

## Business Problem:

The Cardio Vascular Metabolic (CVM) diseases are a cluster of conditions and risk factors that increase the likelihood of developing heart disease, stroke, and/or type 2 diabetes. The impacts of CVM diseases on people, society and our planet are immense and growing, yet they remain underdiagnosed, undertreated and their interconnections under-recognised. These conditions affect hundreds of millions of people around the world; we estimate that one in three people with a CVM disease are living with two or more of these chronic diseases. The improved healthcare and awareness has influenced the death rates. Thus, the deaths related to cardiovascular disease (CVD), such as coronary heart disease, stroke, and hypertension, have declined. The connected mortality rates have declined by 36% during 14 years from 2000 to 2014. However, this rate has been slowed down since 2011. (Nilay S. Shah, Donald M. Lloyd-Jones, Martin O’Flaherty, & al, 2019)

Metabolic conditions linked to CVM diseases, such as obesity and diabetes, are increasingly prevalent. In recent years, approximately 50% of U.S. adults were found to have at least one cardiometabolic condition, with racial disparities evident. (National Health and Nutrition Examination Survey (NHANES))

Thus, it has become imperative to look and explore the trends in claim data of patients related to CVM diseases and give some useful business insights.

### *Steps for analyzing data*

The steps usually involve cleaning and sorting of the data

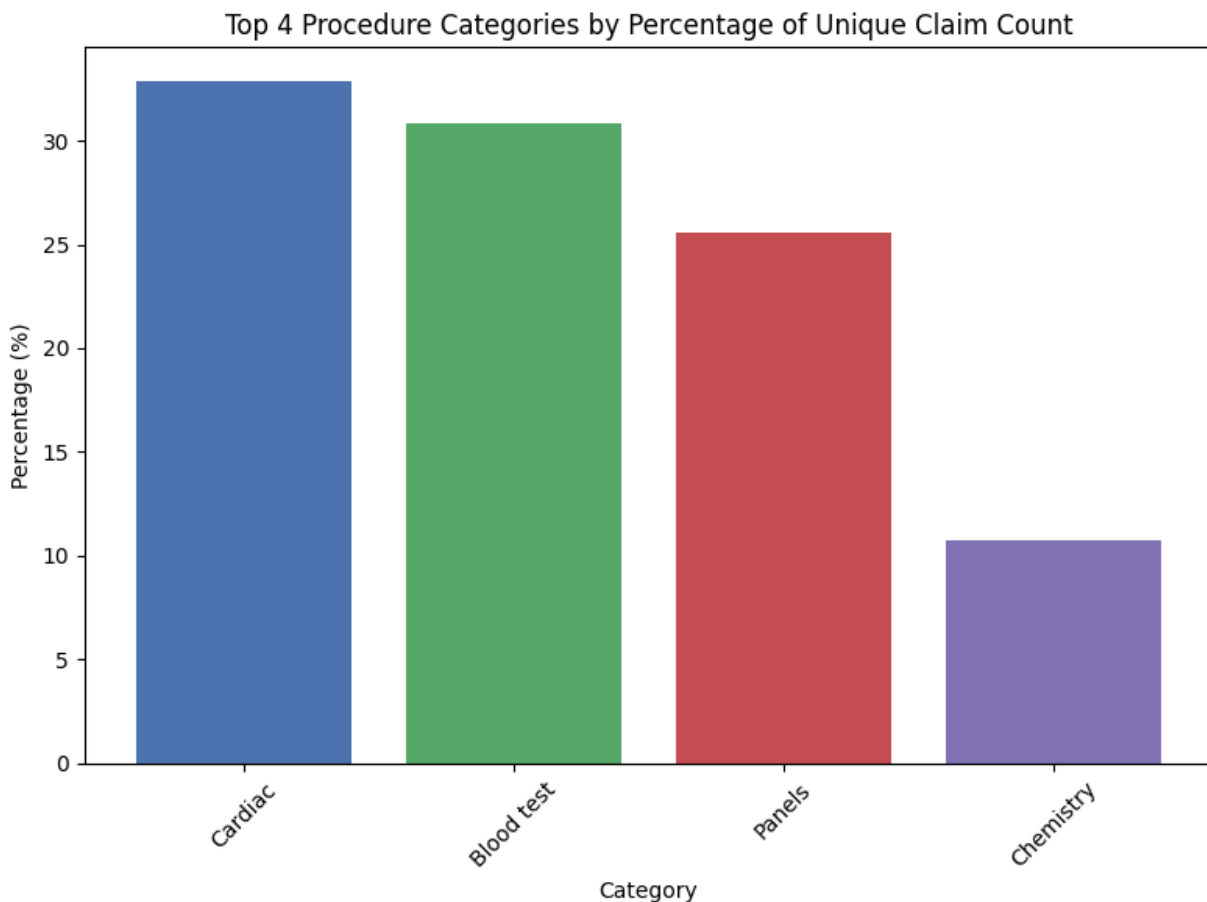
- Firstly, a new binary variable called ‘cardiac\_flag’ has been created with 1 for CVM related claims and 0 for Non-CVM claims based on the ‘category’ column/attribute within `hcpcs_code_100_df` dataframe.
- After that the two dataframes: `hcpcs_code_100_df` and `medicare_df` are merged based on `hcpcs_code`.
- Then the null values were removed based on `cardiac_flag`
- Made sure that the data is filtered for the years 2016 – 2018.
- Then removed the non-procedural categories like ‘Administrative’ and ‘other’s’.
- The null values for `npi_id` were also removed.
- At last, the duplicate values were dropped based on the `claim_id`.

### *Assumptions*

- The analysis has been done on the assumption that the pharma company has enough budget to expand (make their sales force team larger as well as other employees) and increase their product range and product lines.
- The analysis has been done based on the assumption that the actual data is more detailed and rigorous as compared to the Syntegra data.

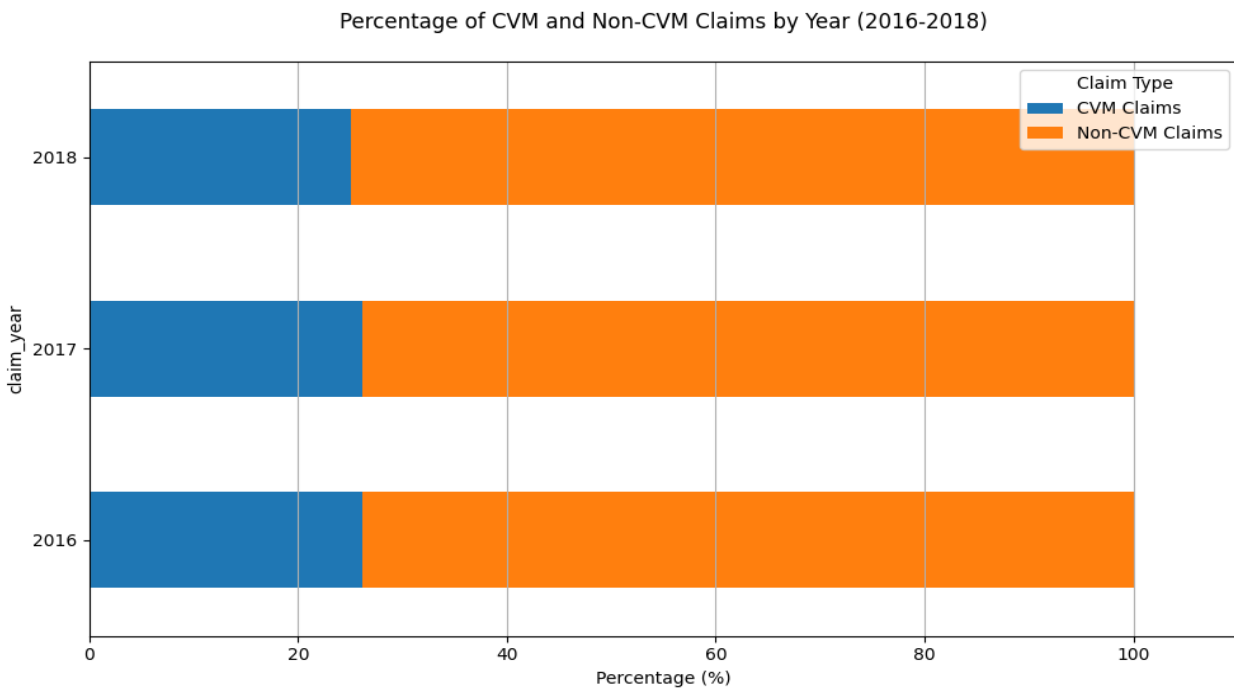
- This report has been written considering the audience to be sales and marketing teams as well as information technology team in a narrative approach.

## Exploratory Data Analysis and Insights:



Here the top four procedure can be observed, and it can be deduced that Cardiac is the top one so pharmaceutical companies have more opportunities in the '**Cardiovascular Diseases**' therapeutic area. They should focus on the products related to this category as well as the other three mentioned above. Although the remaining three are mostly related to blood work so the pharmaceutical companies can focus on medical devices in this area if they are already in this business of medical devices.

## CVM claims 2016 - 2018

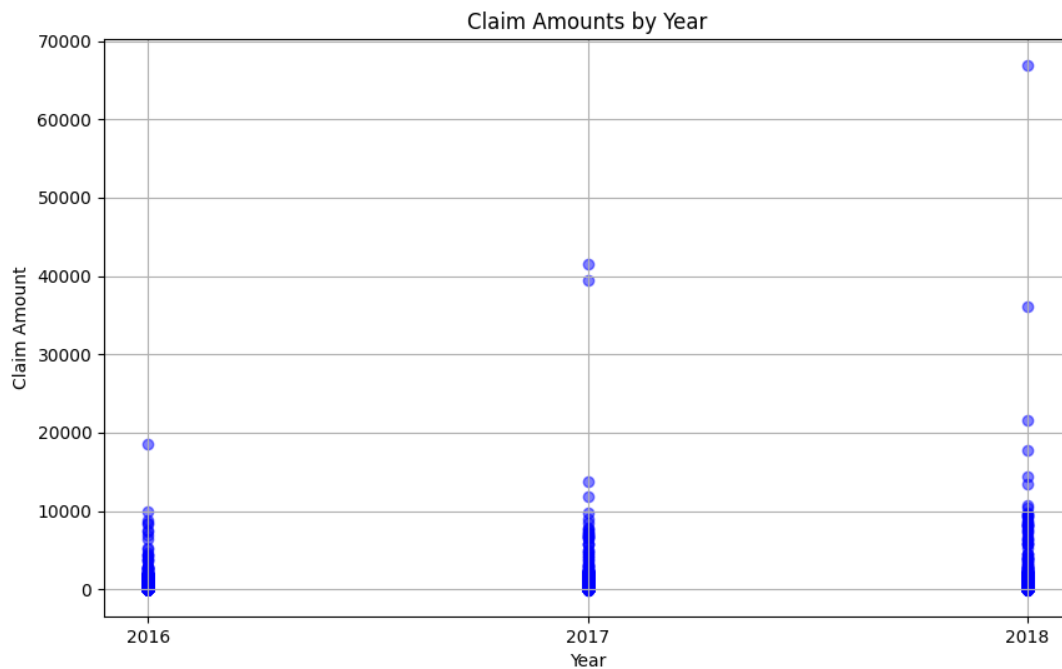


The total CVM claims share for the year 2016 to 2018 are 26.12%, 26.15% and 25.08%, respectively. This shows a very steady trend over the period. We can see a slight decrease in the year 2018. This can be the consequence of awareness and health improvement, or it may be due to the fact that more people have started to cover their medical expenses out-of-the-pocket.

To explore the actual cause, some of the statistics needed to be stated. The trend of claims related to cardiovascular metabolic (CVM) diseases in the U.S. has shown significant growth due to rising prevalence, especially as overlapping conditions like cardiovascular disease (CVD), chronic kidney disease (CKD), and diabetes increase. These conditions frequently co-occur, particularly among older adults, with overlapping conditions almost doubling from 5.3% in 1999 to 8.0% by 2020. (Ostrominski, et al., 2023) Additionally, the number of U.S. adults with all three conditions rose from 0.7% to 1.5% over this period, indicating an upward trend in multimorbidity (having more than one chronic condition simultaneously) linked to CVM diseases. (John W., et al., 2023) Thus, this slight increase and then decrease may be due to factors

such as out-of-pocket payments and insurance variations. The reasons for the out-of-pocket payments might include high deductible health plans, gaps in coverage, or limited insurance benefits for specific treatments. Moreover, changes in health insurance policies, such as increased co-pays, limited coverage for certain CVM medications or treatments could lead patients to delay or reduce care for CVM issues. If the share of CVM claims slightly increased from 2016 to 2017 and then decreased from 2017 to 2018, this could also indicate changes in patient demographics, health awareness, or lifestyle pattern.

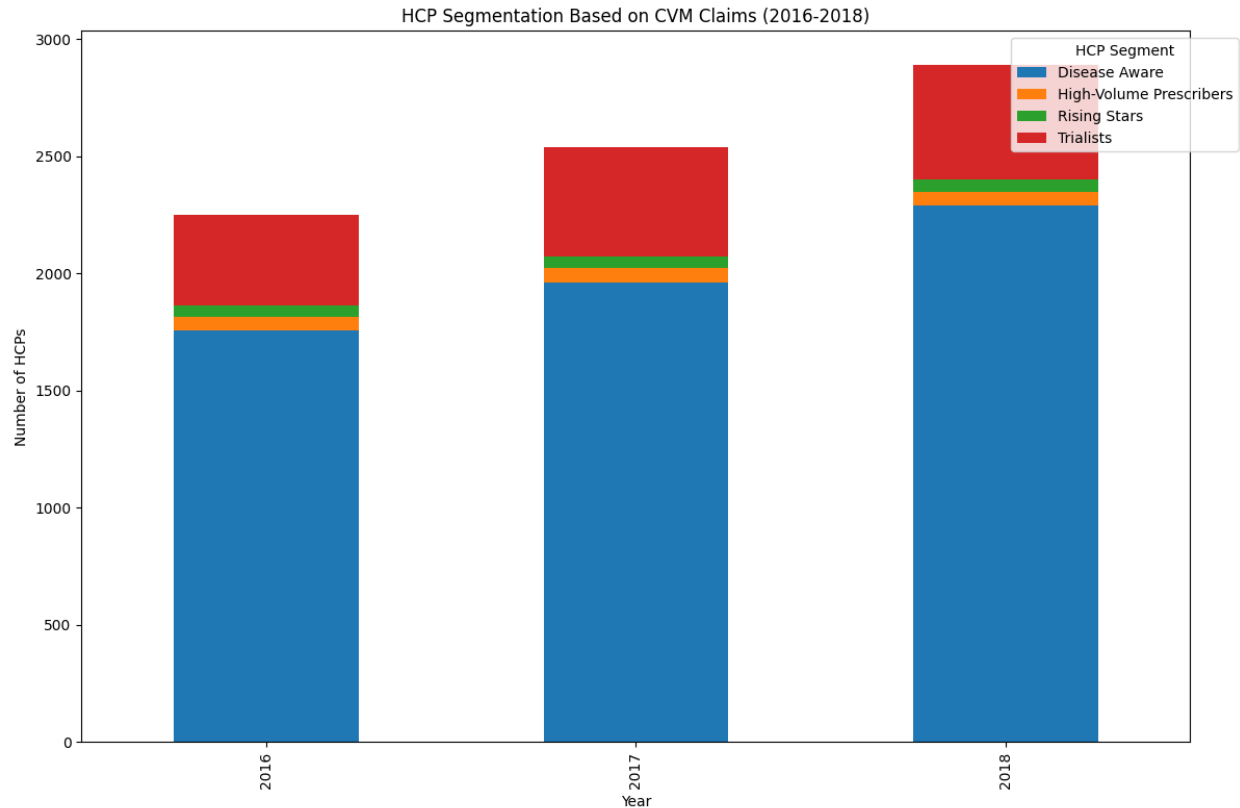
We will look at the claim amount for each year.



The above graph clearly shows the increase in the claim cost over the time. This can be one of the reasons stated above for increased out-of-pocket expenses.

The pharmaceutical companies can work with the US government and other payer organizations to increase the coverage range of medical expenses.

## HCP behavior in context of claim volume from 2016-2018

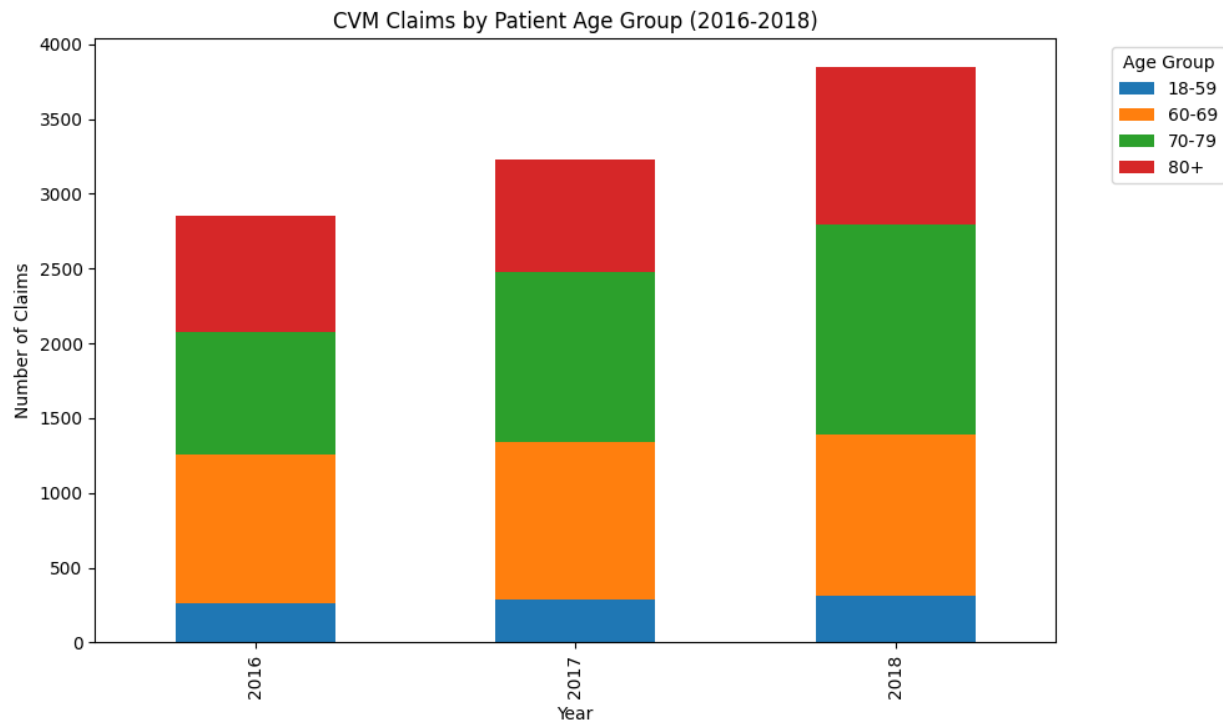


The above figure shows that there mostly are disease aware HCPS (having one claim) and their number is also increasing every year. After that there are trialists (HCPs with 2-4 CVM claims). There is a very small proportion of Rising Stars (HCPs with 5-9 CVM claims) and High-Volume Prescribers (HCPs with 10+ CVM claims).

First of all, the sales teams should investigate the disease aware HCPs whether they are new doctors, or they have started to prescribe the competitor's medications. If they are new doctors the sales team should make follow-up visits to them to encourage them to prescribe the product more. The sales team should also see the Trialists. In this way the disease aware and the Trialists will fall in Rising stars and High-volume prescribers. The ultimate goal is to have maximize the number of High-volume prescribers.

The sales and marketing teams should further look into the channels which are used to target the HCPS and improve them. If the company is already targeting the HCPs using in-Person (sales force) that the sales force team should be in the limelight and trained more to attract the disease aware and Trialists more. If the company is using Non-Personal Promotions (NPP, i.e. Emails, Social Media, Digital etc.) then it should focus on this. The suggestion would be to adopt the omni-channel strategy. They should also supplement this with the Rx data.

## Patient age demographics for the CVM claims



Year-over-Year Change Percentage in Claim Volume for Each Segment:				
age_segment	18-59	60-69	70-79	80+
claim_year				
2016	0.000000	0.000000	0.000000	0.000000
2017	13.184584	12.322792	25.954198	-0.632022
2018	16.935484	5.461165	33.193473	39.929329

Firstly, the number of total claims has increased over the year and the most frequent number of claims are by ages 60 – 69, 70 – 79 and 80+. This is logical because the heart disease risk increases with age. The percentage change also gives more useful insights. The percentage change is mostly positive which resonates with the convention that prevalence of disease is increasing. The percentages are high for patients with 79 – 80 years. The percentage change for the 80+ patient for the year 2017 is negative which further needs to be investigate and for 2018, it is showing maximum increase of around 40%.

The useful takeaway for the pharmaceutical companies is to increase the number of people older than 60 years for insurance coverage. The pharmaceutical companies can influence the government to increase the range of Medicare and Medicaid.

The risk of CVM disease is high also among the people of low income because of their lifestyle and food consumption patterns. Thus, Medicaid will help in the coverage of these types of patients.

The company can come up with more detailed advertising campaigns for their medications for elderly patients.

## Conclusion:

It can be observed that the claims for the three years are showing a steady and very slight growth for the given observed years from 2016 – 2018. So, the pharmaceutical companies really need to investigate the actual cause of this and work with the payers. The pharma company should also strengthen their sales force team and observe other sales and marketing strategies to target their customers.

For the CVM claims the annual growth rate of CVM claims as a percentage of total claims can be calculated. Analyzing these growth rates can reveal whether the trend is accelerating, decelerating, or stable, helping in forecasting future trends more accurately. By assessing monthly or quarterly data, the seasonality patterns in the CVM claims can be analyzed.

### *Further analysis using the whole data:*

Further, the more recent data after 2018 can be incorporated to observe the recent trends. We can also investigate medication adherence trends across age groups in the claims data. Analyze claims data to identify whether particular demographics are more likely to have recurring claims or require additional medications for comorbidities. This could inform research into tailored drug efficacy or formulation adjustments by subgroup, potentially improving treatment outcomes. The claims for out-patient and in-patient claims can also be investigated to understand where pharmaceutical company should focus.

At last, we can use predictive analytics to forecast demand for CVM-related drugs by analyzing trends in patient demographics, claim volumes, and related conditions. This can guide R&D investment, production planning, and strategic marketing to address future needs effectively.

## Works Cited

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