**EDA / Descriptive Statistics - Pharmaceutical Inventory Management**

**Introduction:**

In the fast-paced and critical environment of healthcare, effective management of medical inventory is paramount to ensuring the delivery of quality patient care. From lifesaving medications to essential surgical supplies, medical facilities rely heavily on maintaining optimal inventory levels to meet patient needs while minimizing costs and waste. In recent years, the integration of data analytics into medical inventory management processes has emerged as a game-changer, offering healthcare organizations unprecedented insights and capabilities to optimize their supply chain operations. Our project focuses on visualizing medical inventory data to provide insights into inventory levels, usage patterns, and optimization opportunities.

**Overall Design Strategy:**

The dataset which was given by the client gave us insights about medical inventory transactions, including materials, quantities, locations, and dates. It consisted of more than 65 thousand records which covers information related to medical inventory from April 1, 2020, to March 30, 2024, our approach emphasizes the development of intuitive dashboards and interactive visualizations to visualize inventory trends, identify high-cost items, track usage patterns, and optimize procurement strategies. Data was aggregated at both material and location levels to provide comprehensive insights. Color coding was utilized to highlight important metrics, and consistent font usage and background colors were maintained for clarity and coherence.

**Data Overview:**

The medical inventory data was sourced from internal inventory management systems and the analysis consists of over 65000 records capturing medical inventory transactions over a period of 5 years. The dataset includes information about materials, descriptions, quantities, storage locations, movement types, and financial details. Additional reference data, such as supplier information and purchase orders, was also included. EDA was performed on the data (Quantitative columns) and processed to remove inconsistencies and missing values. We found the data in the numerical columns contained positive and negative values which denoted the purchase and usage of the stocks from the inventory. There are also columns which there are more than 50% of missing values, which are not taken into consideration. Aggregated data summaries were created to analyze inventory levels and usage patterns. Data is extracted into text files and when uploading into tableau all these files are joined based on the keys. Once the data is loaded another extract summarizing the team level data is created using custom SQL.

**Users**

Users of the visualization dashboard include:

* **Inventory Managers:** To track inventory levels, identify trends, and optimize stock levels.
* **Procurement Managers:** To analyze supplier performance, optimize procurement strategies, and reduce costs.
* **Healthcare Administrators:** To monitor inventory expenses, track usage patterns, and ensure adequate supply levels.

**Questions**

**Questions answered by this visualization include**:

Inventory Managers:

* What is the relationship between Plant and Storage Location?
* How do inventory levels vary across different storage locations?
* In which Posting date has there been higher count of procurement and usage of inventory?
* Which materials have the highest usage rates?
* Which materials exhibit the highest consumption rates, and are there any notable variations across departments or facilities?
* How quantity is associated with movement type?

Procurement Managers:

* Which materials have the highest procurement costs?
* How is the Storage Locations distributed within each Plant?
* Which Movement Type has the highest count?
* Which suppliers provide the majority of medical materials and how is their performance?
* What is the procurement costs associated with different materials, and how can cost-saving measures be implemented without compromising quality?

Healthcare Administrators:

* The correlation between the Quantity in Unit of Entry, Quantity in OP Unit, Quantity in order unit, Amount in Local Currency, Quantity
* What is the correlation between Amount in Local Currency and Sales Value and how does it affect the total profit?
* What is the relationship between Quantity and Quantity in Unit of Entry?

**Describe Visualization and How it Answers Questions**:

Inventory Trends:

* A Heat map is used to visualize the relationship between Plant and Storage Location. Heat map provides us with insights on correlation matrix of the numerical columns. We can understand that they have |r| between **0.17 to 1.**
* A Scatter plot is used to display the inventory levels that vary across different storage locations, which in turn tells us the storage location having the highest inventory in procurement and usage which is **UTL(>65000)**
* A line graph displays inventory levels over time, allowing managers to track trends and identify seasonal variations.
* A histogram is used to compare the posting date and determine the highest count with regards to the date.
* A bar chart compares inventory levels across different materials, highlighting high-usage items and potential shortages.

Supplier Analysis:

* A count plot displays the highest count in movement type which is movement type(201) which has a count of more than 25000 materials
* A count plot is used to visualize the distribution of Storage Locations within each Plant. We can conclude that Storage location (UTL) has highest number of plant which surpasses 6000.
* A bar chart displays procurement costs for each material, allowing managers to prioritize cost-saving efforts and negotiate better terms with suppliers.

Inventory Usage Patterns:

* A heat map is used to determine the correlation between the Quantity in Unit of Entry, Quantity in OP Unit, Quantity in order unit, Amount in Local Currency, Quantity
* A Scatter plot is used to establish the correlation between Amount in Local Currency and Sales Value. There a certain outliers which are present both is positive and negative values. Overall Rule of thumb says **|r| > 0.85** is a strong relation. Here the correlation is **1.0**, which is a strong relation.
* A Scatter plot is used to establish the correlation between Quantity and Quantity in Unit of Entry. There a certain outliers which are present both is positive and negative values. Overall Rule of thumb says |r| > 0.85 is a strong relation. Here the correlation is **1.0**, which is a Strong relation.
* Correlation is determined using a heat map.

**Conclusion:**

It is a tedious task to analyze the Medical inventory management dataset as it involves a large amount of data. Visualizing medical inventory data provides valuable insights to procure raw materials in a strategic manner which in turn reduces overpaying and surplus unutilized stock in the inventory. By tracking inventory trends, analyzing supplier performance, and optimizing usage patterns, healthcare facilities can improve inventory management efficiency, reduce costs, and ensure the availability of essential medical supplies. Continued use of data visualization tools will facilitate ongoing monitoring and optimization of inventory management practices in the healthcare sector.