automatically derive sentiments and critical insights.

Amazon SageMaker:

Empowers the creation of bespoke machine learning models for sentiment analysis with a focus on healthcare applications, enabling finer and sector-specific sentiment examination.

4.Integration and Process Automation:

AWS Lambda:

Manages the workflows for data processing and analysis, initiating tasks based on specific events or timetables, including the ingestion, preprocessing, and examination of sentiments in data.

Amazon Simple Notification Service (SNS):

Issues alerts and notifications to health administrators and involved parties based on the outcomes of analyses or set benchmarks, allowing for swift action and response to patient insights.

5.Safeguarding and Compliance:

AWS Identity and Access Management (IAM):

Oversees secure access to AWS services, making sure that only approved individuals have the ability to reach patient data and analytics tools.

Amazon GuardDuty:

Actively scans for security threats and unpermitted access to confidential health data, elevating the security measures and adherence to health industry regulations.

6. Expanding and Enhancing Performance:

Amazon EMR (Elastic MapReduce):

Allows for the horizontal scaling of data processing and analytics efforts through the use of Apache Spark and Hadoop clusters, guaranteeing the system's capacity and scalability for managing extensive data sets.

Architecture Diagram

Architecture Diagram
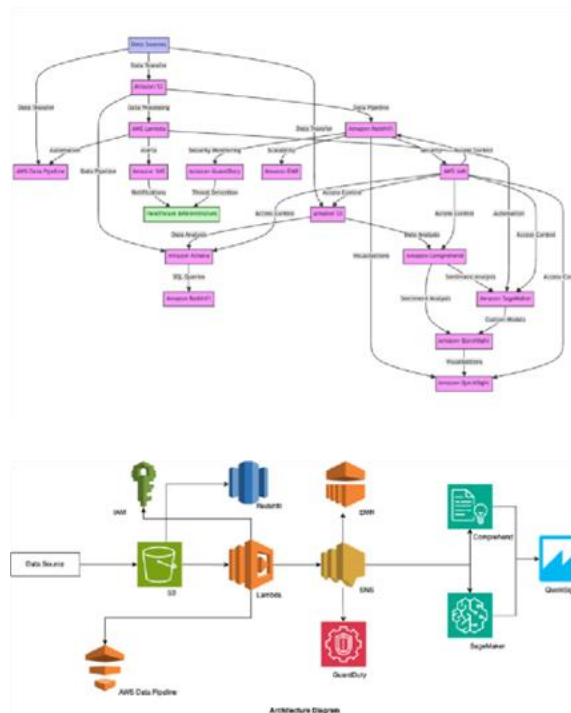
Architecture Overview

Below is an overview of the key components and their roles within the architecture:

1. Sources of Data:

This level embodies a variety of data origins within the healthcare sector, such as responses from patients, digital health records (EHRs), and social media engagements. These sources are important for gathering insights about patient attitudes, choices, and their overall experiences.

2. Storing Data:

The centralized data repository for a wide range of healthcare information is provided by Amazon S3, offering scalable and durable storage solutions. AWS Data Pipeline aids in the data ingestion and preprocessing, securing data accuracy and dependability.

3. Analyzing Data:

For storing and examining the structured information derived from EHRs and other systematic operations, Amazon Redshift, a solution for data warehousing, is used. Ad-hoc query execution and analytical operations on data housed in S3 are made possible by Amazon Athena, utilizing standard SQL queries which allow for versatile data investigation.

Interactive dashboards and visual representations that facilitate healthcare participants in deriving meaningful insights from data are rendered by Amazon QuickSight.

4. Analysis of Sentiments:

For sentiment analysis on textual data such as patient reviews and social media remarks, Amazon Comprehend utilizes natural language processing (NLP) capabilities. Moreover, Amazon SageMaker offers the ability to create custom machine learning models that enhance sentiment analysis precision in scenarios specific to the healthcare industry.

5. Automated Integration:

Data processing and analysis workflows are automated by AWS Lambda, which activate certain actions based upon predefined events or timetables. It is integrated with AWS Data Pipeline to automate data ingestion and preprocessing, and also with Amazon Comprehend and Amazon SageMaker for conducting sentiment analyses.

Notifications and alerts to healthcare managers and stakeholders are dispatched by Amazon SNS, contingent on the outcomes of analysis or preset limits, facilitating prompt actions and responses to patient feedback.

6. Safeguarding and Adherence:

Secure access to AWS resources, making sure that only approved staff have the ability to access patient information and analytics tools, are managed by AWS IAM. Continuous surveillance for potential threats and unauthorized access is conducted by Amazon GuardDuty, thus strengthening the security framework and adherence to healthcare norms.

7. Scaling and Efficiency:

Through Apache Spark and Hadoop clusters, Amazon EMR facilitates the expansion of tasks related to data processing and analytics, ensuring efficiency and scalability to manage extensive data amounts.

Implementation

Below are the key steps involved in the implementation process:

1. Setting Up Your AWS Account:

If you haven't already, establish an AWS account and set up the necessary permissions and access controls through AWS Identity and Access Management (IAM).

2. Ingesting and Storing Data:

Prepare Amazon S3 buckets for the containment of various healthcare data forms, such as patient responses, Electronic Health Records (EHRs), and interactions on social media platforms.

Utilize AWS Data Pipeline for the automated transfer and initial processing of data from multiple sources into Amazon S3.

3. Analyzing Data:

Deploy Amazon Redshift to house and examine structured data sourced from EHRs and management systems.

Employ Amazon Athena for the ad-hoc examination and querying of data residing in Amazon S3 through standard SQL.

Develop dynamic dashboards and visual displays with Amazon QuickSight for insights derivation from the data analyzed.

4. Analyzing Sentiments:

Use Amazon Comprehend for the analysis of sentiments within textual data, such as responses from patients and comments on social media.

Tailor custom machine learning algorithms with Amazon SageMaker for enhanced sentiment analysis, specific to the needs of healthcare.

5. Automating and Integrating Systems:

Configure AWS Lambda to manage data processing and analytical workflows, instigating activities based on specified events or timetables.Merge AWS Lambda with AWS Data Pipeline for streamlined data ingestion and processing, in addition to incorporating Amazon Comprehend and Amazon SageMaker for the analysis of sentiments.

Set Amazon SNS to dispatch notifications and warnings to healthcare managers and involved parties, reflecting upon the results of analyses or set limits.

6. Ensuring Security and Regulatory Compliance:

Establish IAM roles and policies for the safe access to AWS resources, guaranteeing access is restricted to authorized personnel for patient data and analytical services.

Activate Amazon GuardDuty for ongoing surveillance against threats and unauthorized entries, bolstering security and adherence to healthcare guidelines.

7. Managing Scalability and Performance:

Implement Amazon EMR clusters to meet the scalability and performance needs of data processing and analytical endeavors, ensuring the efficient handling of large data volumes.

8. Testing and Ensuring Validity:

Execute comprehensive testing of the deployed solutions to confirm their functionality, dependability, and performance.

Assess the precision and efficacy of the sentiment analysis algorithms by conducting tests with sample data and reallife scenarios.

9. Facilitating Training and Enhancing Adoption:

Offer education and assistance to the healthcare workforce on leveraging the implemented system for data analytics and sentiment analysis.

Advocate for the integration and embracement of datacentric decision-making within standard healthcare operations.

10. Ongoing Monitoring and Upkeep:

Apply monitoring and logging solutions via AWS

CloudWatch for tracking the solution's performance and stability.Periodically reassess and refine security setups\, access management\, and data preservation policies to stay compliant and reduce risks.

Implementation of PoC

Below are the key steps involved in implementing the PoC:

Scope Definition and Objectives:

Clearly outline the boundaries and goals of the Proof of Concept (PoC), specifying particular scenarios and aims concerning data analysis and sentiment evaluation in the healthcare sector.

Establish tangible targets for the PoC, like showcasing the precision of sentiment analysis on patient feedback data.

Data Collection and Organization:

Identify and gather example datasets for the PoC,encompassing patient feedback, Electronic Health Records (EHRs), and interactions on social media, while ensuring adherence to data privacy regulations.

Process the data as required, involving cleansing, standardization, and structuring, to ready it for scrutiny.

AWS Services Selection:

Opt for AWS solutions that match the PoC's aims and offer the critical tools for data analysis and sentiment appraisal.

Pick services like Amazon S3 for data retention, Amazon Comprehend for sentiment assessment, and Amazon QuickSight for data representation.

Infrastructure Configuration:

Arrange the chosen AWS facilities in the AWS

Management Console, adjusting permissions and access controls as necessary.

Set up data ingestion systems using AWS Data Pipeline or AWS Lambda functions to import and prepare sample datasets into Amazon S3 storage.

Sentiment Analysis Implementation:

Carry out sentiment analysis incorporating Amazon Comprehend on the sample text data, be it feedback comments from patients or reviews.

Train and optimize bespoke sentiment analysis models with Amazon SageMaker if required, contingent upon the use case's complexity.

Data Interpretation and Illustration:

Assess the results of sentiment analysis and illustrate discoveries by using Amazon QuickSight, forming interactive dashboards and graphics for stakeholders.

Examination and Appraisal:

Validate the implemented solution with example datasets to assess functionality, precision, and performance.

Appraise the outcomes against set targets and evaluating standards to measure the PoC's efficacy.

Records and Presentations:

Chronicle the execution process, covering setup specifics, data preparation phases, and analysis conclusions.

Produce a summary detailing findings, insights, and takeaways from the PoC, accentuating any hurdles faced and recommendations for future enactments.

Feedback from Key Personnel:

Solicit input from parties involved, like healthcare administrators, medical professionals, and technical staff, about the utility, efficiency, and probable influence of the executed solution.

Adjust and Enhance:

Varied the solution as necessary based on feedback and evaluation outcomes, attending to recognized deficiencies or areas for enhancement.

Assess the potential of scaling up the PoC to a preliminary or full implementation if the outcomes are encouraging and parallel with the organization's intentions and aims.

Uses

Certainly! Here are business issues that can be identified at the data analytics layer through the analysis of ingested data

1. Low Patient Satisfaction Scores: Identification of consistently low patient satisfaction scores across various departments or service areas.
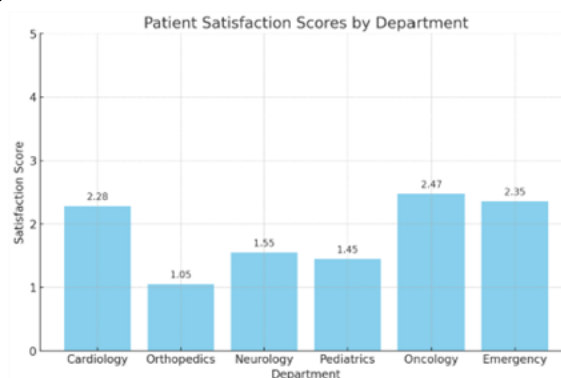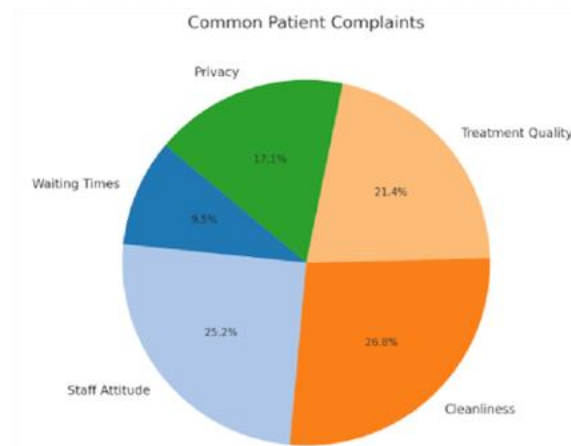

2. Negative Sentiment Trends: Detection of negative sentiment trends in patient feedback over specific time periods or in response to particular events.

Trend of Patient Sentiment Over Time
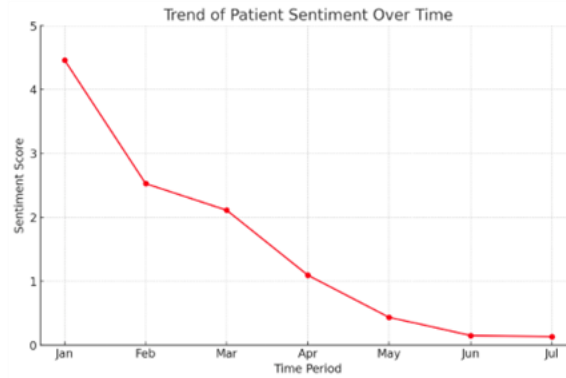
3. Frequent Complaints: Analysis of common complaints or issues raised by patients through feedback forms or surveys.


Common Patient Complaints

4. Unaddressed Concerns: Identification of recurring concerns or complaints that have not been adequately addressed by healthcare providers.
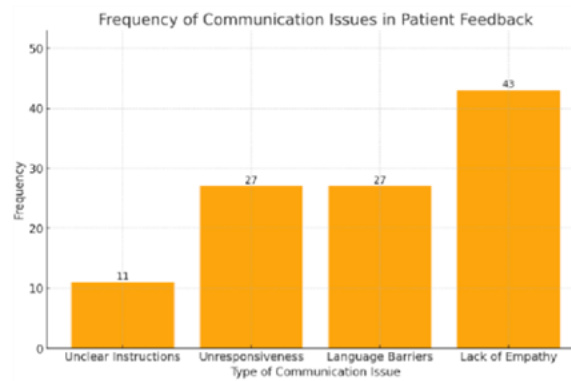

Percentage of Unresolved Patient Concerns by Category
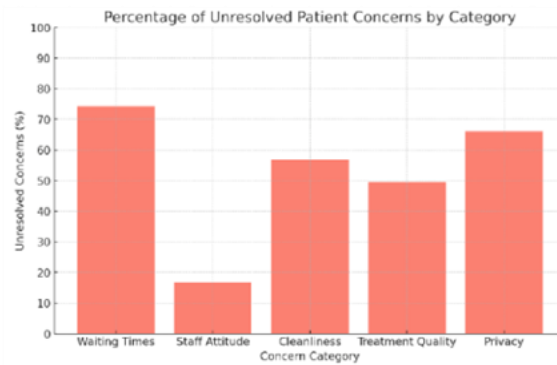
5. Service Delays: Analysis of patient feedback indicating dissatisfaction with waiting times for appointments, tests, or treatments.
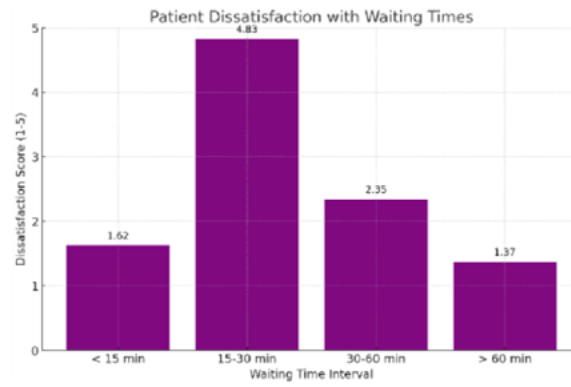
6. Poor Communication: Detection of communication breakdowns or misunderstandings between patients and healthcare staff.


7. Inaccurate Billing: Identification of billing errors or discrepancies reported by patients in their feedback.
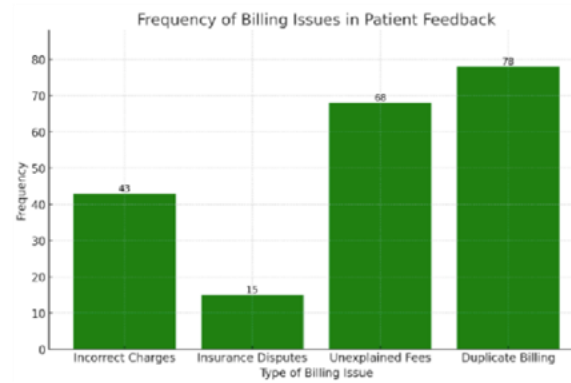

8. Lack of Personalization: Analysis of feedback indicating a lack of personalized care or treatment plans tailored to individual patient needs.
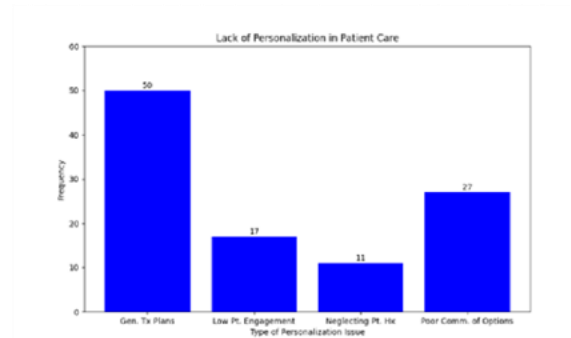
9. Facility Cleanliness: Detection of cleanliness-related issues or concerns raised by patients about the healthcare facility.
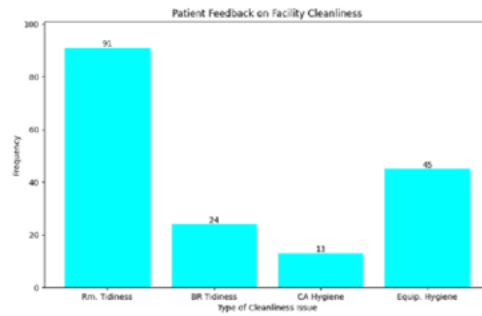
10. Equipment Malfunctions: Identification of recurring complaints related to malfunctioning equipment or technology used in patient care.
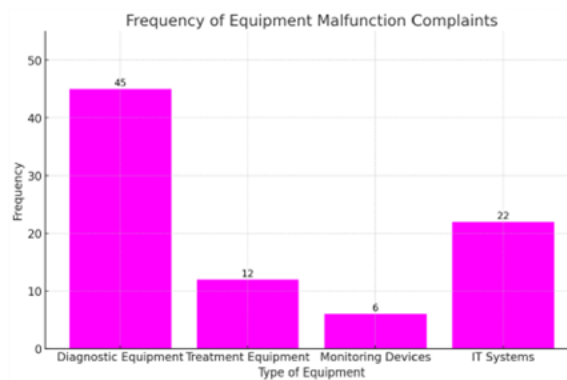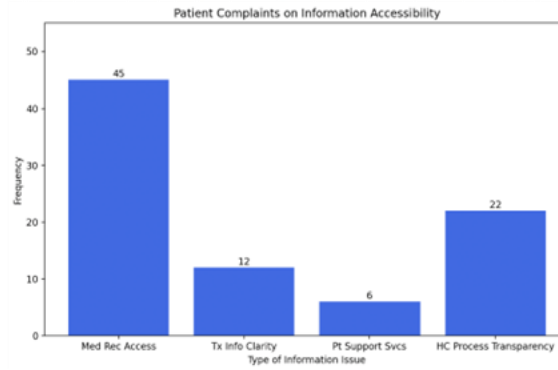

11. Staff Attitude: Analysis of patient feedback indicating dissatisfaction with the attitude or behavior of healthcare staff.
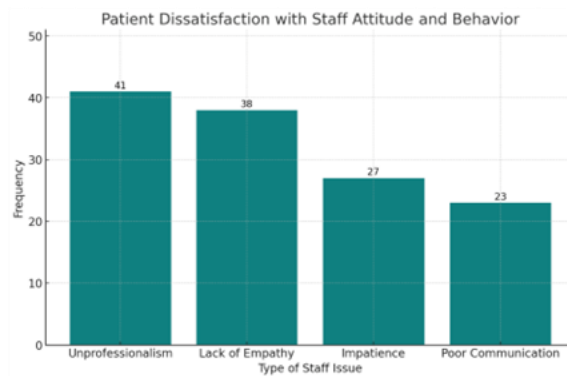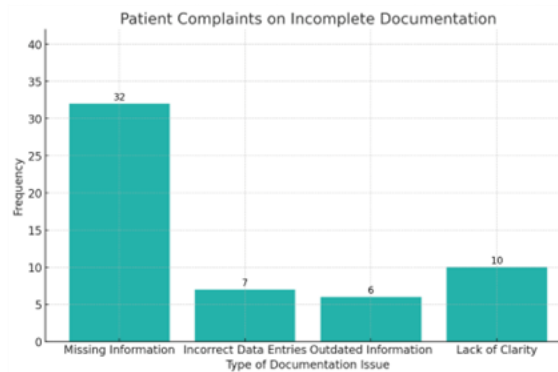

12 Information Accessibility: Detection of complaints regarding difficulties in accessing medical records or obtaining information about treatment options.
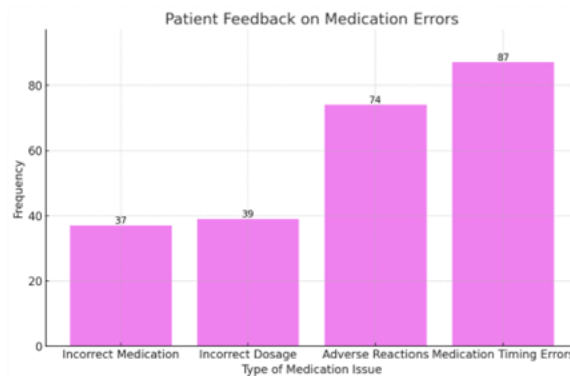
13. Incomplete Documentation: Identification of gaps or inaccuracies in patient records or documentation reported by patients.
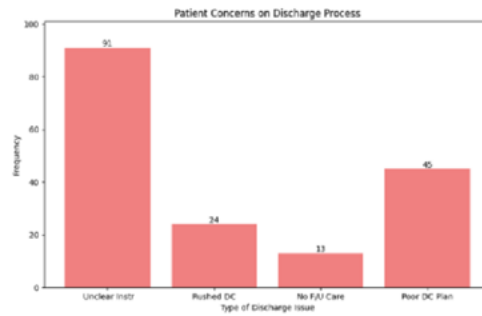

14. Medication Errors: Analysis of feedback indicating instances of medication errors or adverse drug reactions experienced by patients.
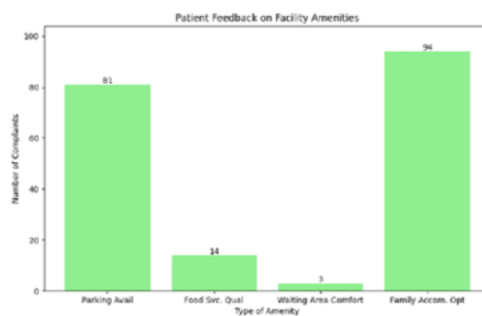

15. Long Wait Times: Detection of complaints related to long wait times for medication refills or prescription pickups.
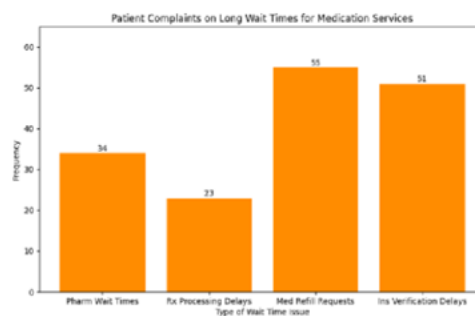
16. Discharge Process: Identification of issues or concerns raised by patients regarding the discharge process or post discharge care instructions.

17. Facility Amenities: Analysis of feedback indicating satisfaction or dissatisfaction with amenities such as parking, food services, or accommodation for family members.

18. Language Barriers: Detection of communication challenges or language barriers reported by patients from diverse linguistic backgrounds.
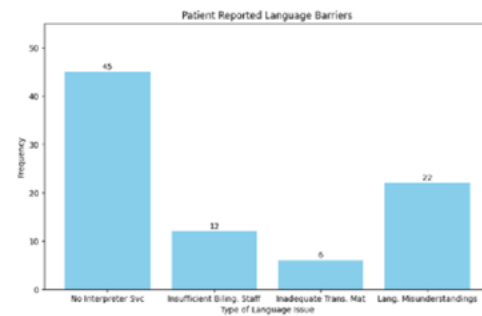
19. Cultural Sensitivity: Identification of complaints related to cultural insensitivity or lack of cultural competence in patient care.
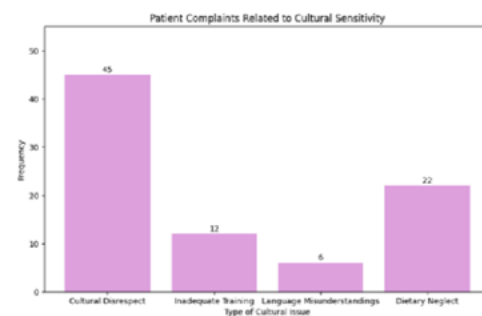
20. Quality of Referrals: Analysis of patient feedback indicating satisfaction or dissatisfaction with referrals to specialist services or external healthcare providers.

Impact

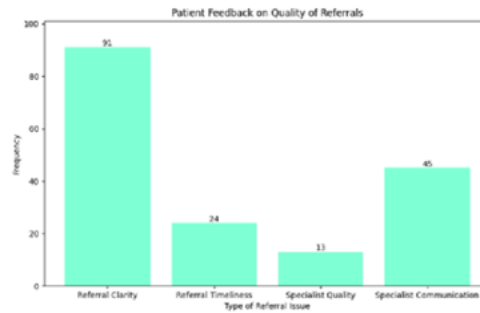Here are impacts that leveraging data analytics and sentiment analysis for monitoring and improving patient satisfaction and engagement can bring to a healthcare business:

1. Enhanced Patient Experience:

By analyzing patient feedback and sentiments, healthcare providers can identify areas for improvement and tailor services to meet patient preferences, ultimately enhancing the overall patient experience.

2. Improved Patient Satisfaction Scores:

Proactively addressing issues identified through sentiment analysis can lead to higher patient satisfaction scores, positively impacting the reputation and competitiveness of the healthcare business.

3. Increased Patient Retention:

By addressing concerns and meeting patient needs more effectively, healthcare businesses can increase patient loyalty and retention rates, reducing the need for costly patient acquisition efforts.

4. Better Clinical Outcomes:

Understanding patient sentiments can help healthcare providers personalize treatment plans and interventions, leading to better clinical outcomes and patient health.

5. Reduced Operational Costs:

By streamlining processes and addressing inefficiencies identified through data analytics, healthcare businesses can reduce operational costs associated with patient complaints and dissatisfaction.

6. Enhanced Brand Reputation:

Positive patient experiences resulting from improved satisfaction and engagement can enhance the brand reputation of the healthcare business, attracting more patients and referrals.

7. Optimized Resource Allocation:

Data analytics can help healthcare organizations allocate resources more effectively by identifying high-impact areas for improvement and prioritizing investments accordingly.

8. Compliance with Regulations:

By identifying and addressing issues related to patient satisfaction and engagement, healthcare businesses can demonstrate compliance with regulatory requirements focused on patient-centered care and quality improvement.

9. Increased Staff Satisfaction:

Addressing issues identified through sentiment analysis can lead to a more positive work environment for healthcare staff, resulting in increased job satisfaction and retention rates.

10. Competitive Advantage:

Healthcare businesses that leverage data analytics and sentiment analysis to drive improvements in patient satisfaction and engagement can gain a competitive edge in the market, attracting more patients and outperforming competitors.

Extended Use Cases

Here are extended use cases for different industries, demonstrating the application of data analytics and sentiment analysis for monitoring and improving customer satisfaction and engagement:

1. Energy

Customer Feedback Analysis:

Energy companies can analyze customer feedback from various channels, such as online reviews and social media, to understand sentiments regarding their services and identify areas for improvement. This can include sentiments related to billing accuracy, customer service responsiveness, and satisfaction with energy-saving initiatives.

2. Retail:

Product Reviews Analysis:

Retailers can leverage sentiment analysis to analyze product reviews and customer feedback to understand sentiments towards specific products or brands. This information can be used to improve product offerings, marketing strategies, and customer experiences.

3. Travel:

Travel Experience Monitoring:

Travel companies can monitor customer sentiments throughout the travel journey, including booking, accommodation, transportation, and overall experience. Sentiment analysis can help identify pain points, such as flight delays, hotel cleanliness, or customer service issues, allowing for proactive interventions and service improvements.

4. Pharmacy:

Medication Adherence Analysis:

Pharmacies can use sentiment analysis to monitor patient sentiments regarding medication adherence and treatment experiences. By analyzing patient feedback, pharmacies can identify barriers to adherence, provide targeted interventions, and improve patient engagement in their healthcare journey.

5. Hospitality:

Guest Experience Enhancement:

Hospitality businesses can leverage sentiment analysis to monitor guest sentiments and feedback during their stay. This includes analyzing sentiments related to room cleanliness, staff friendliness, amenities, and overall satisfaction. Insights derived can guide operational improvements and personalized guest experiences.

6. Supply Chain:

Supplier Relationship Management:

Supply chain companies can analyze sentiments from supplier feedback to monitor supplier satisfaction and identify potential issues or opportunities for improvement in supplier relationships. This can lead to better supplier management, reduced supply chain disruptions, and improved operational efficiency.

7. Finance:

Customer Service Analysis:

Financial institutions can analyze customer sentiments from interactions with customer service representatives, chatbots, and online platforms to gauge customer satisfaction levels and identify areas for improvement in service delivery. Insights derived can inform training programs, process optimizations, and service enhancements.

8. E-commerce:

Customer Feedback Analysis:

E-commerce platforms can analyze customer feedback and sentiments regarding product quality, delivery experiences, and customer service interactions. This analysis can inform product recommendations, marketing strategies, and website enhancements to improve overall customer satisfaction and loyalty.

9. Shipping:

Delivery Experience Monitoring:

Shipping companies can monitor customer sentiments related to delivery experiences, including delivery times, package condition, and delivery personnel interactions. Sentiment analysis can identify areas for improvement in delivery processes, customer communication, and service quality.

10. CRM (Customer Relationship Management)

Client Relationship Analysis:

Companies across various industries can leverage sentiment analysis to analyze client sentiments and feedback to monitor client satisfaction and engagement. This can include sentiments related to service quality, responsiveness, and overall satisfaction, enabling businesses to strengthen client relationships and loyalty.

Conclusions

Incorporating data analysis and sentiment examination within the healthcare sector offers a great potential for the adoption of practices focused around the patient, the enhancement of care quality, and the betterment of patient experiences. Utilizing various data sources, including feedback from patients, electronic medical records, and interactions on social media, allows medical providers to acquire crucial insights regarding patient sentiments, preferences, and experiences.

Techniques for sentiment analysis facilitate the automatic review of textual data, offering insights into patient satisfaction in real-time and pinpointing opportunities for enhancement. By being proactive in addressing patient issues, personalizing the delivery of care, and initiating focused efforts, healthcare institutes can cater to the distinct necessities of their patient demographics.

Employing a solution architecture based on AWS, which integrates components like Amazon S3, Amazon Redshift, Amazon Comprehend, and Amazon SageMaker, offers a scalable, secure, and efficient framework for executing data analytics and sentiment analysis within the healthcare domain. Such an infrastructure supports the ingestion, storage, analysis, and visualization of Moreover, the application of data analytics and sentiment healthcare-related data, fostering decisions based on data analysis extends to various sectors outside of healthcare, and the perpetual refinement of patient satisfaction and including energy, retail, travel, pharmacy, hospitality, engagement. supply chain, finance, e-commerce, shipping, and customer relationship management. By scrutinizing Nevertheless, the embrace of these technological customer feedback and sentiments, companies can derive solutions carries with it challenges and ethical dilemmas. valuable insights for the betterment of their products, It's imperative for healthcare institutions to give services, and overall customer experiences, precedence to data privacy, uphold transparency, and adhere to healthcare stipulations. It is critical to balance In essence, the adoption of data analytics and sentiment the advantages of data analytics with the safeguarding of analysis within healthcare is laden with the potential to patient privacy to maintain trust and ethical standards, foster patient-centered care, enhance patient satisfaction, and optimize the delivery of healthcare services. As The benefits of deploying data analytics and sentiment healthcare entities face the challenges and adopt these analysis in healthcare go beyond the enhancement of technologies, they unlock novel opportunities for patient satisfaction. This approach leads to improved expansion, innovation, and the offering of care that truly patient experiences, higher patient retention, superior places patients at the forefront Clinical outcomes, reduced costs of operations, and provides a competitive edge in the healthcare industry.

References

[1]. Choi, T., Wallace, S. W., & Wang, Y. (2018). Big Data Analytics in operations management. Production and Operations Management, 27(10), 1868–1883. https://doi.org/10.1111/poms.12838

[2]. Wang, Y., Kung, L., & Byrd, T. A. (2018). Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. Technological Forecasting and Social Change, 126, 3–13. https://doi.org/10.1016/j.techfore.2015.12.019

[3]. Ristevski, B., & Chen, M. (2018). Big data analytics in medicine and healthcare. Journal of Integrative Bioinformatics, 15(3).https://doi.org/10.1515/jib-2017-0030

[4]. Rao, P. V., Krishna, S. M., & Kumar, A. (2018). Privacy preservation techniques in big data analytics: a survey. Journal of Big Data, 5(1). https://doi.org/10.1186/s40537-018-0141-8

[5]. Beer, D. (2017). Envisioning the power of data analytics. Information, Communication & Society, 21(3), 465–479.https://doi.org/10.1080/1369118x.2017.1289232

[6]. Beer, D. (2017). Envisioning the power of data analytics. Information, Communication & Society, 21(3), 465–479.https://doi.org/10.1080/1369118x.2017.1289232

[7]. Kruse, C. S., Smith, B., Vanderlinden, H., & Nealand, A. (2017). Security techniques for the electronic health records. Journal of Medical Systems, 41(8). https://doi.org/10.1007/s10916-017-0778-4

[8]. Tubaishat, A. (2017). Evaluation of electronic health record implementation in hospitals. CIN: Computers, Informatics,Nursing, 35(7), 364–372. https://doi.org/10.1097/cin.0000000000000328

[9]. Tavares, J., & Oliveira, T. (2017). Electronic Health Record Portal Adoption: a cross country analysis. BMC Medical Informatics and Decision Making, 17(1). https://doi.org/10.1186/s12911-017-0482-9

[10]. Palojoki, S., Mäkelä, M., Lehtonen, L., & Saranto, K. (2016). An analysis of electronic health record–related patient safety incidents. Health Informatics Journal, 23(2), 134–145. https://doi.org/10.1177/1460458216631072

[11]. Bjarnadottir, R. I., Herzig, C., Travers, J., Castle, N. G., & Stone, P. W. (2017). Implementation of electronic health records inUS nursing homes. CIN: Computers, Informatics, Nursing, 35(8), 417–424. https://doi.org/10.1097/cin.0000000000000344

[12]. Fong, A. (2017). The role of app intermediaries in protecting data privacy. International Journal of Law and Information Technology, 25(2), 85–114. https://doi.org/10.1093/ijlit/eax002

[13]. Listokin, S. (2017). Does Industry Self-Regulation of Consumer Data Privacy work? IEEE Security & Privacy, 15(2), 92–95.https://doi.org/10.1109/msp.2017.45

[14]. Mendes, R., & Vilela, J. P. (2017). Privacy-Preserving Data Mining: Methods, metrics, and applications. IEEE Access, 5,10562–10582. https://doi.org/10.1109/access.2017.2706947

[15]. Martin, K. D., Borah, A., & Palmatier, R. W. (2017). Data privacy: Effects on customer and firm performance. Journal of Marketing, 81(1), 36–58. https://doi.org/10.1509/jm.15.0497

[16]. He, Z., Cai, Z., Sun, Y., Li, Y., & Cheng, X. (2016). Customized privacy preserving for inherent data and latent data. Personal and Ubiquitous Computing, 21(1), 43–54. https://doi.org/10.1007/s00779-016-0972-2

[17]. Kraska, R. A., Weigand, M., & Geraedts, M. (2016). Associations between hospital characteristics and patient satisfaction in Germany. Health Expectations, 20(4), 593–600. https://doi.org/10.1111/hex.12485

[18]. Pajnkihar, M., Štiglic, G., & Vrbnjak, D. (2017). The concept of Watson's carative factors in nursing and their (dis)harmony with patient satisfaction. PeerJ, 5, e2940. https://doi.org/10.7717/peerj.2940

[19]. Aiken, L. H., Sloane, D. M., Ball, J., Bruyneel, L., Rafferty, A. M., & Griffiths, P. (2017). Patient satisfaction with hospital care and nurses in England: an observational study. BMJ Open, 8(1), e019189. https://doi.org/10.1136/bmjopen-2017-019189

[20]. Thornton, R. D., Nurse, N., Snavely, L., Hackett-Zahler, S., Frank, K., & DiTomasso, R. A. (2017). Influences on patient satisfaction in healthcare centers: a semi-quantitative study over 5 years. BMC Health Services Research, 17(1).https://doi.org/10.1186/s12913-017-2307-z

[21]. McCray, S., Maunder, K., Krikowa, R., & MacKenzie-Shalders, K. (2018). Room service improves nutritional intake and increases patient satisfaction while decreasing food waste and cost. Journal of the Academy of Nutrition and Dietetics, 118(2), 284–293. https://doi.org/10.1016/j.jand.2017.05.014