



Visualizing Community Health Using Power Bi: Camino Patient Profile

Final Internship Report
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Master of Science, Health Informatics and Analytics

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1. Executive Summary

This report encapsulates the endeavors undertaken during the internship period spanning from February 5, 2024, to May 3, 2024, at Camino Research Institute, under the mentorship of Daniel Alvarez, a seasoned Data Scientist. Understanding the care delivery process is imperative for Camino, a not-for-profit organization dedicated to providing quality healthcare services for the uninsured and underinsured population. The objective was to utilize data analytics for enhancing clinical operations efficiency and fostering organizational growth. The institute, dedicated to advancing healthcare through innovation, focused on compiling, analyzing, and visualizing data to support medical billing, coding, and claim analytics. Leveraging tools from the Health Informatics and Analytics (HIA) program, the intern aimed to optimize reimbursement and overall service revenue. With a keen eye on enhancing operational dashboards, the intern facilitated administrative decision-making. Active involvement in community events extended the institute's outreach efforts. Overall, the internship highlighted the application of data analytics in advancing healthcare operations, in line with Camino Research Institute's commitment to innovation and quality care.

The internship enabled me to implement the skillset developed in Health Informatics and Analytics (HIA) program in the real world and drive positive business impact.

2. Introduction

2.1 Study Objectives

The study conducted the following objectives.

- Develop Power BI dashboards to analyze patient encounters at Camino Research Institute.
- Enhance Excel skills through coding CPT codes for lab and follow-up reports.
- Achieved substantial progress on the Camino Operational Outcomes Dashboard using Power BI.
- Initiate ECW to Epic data migration project to streamline operational efficiency.

2.2 Business Problem

Key Business Challenges

- Data Analytics Challenges: Issues in data transformation and dashboard design hinder actionable insights for operational improvements.
- Stakeholder Collaboration: Inadequate collaboration limits refinement of data analytics solutions to meet organizational goals.
- Data Migration Complexity: Project complexity requires resolving data compatibility issues for smooth transition and integrity maintenance.
- Insights Delivery: Limited analytics capabilities hinder data-driven decision-making for operational efficiency and patient care.

2.3 Background & Literature

In today's rapidly evolving healthcare landscape, organizations are increasingly turning to data analytics to drive improvements in operational efficiency and patient care outcomes. However, the implementation of data analytics initiatives presents various challenges, including issues related to data transformation, dashboard design, stakeholder collaboration, and data migration. Overcoming these obstacles is essential for healthcare organizations to harness the full potential of data analytics and achieve their strategic goals.

Extensive literature has been reviewed to gain insights into the application of data analytics in healthcare. Smith and Johnson's review delves into the potential of data analytics in healthcare, highlighting challenges in implementation and the necessity for effective strategies to derive actionable insights [1]. Brown and White's paper focuses on stakeholder engagement in healthcare decision-making, emphasizing the importance of effective communication to align aims and drive organizational success [2]. Garcia and Martinez provide an analysis of data migration strategies in healthcare systems, offering best practices for ensuring data integrity and system interoperability during transitions [3]. Additionally, Lee and Kim explore the role of data analytics in enhancing operational efficiency, discussing its impact on resource allocation and patient care delivery [4].

3. Methods

Following are the methods used as part of the data analysis and the barriers to achieving objectives.

3.1 Methods

3.1.1 Microsoft Excel: Excel played a pivotal role in data management, analysis, and visualization throughout the internship projects. It compiled clinical data, generated detailed reports, and supported Power BI dashboard creation. Excel facilitated meticulous coding of CPT for lab reports and follow-up visits, ensuring data accuracy for audits. It managed data gathering, cleanup, and transformation for visualization in Power BI, while also aiding in data refinement, visualization design, stakeholder collaboration, and data migration between EMR systems. Overall, Excel's versatility was crucial for efficient data handling and analysis across all projects, contributing significantly to their success.

3.1.2 Data Preprocessing: Transforming raw data into actionable insights. Beginning with meticulous data collection and compilation, attention is focused on ensuring accuracy and relevance. Excel serves as a cornerstone tool for data manipulation, facilitating thorough analysis and visualization. Advanced techniques enable comprehensive summarization and insightful trend identification. Moreover, Power BI enhances visualization creation, providing dynamic representations of operational outcomes. Through rigorous data processing, the project aims to empower stakeholders with reliable insights, fostering improvements in patient care and operational efficiency.

3.1.3 Data Visualization: Data visualization plays a crucial role throughout the internship project, particularly in the development of the Camino Operational Outcomes Dashboard. Leveraging tools like Power BI, Excel, and other visualization platforms, data is transformed into meaningful and insightful visual representations. These visualizations aid in the comprehensive analysis of patient encounters, clinic performance, provider-specific metrics, and other key aspects of healthcare operations. By presenting data in easily interpretable charts, graphs, and tables, stakeholders gain actionable insights to drive improvements in patient care, operational efficiency, and strategic decision-making. The dashboards crafted provide a holistic view of Camino's healthcare services, enabling stakeholders to identify trends, track performance metrics, and make informed decisions to optimize operational outcomes.

3.1.4 Data Migration: The data migration from one Electronic Medical Records (EMR) system to another, specifically from ECW to Epic systems. This process is vital for ensuring the seamless transfer of essential patient information, encompassing diverse data types ranging from critical patient details like allergies and medications to supporting data such as social and family history. Through meticulous research and stakeholder engagement, a comprehensive plan is developed, prioritizing data types based on their importance and complexity. Rigorous data mapping, validation, and continual improvement efforts are undertaken to guarantee the accuracy and reliability of the transferred information.

3.2 Barriers

3.2.1 Data Quality Issues: Ensuring the accuracy and integrity of transferred patient information is crucial for uninterrupted healthcare delivery. Any unexpected data quality issues or discrepancies could impede the migration process and compromise patient care. This barrier requires meticulous data auditing and validation checks to identify and rectify any inconsistencies or errors before and during the migration process.

3.2.2 Language barrier: Dealing with user responses primarily in Spanish presented a challenge in comprehending and categorizing them for subsequent analysis. Nevertheless, collaborating with bilingual teammates and a mentor aided in alleviating this issue.

3.2.3 Technical Challenges: Data migration between different Electronic Medical Records (EMR) systems often involves complex technical processes and compatibility issues. Technical challenges such as data format discrepancies, system interoperability issues, or unexpected software limitations can impede the smooth execution of the migration plan, requiring additional time and expertise to resolve.

4. Results and Interpretation

4.1 Patient Encounters by Department and Associated Resource Providers

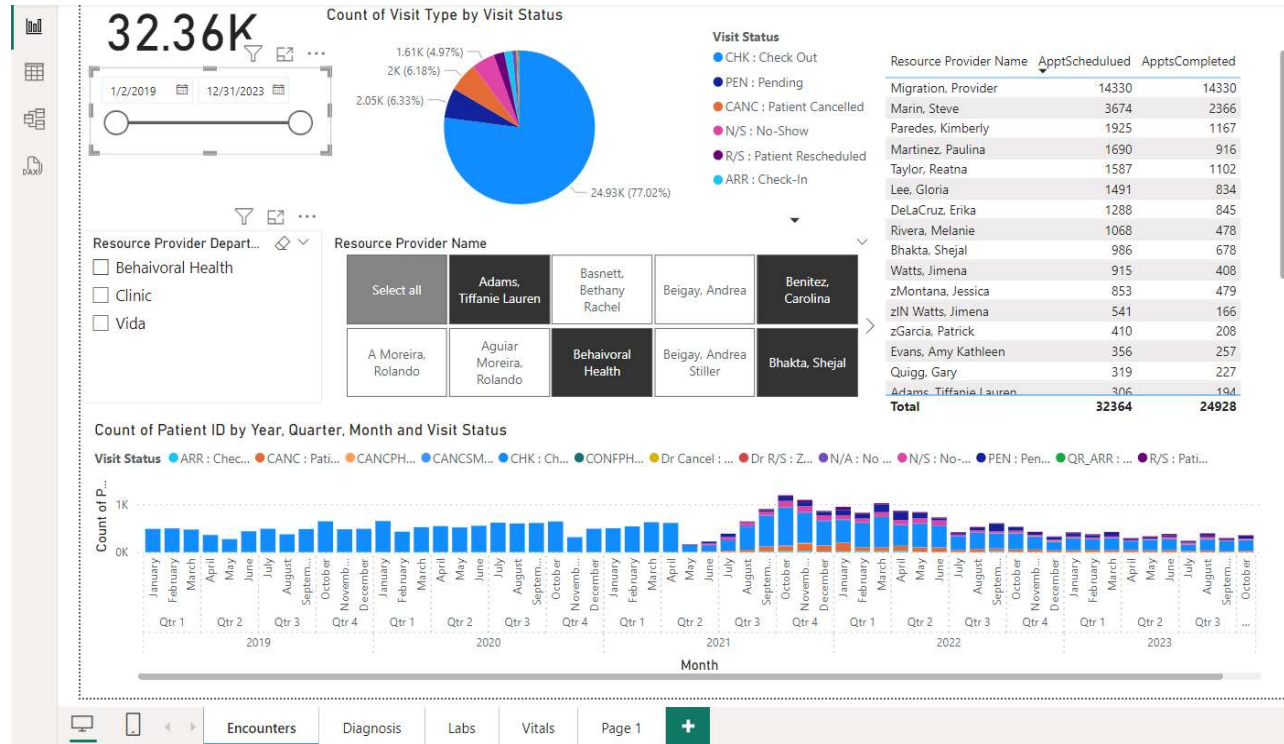


Figure1: Clinical Encounters Report

1. Date Range and Total Patient Visits: The visual encapsulates data spanning from January 2019 to December 2023, reflecting a total of 32,364 patient visits over this period.
2. Distribution of Visits: A pie chart provides a comprehensive breakdown of visits based on their respective statuses, offering a clear representation of the distribution of visit types within the dataset.
3. Patient ID Count by Year, Quarter, Month, and Visit Status: Presented in a bar chart format, this visualization offers a detailed breakdown of patient IDs categorized by year, quarter, month, and visit status, enabling users to discern patterns and trends over time.
4. Monthly Patient Visits by Visit Status: The bar chart highlights the monthly patient visit counts segmented by visit status, providing insights into the fluctuation of visits throughout the months. Moreover, it includes a delineation of visits by "Resource Provider," indicating the healthcare professional involved in each visit.
5. Resource Provider: This term refers to the healthcare professional engaged in patient visits and is incorporated within the context of monthly patient visit analysis, offering additional granularity to understand the distribution of visits across different healthcare providers.

4.2 Patient Demographics and Diagnosis Distribution

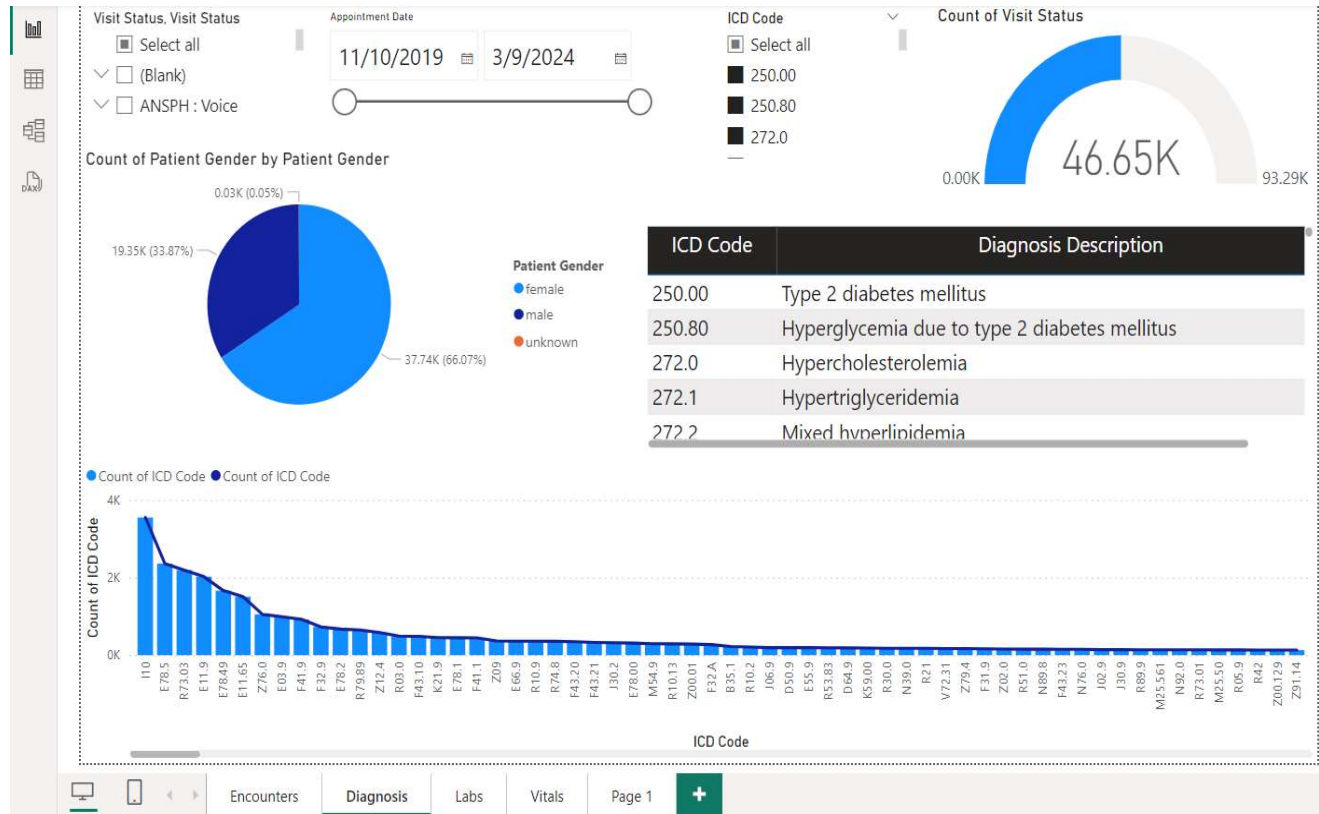
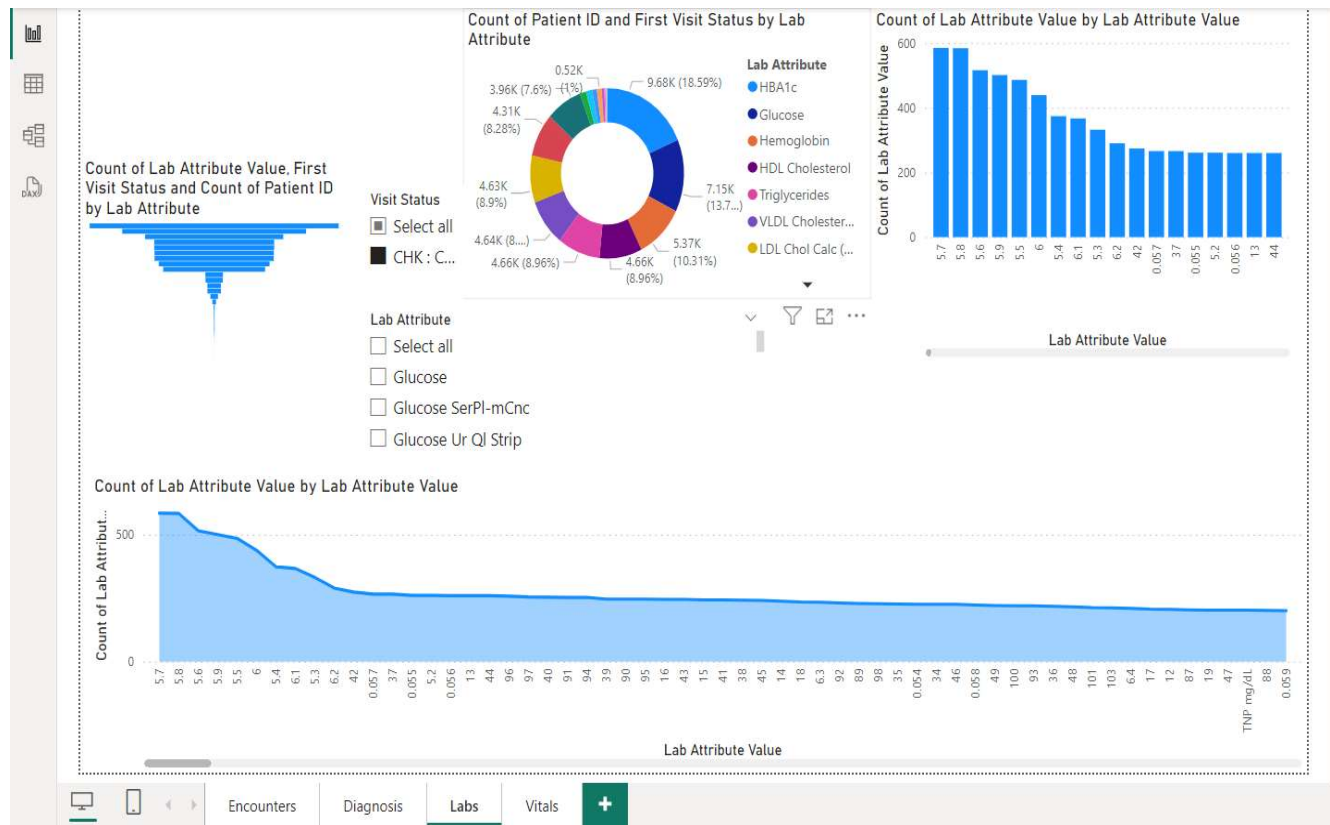


Figure2: Diagnosis visit report.

1. **Pie Chart - Patient Gender Distribution:** Provides a visual breakdown of patients by gender, with a notable skew towards female patients.
2. **Bar Chart - ICD Code Frequency:** Illustrates the prevalence of various ICD codes, standardized for medical diagnosis, with each bar representing a specific code and its corresponding patient count.
3. **Gender Analysis:** Indicates a higher representation of female patients compared to male patients based on the pie chart's proportions.
4. **ICD Code Insights:** Offers insights into the frequency of specific medical diagnoses through the bar chart, aiding in understanding prevalent medical conditions among patients.

4.3 Optimizing Patient Care: Analysis of Lab Test Data



4.5 ECW to Epic Data Migration Priority Matrix

In the data migration priority matrix, the Master Patient Index (MPI) takes precedence with a Priority Level of 1, essential for seamless patient identification and data integration. Following closely is Future Appointments at Priority Level 2, ensuring continuity of care post-migration. The Problem List ranks third (Priority Level 3), offering vital insights into patient health issues for ongoing management. Allergies follow at Priority Level 4, crucial for preventing adverse reactions. Medications, prioritized fifth (Priority Level 5), play a vital role in patient safety. Together, these prioritize patient data types facilitate seamless migration, ensuring patient safety and care continuity.

Data Elements	
Data Type	Description
MPI	Patient key identifiers to confirm/create one unique record across entire instance/database.
Future Appointments	Any scheduled appointments to occur after go-live date on Encompass
Problems List	Discrete active outpatient problems (manual reconciliation required)
Allergies	Discrete active allergies (meds, food, environmental....incl severity, reaction, and comments) (manual reconciliation required)
Medications	Discrete medications the patient is actively taking, prescribed in outpatient visits (manual reconciliation required)
Immunizations	Discrete information on vaccine administrations, historical vaccines, or evidence of immunities (manual reconciliation required)

Figure 4

Data Elements	
Data Type	Description
Lab Results	Discrete or textual results for general chemistry, microbiology, pathology, and other lab tests Depth of Historical Data: 3 years for most procedures, 10 years for textual pathology For population health: high risk HPV lab test – 5 years
Imaging Results	Textual reports for radiology, cardiology, gastroenterology, and other studies, Depth of Historical Data: 5 years For population health: colonoscopy - 10 years, flexible sigmoidoscopy – 5 years, CT colonography - 4 years, mammogram – 2 years
Notes	Notes may include H&P, Progress Notes, transcription or dictated reports, and other documentation Depth of Historical Data: 3 years
Guarantor Accounts	Personal, family, and other guarantor account types to support patient registration
Referrals & Authorizations	Provider-to-provider patient referrals or authorization information from payers
Insurance Coverages	Patient-specific insurance coverages, including subscribing information
Future Orders	Lab, imaging, and other orders that will be performed after go-live

Figure 5

1. The priority matrix reflects a patient-centric approach, focusing on essential data types crucial for managing chronic disease patients with complex health needs.
2. High priority is given to foundational data like MPI, ensuring seamless patient identification and data linkage across systems, which is critical for maintaining continuity of care.
3. Clinical data such as problem lists, allergies, and medications are prioritized to support accurate diagnosis, treatment decisions, and patient safety post-migration.
4. Ancillary data types like immunizations, lab results, and imaging reports are also prioritized to ensure comprehensive patient care and informed decision-making during and after the data migration process.

5. Discussion and Conclusion

5.1 Overall business impact:

This internship project yielded significant business impacts across multiple dimensions. By enhancing operational efficiency through streamlined reporting processes, the organization experienced improved data visibility and decision-making capabilities, leading to optimized resource allocation and enhanced productivity. The focus on securing revenue growth through grants resulted in better outcomes tied to continued support, fostering financial sustainability, and enabling the organization to expand its services and reach. Lastly, the emphasis on quality improvement through patient health outcome monitoring facilitated proactive interventions and tailored care delivery, enhancing patient satisfaction and loyalty. Collectively, these initiatives not only bolstered the organization's operational effectiveness but also positioned it for sustained growth and success in delivering high-quality healthcare services to its stakeholders.

5.2 New avenues of inquiry:

Predictive Analytics for Proactive Care:

Predictive analytics transforms healthcare by predicting patient outcomes and spotting health risks early. Clinicians use vast datasets to intervene ahead of time, cutting costs and enhancing patient welfare. These predictive models empower clinicians to implement targeted interventions and preventive measures, mitigating health issues and improving patient well-being. As a result, predictive analytics not only optimize healthcare resource allocation but also contribute to significant cost savings by reducing emergency admissions and hospital readmissions.

NLP and Sentiment Analysis in Healthcare:

NLP and sentiment analysis extract insights from patient feedback, guiding service enhancements. Analyzing feedback improves care delivery and elevates patient satisfaction. By leveraging NLP algorithms to analyze various data sources such as surveys, social media, and electronic health records, healthcare providers gain valuable insights into patient preferences and concerns. This deeper understanding enables organizations to tailor services to meet patient needs effectively, fostering a patient-centric approach to healthcare delivery.

6. Appendix

6.1 Internship Experience

This internship has been a transformative experience, allowing me to apply the knowledge acquired from the HIA program in real-world scenarios. Beyond merely contributing to my field of interest, it served as a platform to utilize a diverse skill set, encompassing Power BI, data visualization, data preprocessing, Data Migration, EMR patient record management, CPT coding, and data cleaning, with authentic data. Working in-person during the internship cultivated a keen sense of teamwork, enhancing my collaborative skills and providing exposure to individuals from diverse backgrounds and age groups. This environment not only strengthened my interpersonal abilities but also broadened my perspective through exposure to varying viewpoints and approaches. Moreover, beyond the technical aspects, this internship offered insight into organizational culture and dynamics, allowing me to refine essential soft skills such as communication, leadership, and problem-solving. It provided a deeper understanding of project planning strategies within healthcare organizations and instilled a sense of confidence in navigating professional challenges. Overall, this experience has been instrumental in my professional development, equipping me with practical skills and invaluable insights essential for success in the healthcare industry.

6.2 Role of Internship mentor

Throughout the internship journey, my mentor has played a vital and irreplaceable role. His guidance has been meticulous, offering thorough support at every stage of the process. His method of task explanation and delegation has been exceptionally detailed and strategic, ensuring a thorough grasp of each component. With the surveys conducted at Camino being bilingual, my mentor's assistance has been pivotal in helping me understand the data effectively. His expertise and detailed explanations have assisted in navigating the complexities of analyzing bilingual survey data. Consistently providing constructive feedback and insightful guidance for every task, he has fostered continual learning and skill enhancement. This feedback loop has not only enriched my learning experience but also led to the refinement and improvement of my abilities throughout the internship. Overall, my mentor's professionalism, meticulous attention to detail, and strategic guidance have played a crucial role in the success of my internship journey.

6.3 References

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