SQL DATA ANALYSIS AND VISUALIZATION WITH POWER BI FOR FDA

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INTRODUCTION

As an analyst student, I am thrilled to present the outcome of my study on the U.S. Food and Drug Administration (FDA) through our project on SQL Data Analysis and Visualization. This project represents a unique opportunity to explore regulatory data and its implications for public health. By utilizing powerful tools like MySQL and Power BI, I aimed to dissect the FDA's dataset, focusing on critical aspects such as drug approval trends, segmentation patterns, and therapeutic evaluations. Through meticulous analysis, I endeavored to uncover actionable insights capable of informing regulatory decisions and contributing to the broader mission of safeguarding public health.

UNVEILING TRENDS: ANALYZING DRUG APPROVALS OVER TIME

The data analysis from 1939 to 2016 reveals fluctuating trends in drug approvals, with notable periods of growth, decline, and stability. Growth peaks in the late 1970s and early 1980s, possibly driven by advancements in pharmaceutical research and regulatory policies. Conversely, the early 2000s show a plateau or slight decrease, reflecting potential regulatory shifts or developmental challenges. Yearly fluctuations highlight the complexity of influencing factors, while recent years demonstrate a relatively stable approval landscape, indicating regulatory maturation and pharmaceutical innovation. This analysis provides insights crucial for future regulatory strategies and pharmaceutical development.

ApprovalYear	NumOfApprovals
1939	12
1940	11
1941	14
1942	11
1943	6
1944	9
1945	5
1946	13
1947	11
1948	22

TOP AND BOTTOM: ANALYZING PEAKS AND TROUGHS IN DRUG APPROVALS

The analysis reveals peaks and troughs in pharmaceutical activity over multiple decades. While 2002 stands out with a remarkable 5661 drug approvals, 1945 records the lowest count at just 5 approvals. These findings highlight periods of heightened innovation and regulatory activity, as well as potential constraints or subdued innovation. Understanding these trends informs strategic decisions and future developments in the pharmaceutical industry.

ApprovalYear	NumOfApprovals
2002	5661
2000	5204
2001	5098

ApprovalYear	NumOfApprovals
1945	5
1943	6
1944	9

APPROVAL RANKINGS BY SPONSOR (1939-1960)

The analysis of drug approval trends spanning from 1939 to 1960 offers a comprehensive overview of the pharmaceutical landscape during this significant period. It illuminates the dynamic interplay between yearly approval counts and the pivotal contributions of various sponsors, such as Lederle, King Pharma, Pfizer, Novartis, and Sanofi Aventis US. Notably, the data underscores the industry's fluctuating activity levels, characterized by peaks and troughs in approval counts. This historical analysis provides invaluable insights into the evolution of drug approvals and the pivotal roles played by key sponsors. Such insights are instrumental in informing strategic decision-making processes within drug development and regulatory spheres, thereby enriching our understanding of pharmaceutical industry dynamics throughout this era.

ApprovalYear	SponsorApplicant	ApprovalCount	SponsorRank
1939	LILLY	2	1
1939	ORGANON USA INC	2	1
1939	MEDA PHARMS	1	3
1939	MERCK SHARP DOHME	1	3
1940	ISO TEX	1	1
1940	GD SEARLE LLC	1	1
1940	POYTHRESS	1	1
1941	US PHARM HOLDINGS	1	1

EXPLORING PRODUCT SEGMENTATION PATTERNS BASED ON MARKETING STATUS

ProductMktStatus	ProductCount
1	18344
2	681
3	14209
4	1231

The analysis of product market statuses reveals a clear distribution across different categories. With the majority of products falling under statuses 1 and 3, it indicates a significant presence of products actively marketed or with ongoing regulatory actions. However, the relatively lower count in status 4 suggests a smaller proportion of products facing regulatory restrictions or being withdrawn from the market. This distribution offers insights into the dynamics of product availability and regulatory compliance within the dataset.

APPLICATIONS BY MARKETING STATUS SINCE 2011

The provided data outlines the total number of applications categorized by Marketing Status over the period from 2011 to 2016. Marketing Status 1 consistently exhibits the highest number of applications throughout these years, followed by Status 3, Status 2, and Status 4. The observed fluctuations in application numbers across different statuses warrant further investigation to discern underlying trends or factors influencing application patterns within each status category over time.

ApprovalYear	ProductMktStatus	TotalApplications
2011	1	1279
2011	2	63
2011	3	260
2011	4	51
2012	1	1364
2012	2	69
2012	3	215
2012	4	53

TOP MARKETINGSTATUS: TRENDS OVER TIME

The data suggests that MarketingStatus 1 is the top category with the highest number of applications, demonstrating fluctuations in application volumes over the years. Specifically, there is a notable peak in 2002, followed by a gradual decline until 2015, where the number of applications stabilizes. These fluctuations could indicate various factors affecting application rates, such as regulatory changes, shifts in market demand, or product innovation. Further analysis would be beneficial to understand the underlying drivers behind these trends and their implications for regulatory processes and market dynamics.

ProductMktStatus	application_year	num_applications
1	2002	7115
1	2013	6654
1	2014	6637
1	2015	5941
1	2000	5882

ANALYZING DISTRIBUTION OF PRODUCTS BY DOSAGE FORM

The analysis categorizes products by dosage form and highlights their distribution. Tablets for oral administration emerge as the most prevalent form, with 13,942 products, followed by injectable formulations, including injections and intravenous solutions, totaling 6,172. Capsules for oral use also feature prominently, with 3,316 products. Extended-release formulations, creams, solutions, and suspensions are also observed, showcasing the diversity in pharmaceutical formulations.

DosageForm	ProductCount
TABLET;ORAL	13942
INJECTABLE;INJECTION	6172
CAPSULE;ORAL	3316
TABLET, EXTENDED RELEASE;ORAL	1501
CAPSULE, EXTENDED RELEASE;ORAL	706
TABLET; ORAL	491
CREAM;TOPICAL	457

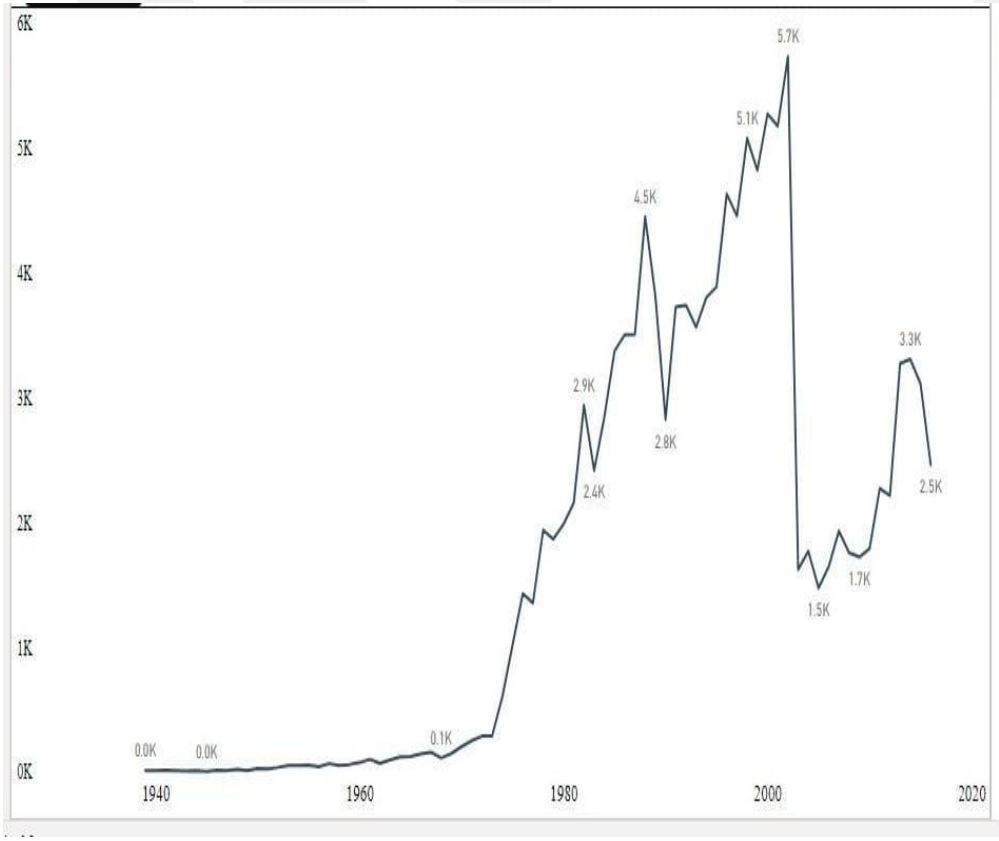
ANALYSIS OF REGULATORY APPROVALS BY DOSAGE FORM

The analysis of the provided data reveals that tablets for oral administration emerge as the most prevalent dosage form with the highest number of approvals, totaling 7483. Following tablets are injectable formulations, primarily for injections, with 3782 approvals. Oral capsules rank third with 1968 approvals. This suggests a strong preference for solid oral dosage forms in regulatory approvals, highlighting tablets as the most successful form among the options presented.

DosageForm	TotalApprovals
TABLET;ORAL	7483
INJECTABLE;INJECTION	3782
CAPSULE;ORAL	1968
TABLET, EXTENDED RELEASE;ORAL	669
CREAM;TOPICAL	414
SOLUTION;ORAL	368
SOLUTION/DROPS;OPHTHALMIC	367

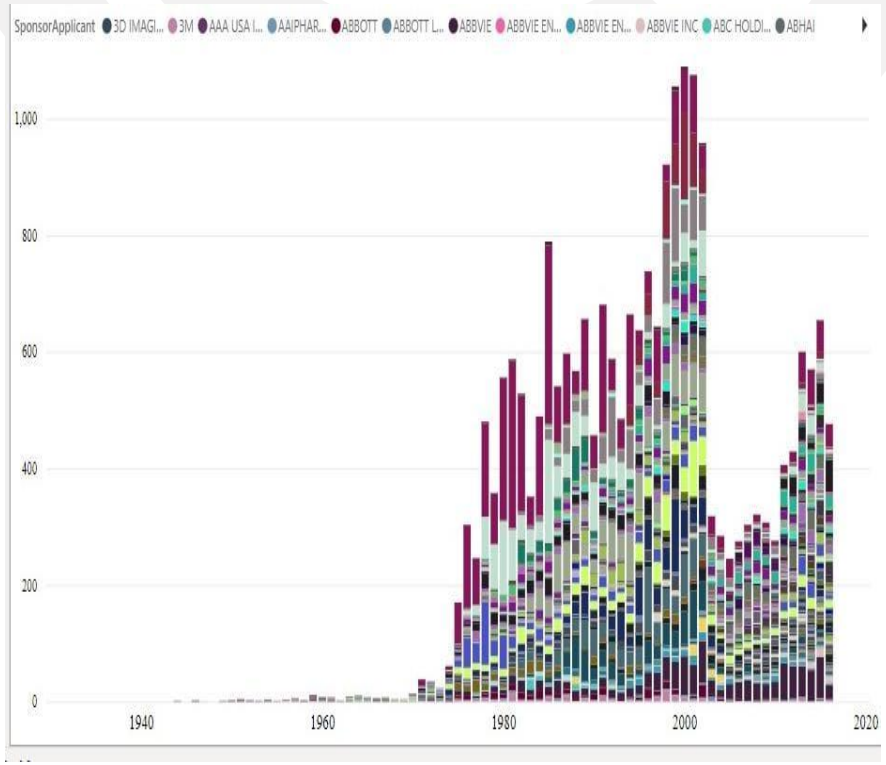
YEARLY DRUG APPROVAL TRENDS: PATTERNS AND FLUCTUATIONS

- From 1939 to 2016, the dataset tracks drug approval counts, giving us a rich insight into regulatory activities spanning nearly eight decades.
- What stands out is the consistent rise in drug approvals over time, showing the ongoing growth in both pharmaceutical innovation and regulatory oversight.
- We can't miss the significant spikes in approval counts during the mid-1990s and early 2000s. It seems like those were busy periods with lots of new drugs making their way through the approval process.
- However, in more recent years, especially after 2010, there's been a bit of a slowdown or stabilization in approval counts. This could be due to changes in how regulations are applied or shifts in the industry itself.
- These observations underscore the dynamic interplay among pharmaceutical innovation and regulatory oversight, shaping the panorama of drug approvals over the years.



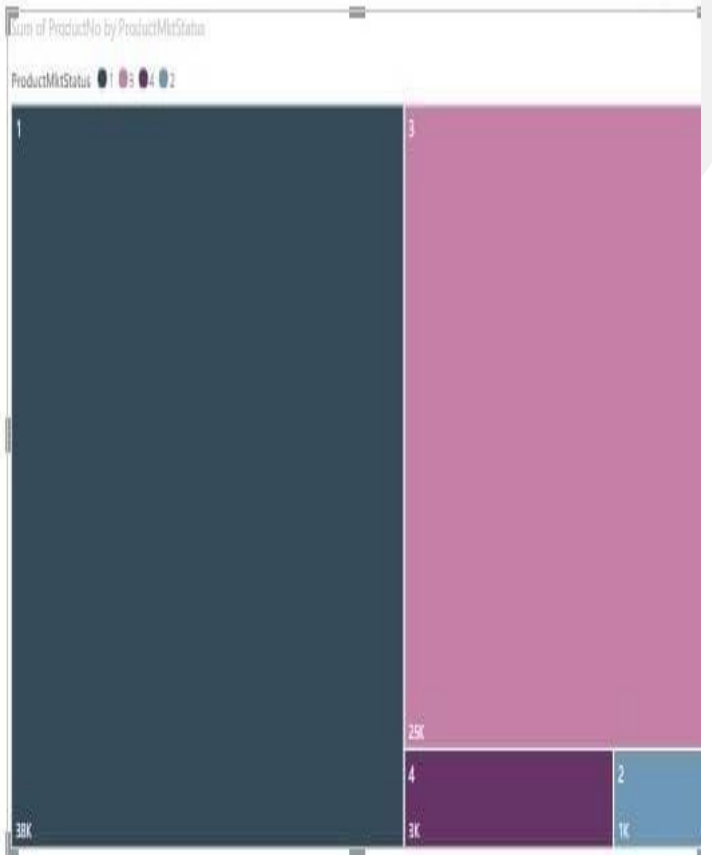
APPROVAL TRENDS BY SPONSOR: CHANGES OVER TIME

- Across the years, we've seen a steady increase in the number of Application Numbers (ApplNo), reflecting the ongoing efforts in drug approvals.
- But it's not always smooth sailing. There are ups and downs, indicating times of intense activity and quieter periods.
- Take, for example, the years 2002 and 2000. They really stand out with a surge in ApplNo counts, suggesting some exciting developments or perhaps a surge in regulatory approvals during those times.
- However, in more recent years, from 2013 to 2016, things seem to have leveled off or even dipped slightly. This could signal a shift in how regulations are applied or maybe some changes in the industry landscape.
- These trends aren't happening in a vacuum. External factors like changes in regulations or shifts in market demand play a big role in shaping these patterns.
- By understanding these fluctuations and tying them to real-world factors, we can make better decisions about drug development strategies, where to focus resources, and how to navigate regulatory hurdles effectively.



PRODUCT SEGMENTATION BY MARKETINGSTATUS: VISUAL ANALYSIS

- Treemap visualizations are a useful tool for viewing the distribution of products across multiple MarketingStatus categories. Its visual representation allows stakeholders to quickly determine the relative importance of items in each category.
- MarketingStatus 1 appears as the largest node in the tree diagram and represents the most used product. This shows the importance of the products belonging to this group in the data set.
- After MarketingStatus 1, MarketingStatus 3 appears as another key in the tree diagram. Although it is slightly smaller than MarketingStatus 1, its presence indicates that there are still great products in this category.
- In contrast, MarketingStatus 4 and 2 are shown as small expressions in the tree map. This shows that there are fewer products associated with this category compared to MarketingStatus 1 and 3.
- Clear and concise instructions provided by graphics enable participants to quickly understand the distribution of different products. It provides an overview of different products, making it easier to make decisions about resource allocation and marketing strategies.



TOTAL APPLICATIONS BY MARKETING STATUS

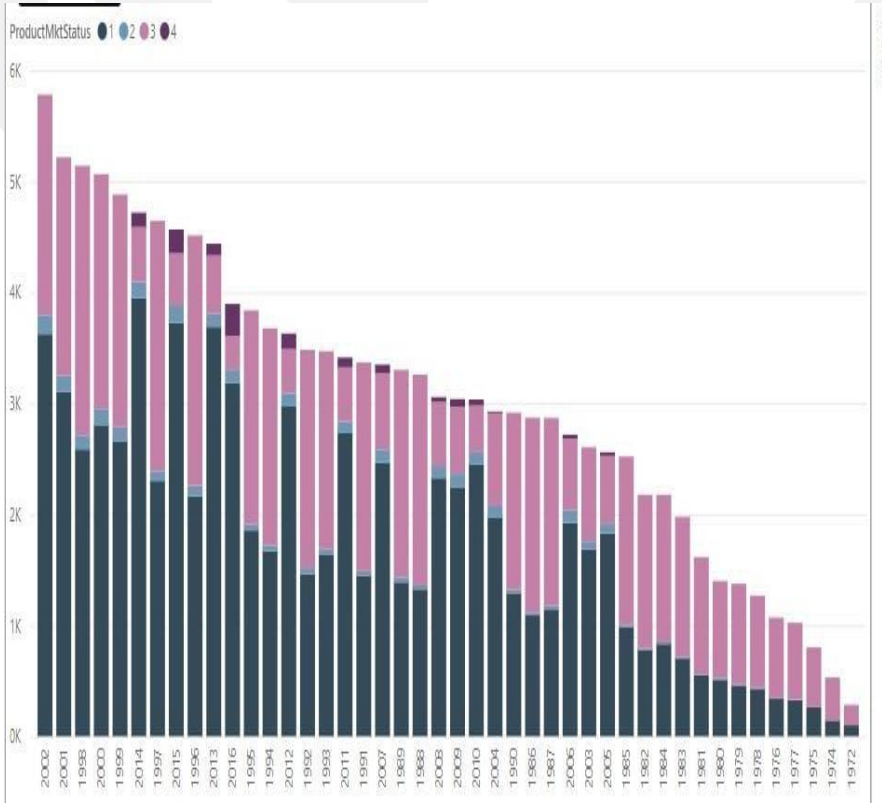
The chart provides the annual distribution of number of applications (ApplNo) across MarketingStatus categories from 1939 to 2016.

MarketingStatus 1 consistently dominates with significantly higher numbers compared to other categories.

MarketingStatus 3 also shows significant numbers, although lower than MarketingStatus 1.

MarketingStatus 2 and 4 generally have lower numbers compared to MarketingStatus 1 and 3.

Insights from this data can serve as a basis for strategic decisions in resource allocation, regulatory strategies and market analysis in the pharmaceutical industry.



DRUG GROUPING BY DOSAGE FORM: DISTRIBUTION ANALYSIS

The datasets provide information on various dosage forms along with their corresponding frequency counts and action types.

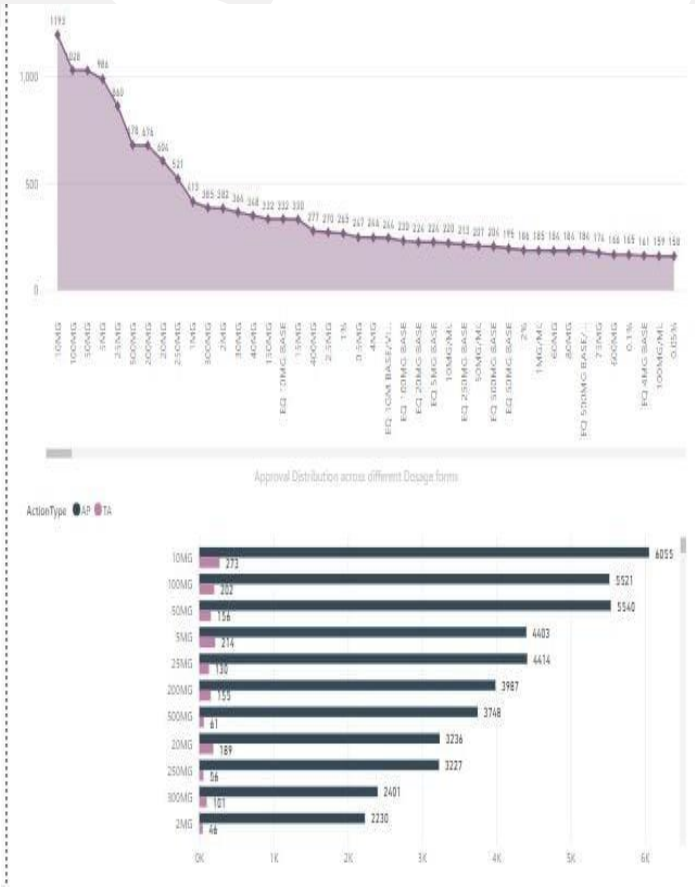
By analyzing the distribution of drug approvals across different dosage forms, we can identify patterns and trends in the pharmaceutical industry.

The dosage form "10MG" appears to have the highest frequency count in both datasets, suggesting its prevalence in drug approvals.

Other commonly occurring dosage forms include "50MG," "100MG," "25MG," and "5MG," indicating their significance in pharmaceutical products.

Action types such as "AP" (presumably representing "Approval") dominate the dataset, reflecting the successful regulatory processes for these dosage forms.

Insights from this analysis can guide decisions related to drug development strategies, regulatory compliance, and market positioning within the pharmaceutical landscape.



THERAPEUTIC CLASS APPROVALS: IDENTIFYING TOP CLASSES

The chart provides information on drug approvals categorized by therapeutic classes (TECode) along with their corresponding numbers and types of actions.

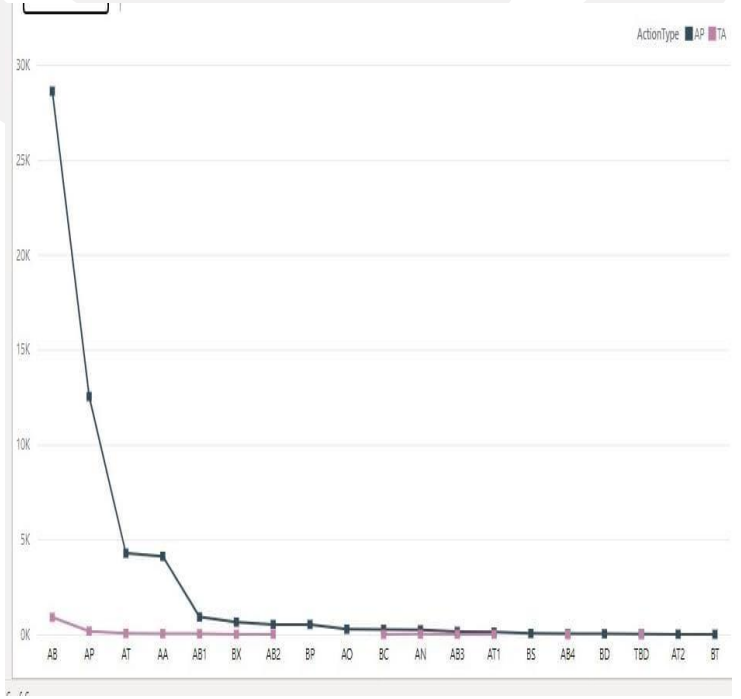
Therapeutic classes "AB", "AP", "AT" and "AA" have the highest number of approvals, with 28599, 12527, 4273 and 4110 respectively.

These classes mostly receive the action type "AP" (approval), indicating successful regulatory processes for these therapeutic classes.

Other classes such as "AB1", "BX", "BP" and "AB2" also show a significant number of approvals, although lower than the highest classes.

Interestingly, some classes receive "TA" action types (probably standing for "Preliminary Approval"), indicating a different regulatory status or process for these drugs.

Visualization of drug approvals based on therapeutic classes enables stakeholders to identify the most significant classes in terms of number of approvals, aiding in strategic decision-making and resource allocation in pharmaceutical development.



CONCLUSION

The thorough analysis of FDA data spanning from 1939 to 2016, conducted with tools like MySQL and Power BI, offers invaluable insights into drug approvals, therapeutic classes, and dosage forms. These insights play a crucial role in fulfilling the FDA's mission of safeguarding public health by ensuring the safety and efficacy of pharmaceutical products. Through collaboration between iVision and the FDA, data analysis serves as a powerful tool to inform decision-making processes regarding regulatory frameworks and drug development strategies. By leveraging data-driven insights, both organizations can enhance their ability to address emerging health risks, enforce regulations effectively, and promote advancements in healthcare delivery for the benefit of society.