ASA Competition

How can Texas better allocate its resources to serve residents?

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Prompt/Objective

In our pursuit of attempting to optimize the allocation of Texas's resources, we attempt to answer the following question:

How can Texas better allocate its resources to serve residents?

Data Sources

In order to address this objective we will use these datasets for analysis:

- Graduation Rates at public universities (2019-2021): lists various public institutions in Texas and their 4, 5, and 6 year graduation rates
- Public Utility Complaints: lists informal complaints with descriptions, date received, company name, location of complaint, etc.
- Local Government Debt: lists financial metrics for various local government entities in Texas
- Texas County Referral Data: contains information on juvenile referrals organized by county and year
- Texas School District Debt: contains financial data pertaining to school districts in Texas.
- Texas Region Recidivism Data: contains information on recidivism in Texas by region and county.

Methodology

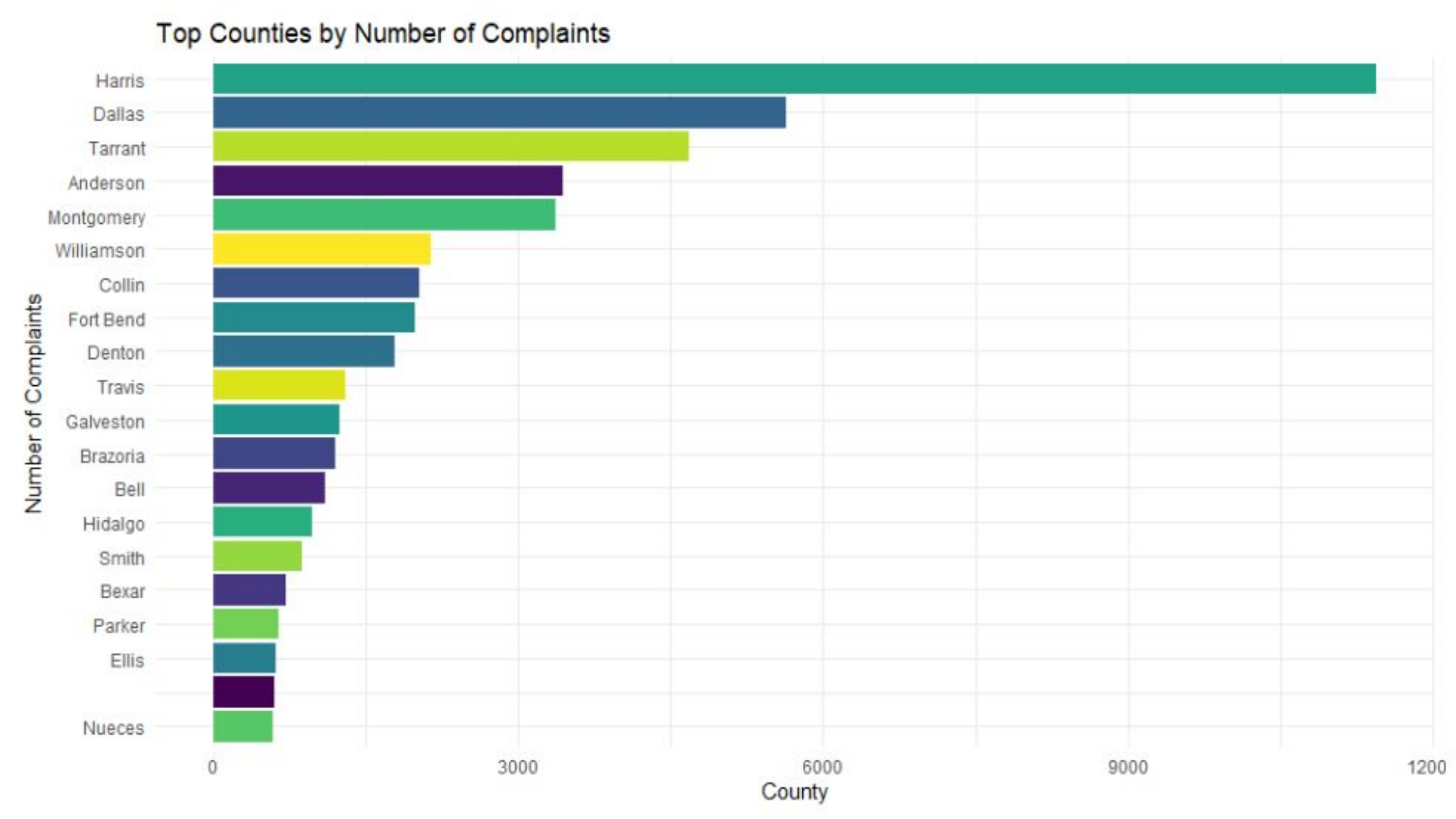
Analytical Tools:

- **R:** Our primary tool for statistical computing and graphics, allowing for in-depth data analysis and visualization.
- **R Libraries:** Utilized various libraries including ggplot2 and Plotly for visualization, dplyr for data manipulation, and tidyr for data tidying.

Techniques Employed:

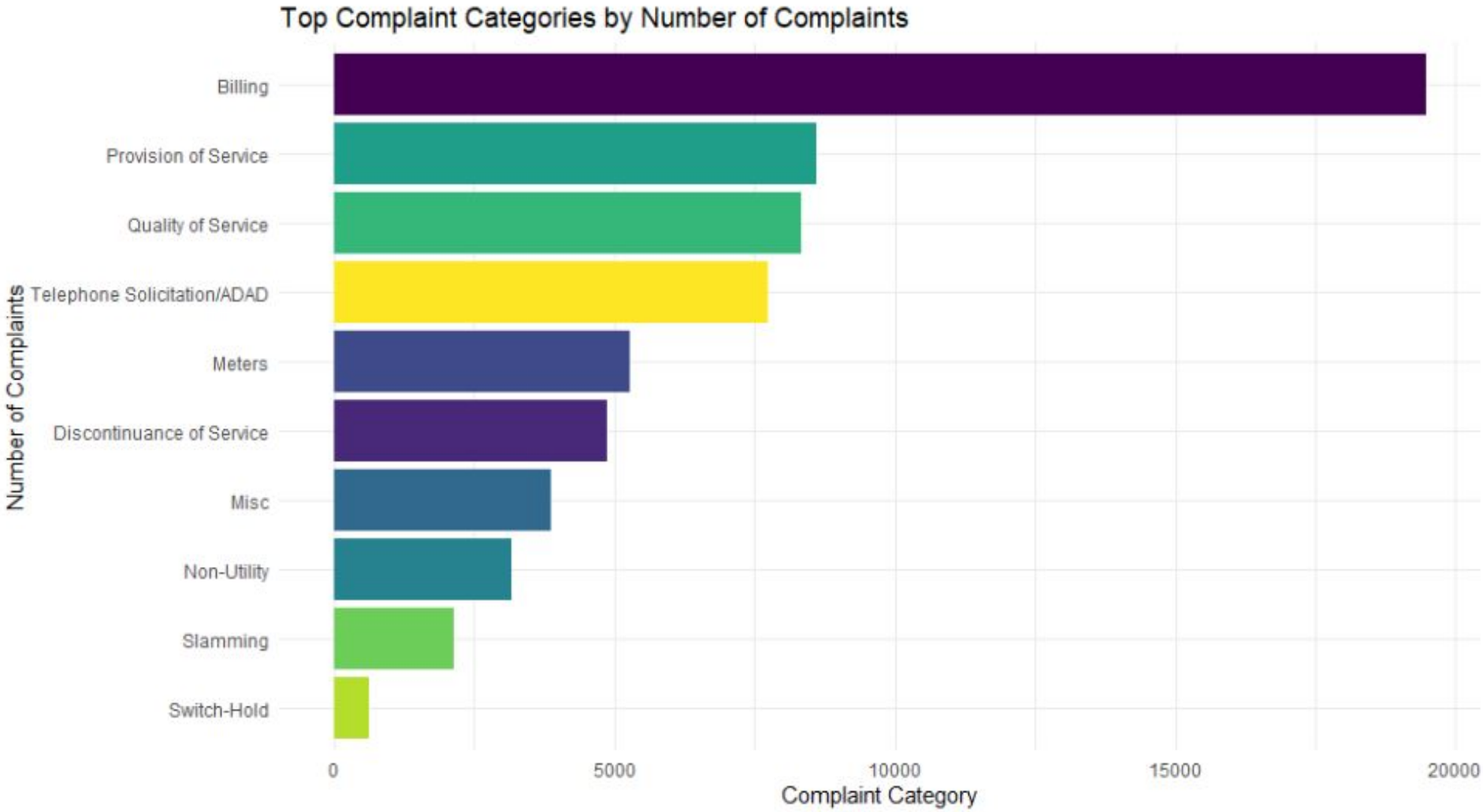
- **Data Cleaning:** Ensuring data quality by handling missing values and removing duplicates.
- **Exploratory Data Analysis (EDA):** Employing visual and quantitative methods to understand the data before the formal modeling or hypothesis testing.
- **Data Visualization:** Creating graphical representations of data to uncover patterns and insights.
- **Linear Regression:** Using past data to predict future patterns that can occur.

Public Utility Complaints Data Analysis


Top Counties by Number of Complaints
Harris
Dallas
Tarrant
Anderson
Montgomery
Williamson
Collin
Fort Bend
Denton
Travis
Galveston
Brazoria
Bell
Hidalgo
Smith
Bexar
Parker
Ellis
Nueces
Number of Complaints
0
3000
6000
9000
1200
County

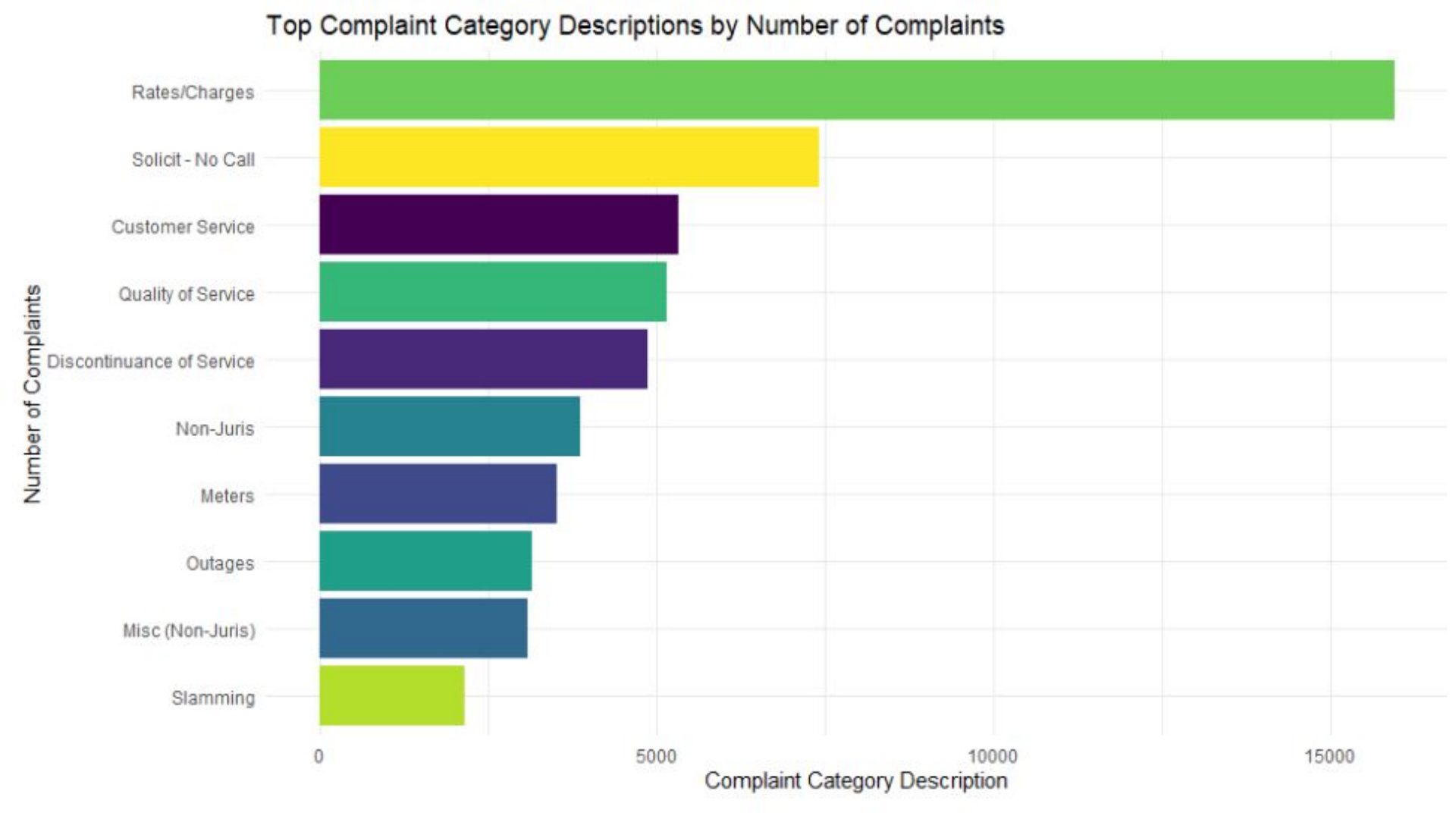
Top Counties by Number of Complaints

Based on the bar graph displaying the top counties in terms of number of complaints there seems to be regional disparity as Harris and Dallas counties in particular show a very high volume of complaints possibly reflecting a larger population and/or more systematic issues in these areas. It would make sense to apply more intensive resource allocation in the counties with higher complaint volume(Harris, Dallas, Tarrant, etc.) in order to effectively address the underlying cause of the complaints and better serve the residents there. This could include examining local utility providers' operations, customer service capabilities, infrastructure, etc.


Top Complaint Categories by Number of Complaints
Billing
Provision of Service
Quality of Service
Telephone Solicitation/ADAD
Meters
Discontinuance of Service
Misc
Non-Utility
Slamming
Switch-Hold
Number of Complaints
0
5000
10000
15000
20000
Complaint Category

Top Complaint Categories by Number of Complaints

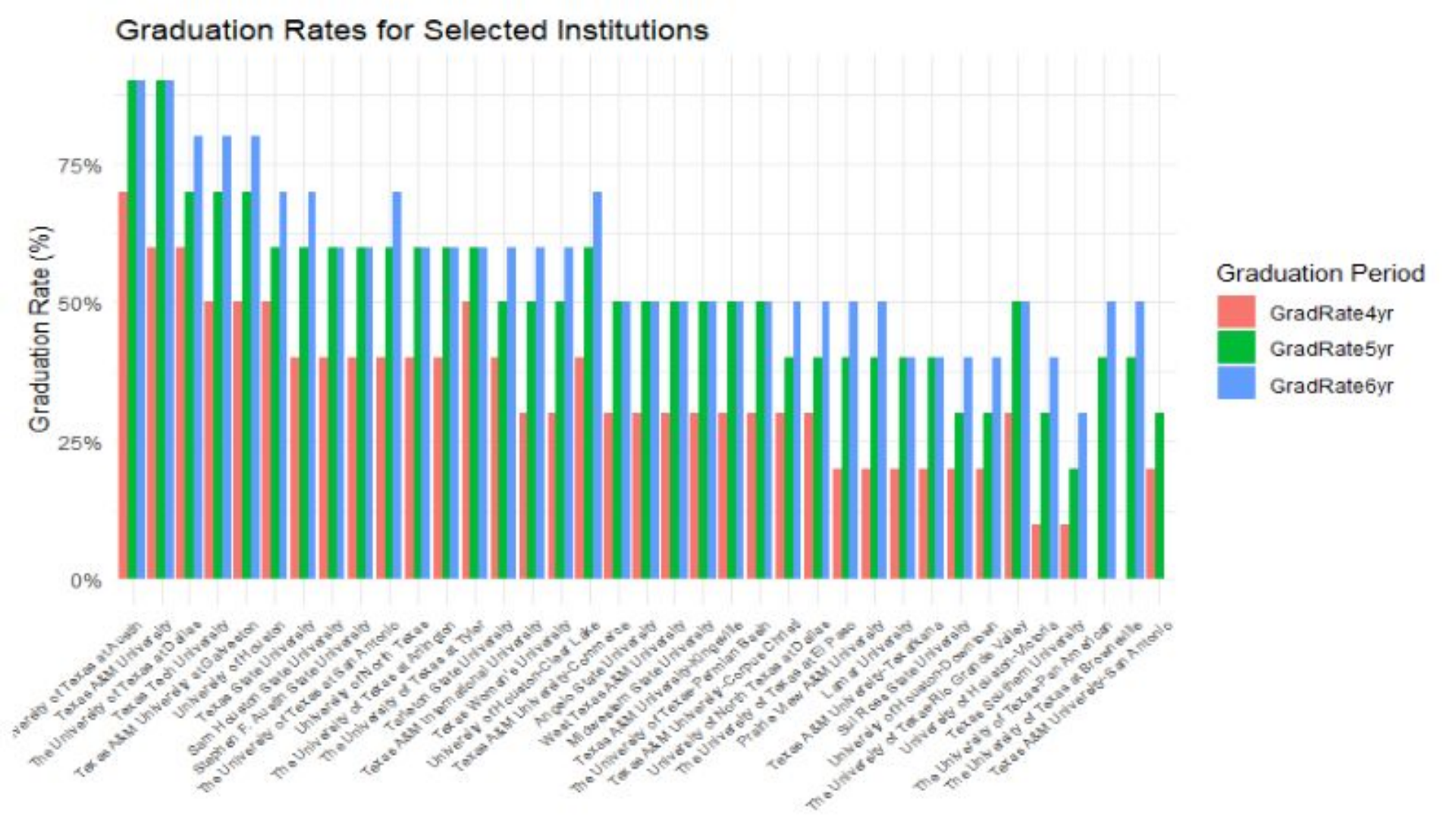
Based on the bar graph displaying the top complaint categories by number of complaints, it can be seen that billing issues, by far, are the cause of the most complaints, with provision and quality of service also generating a high number of complaints. This could indicate that there needs to be more transparency in terms in billing processes and/or more customer education programs to provide clarity for billing details. As far as provision and quality issues go, they point to possible problems with the reliability and/or satisfaction with utility services so a way to address this could be to implement service quality improvements through infrastructure investments and/or enhanced operational practices.


Top Complaint Category Descriptions by Number of Complaints
Rates/Charges
Solicit - No Call
Customer Service
Quality of Service
Discontinuance of Service
Non-Juris
Meters
Outages
Misc (Non-Juris)
Slamming
Number of Complaints
0
5000
10000
15000
Complaint Category Description

Top Complaint Category Descriptions by Number of Complaints

The bar graph shows that rates/charges are responsible for a majority of complaints, possibly indicating that residents are under the impression that costs are too high and/or unjustified. There also seems to be a prevailing issue with solicitation, “No Call” in particular which potentially points to residents not being content with current regulations. A way to possibly address these problems could be review and restructure rate plans to make them more equitable and strengthen enforcement of “No Call” regulations and increase penalties for violations to reduce unwanted solicitations.

Public University Graduation Rates Analysis

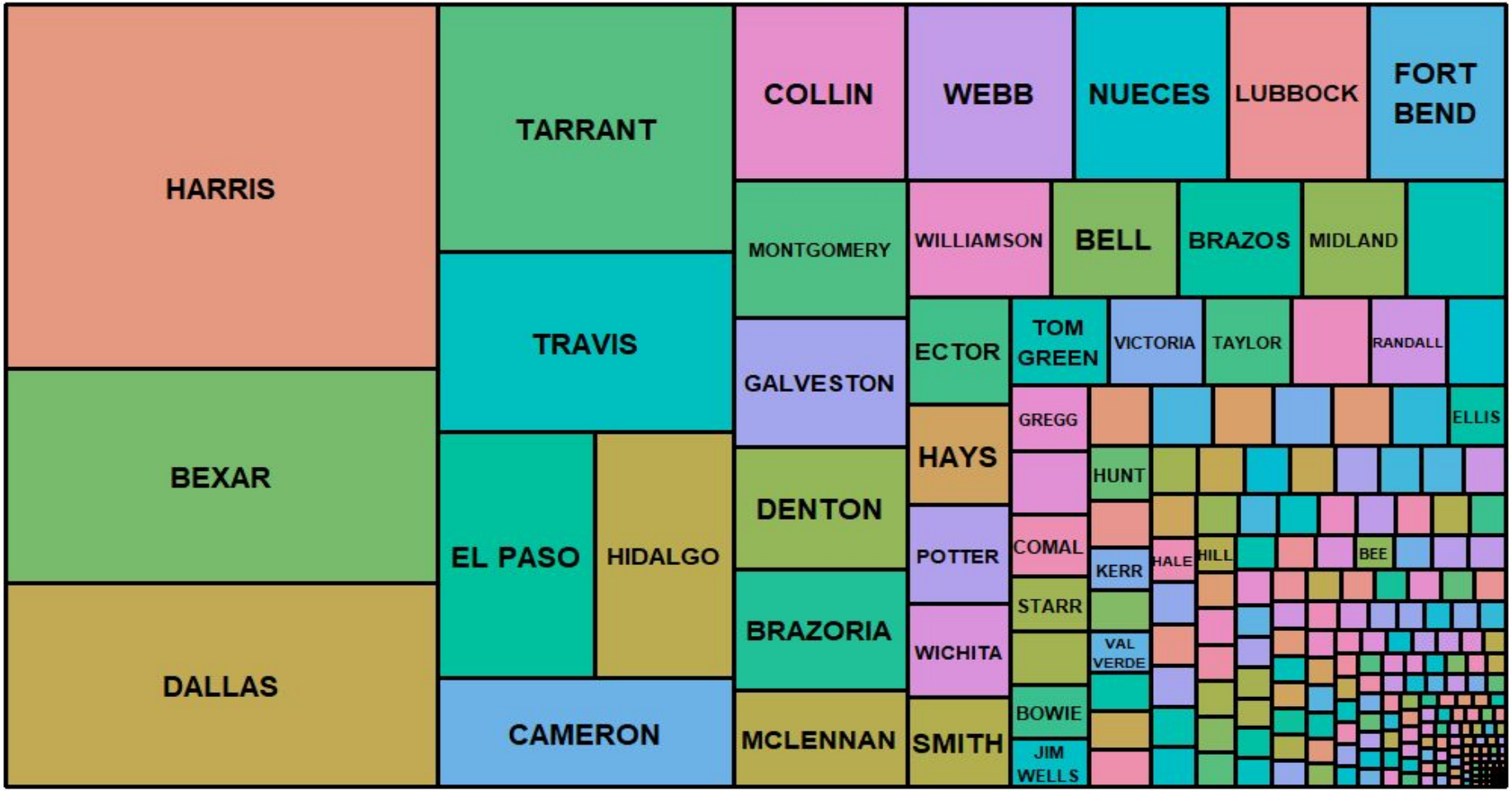

Graduation Rates for Selected Institutions
Graduation Rate (%)
75%
50%
25%
0%
Graduation Period
GradRate4yr
GradRate5yr
GradRate6yr
Texas A&M University
The University of Texas at Dallas
Texas Tech University
University of Houston
Texas State University
Sam Houston State University
Stephen F. Austin State University
The University of Texas at San Antonio
University of North Texas
The University of Texas at Arlington
The University of Texas at Tyler
Tarleton State University
Texas A&M International University
Texas Woman's University
University of Houston-Clear Lake
Texas A&M University-Commerce
Angelo State University
West Texas A&M University
Midwestern State University
Texas A&M University-Kingsville
The University of Texas-Permian Basin
Texas A&M University-Corpus Christi
University of North Texas at Dallas
The University of Texas at El Paso
Prairie View A&M University
Lamar University
Texas A&M University-Texarkana
Sul Ross State University
University of Houston-Downtown
The University of Texas-Rio Grande Valley
University of Houston-Victoria
Texas Southern University
The University of Texas-Pan American
The University of Texas at Brownsville
Texas A&M University-San Antonio

Graduation Rates Data Analysis

From the graph we can there is quite a bit of variability among the institutions, some universities have consistently high/low rates among all 3 periods, while some show significant differences between their 4 year to 6 year rates. Some universities have similar rates in terms of their 4 and 6 year rates, indicating that if someone from said institution graduates, it will most likely be within 4 years. Overall colleges such as UT Austin(!!!), Texas A&M, Texas Tech, etc. had relatively high graduations indicating that allocating more resources to these institutions isn't necessary. However institutions with low graduation rates(Texas Southern University, University of Houston- Victoria, Texas A&M- Texarkana could definitely use some more investment in resources. Some ways to potentially aid these lagging institutions could be financial aid, student support services, academic advising, mentorship programs, etc. A thorough investigation into each of these institutions should also be employed in order to investigate the causes of these subpar numbers in order to be able to properly attack the issues at hand.

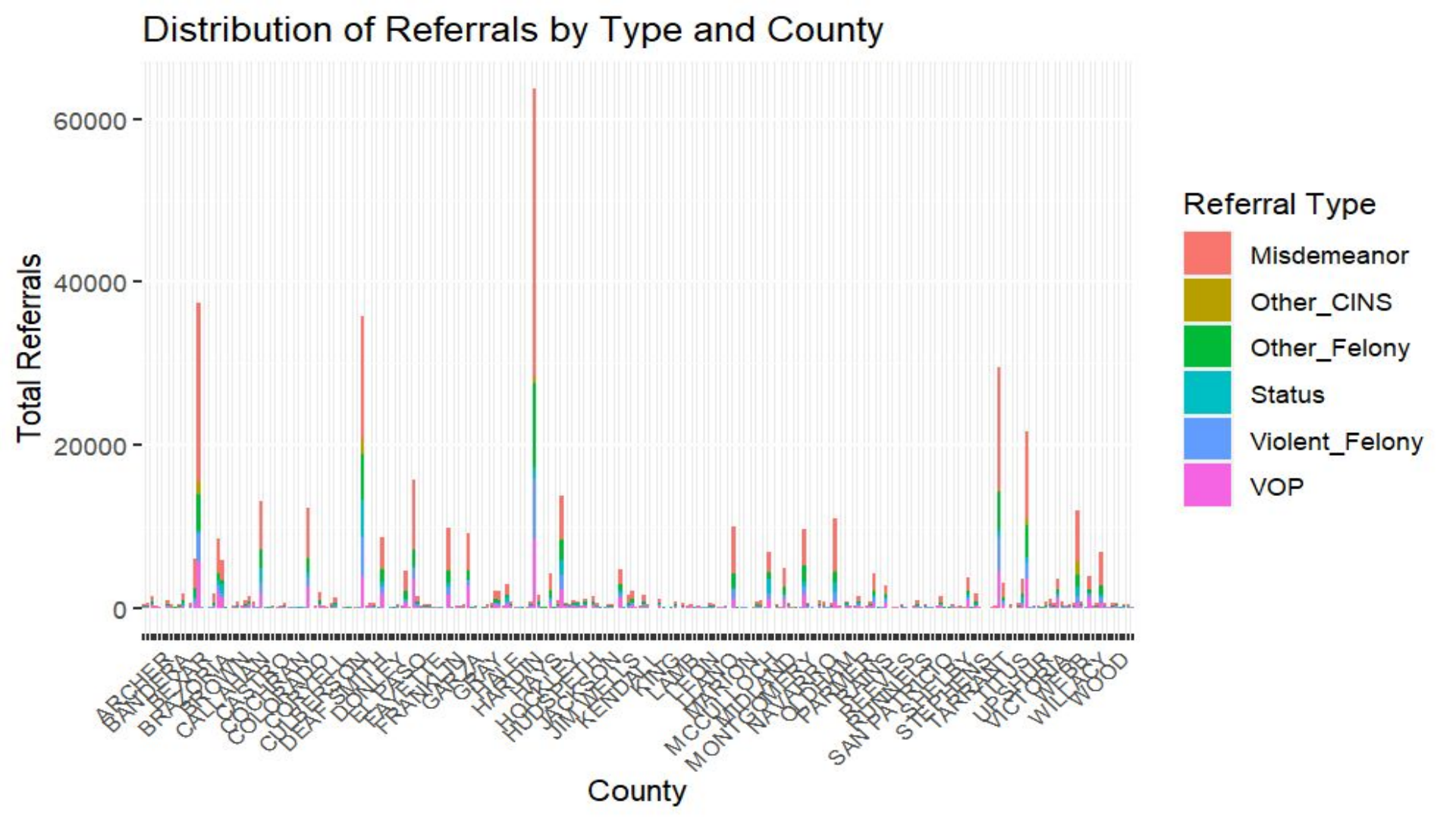
Texas County Referral Analysis

Total Referrals by County



Understanding the Juvenile Referral Treemap

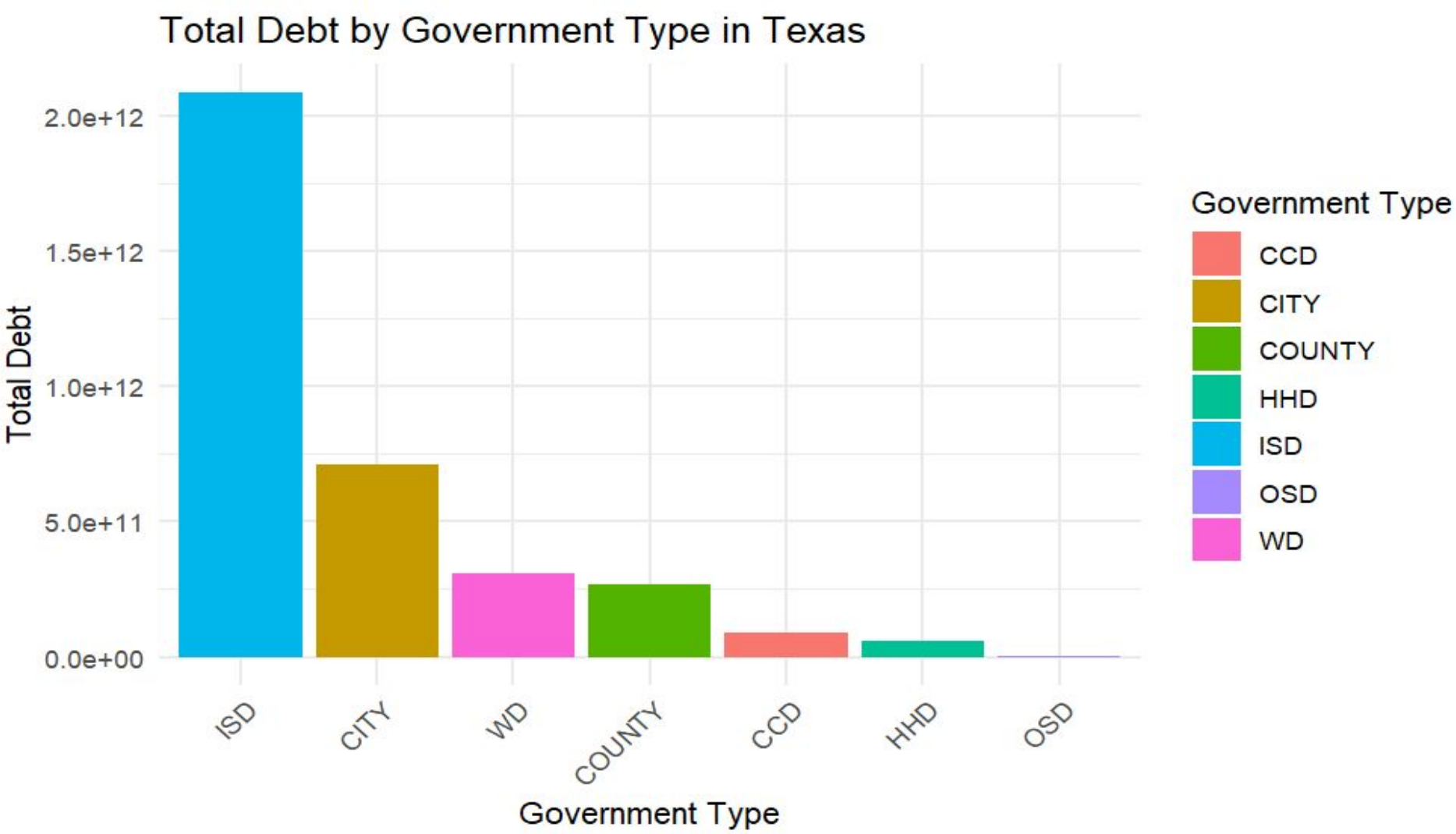
By displaying a total amount of referrals for each county, separated by referral type, the graph suggests locations where specific types of interventions or support services are most needed. For instance, if particular counties have a higher rate of referrals for Violent Felony or Other Felony, resources may be directed toward law enforcement, crime prevention initiatives, or rehabilitation services designed to address these issues. Similarly, a large rate of referrals for misdemeanors may indicate a need for community-based interventions, diversion programs, or mental health care. Policymakers and stakeholders can strategically allocate resources to address the diverse needs of residents throughout Texas by identifying areas with the highest demand for particular types of services.


Distribution of Referrals by Type and County
Total Referrals
60000
40000
20000
0
County
Referral Type
Misdemeanor
Other_CINS
Other_Felony
Status
Violent_Felony
VOP

Description of Stacked Bar Chart Visualization

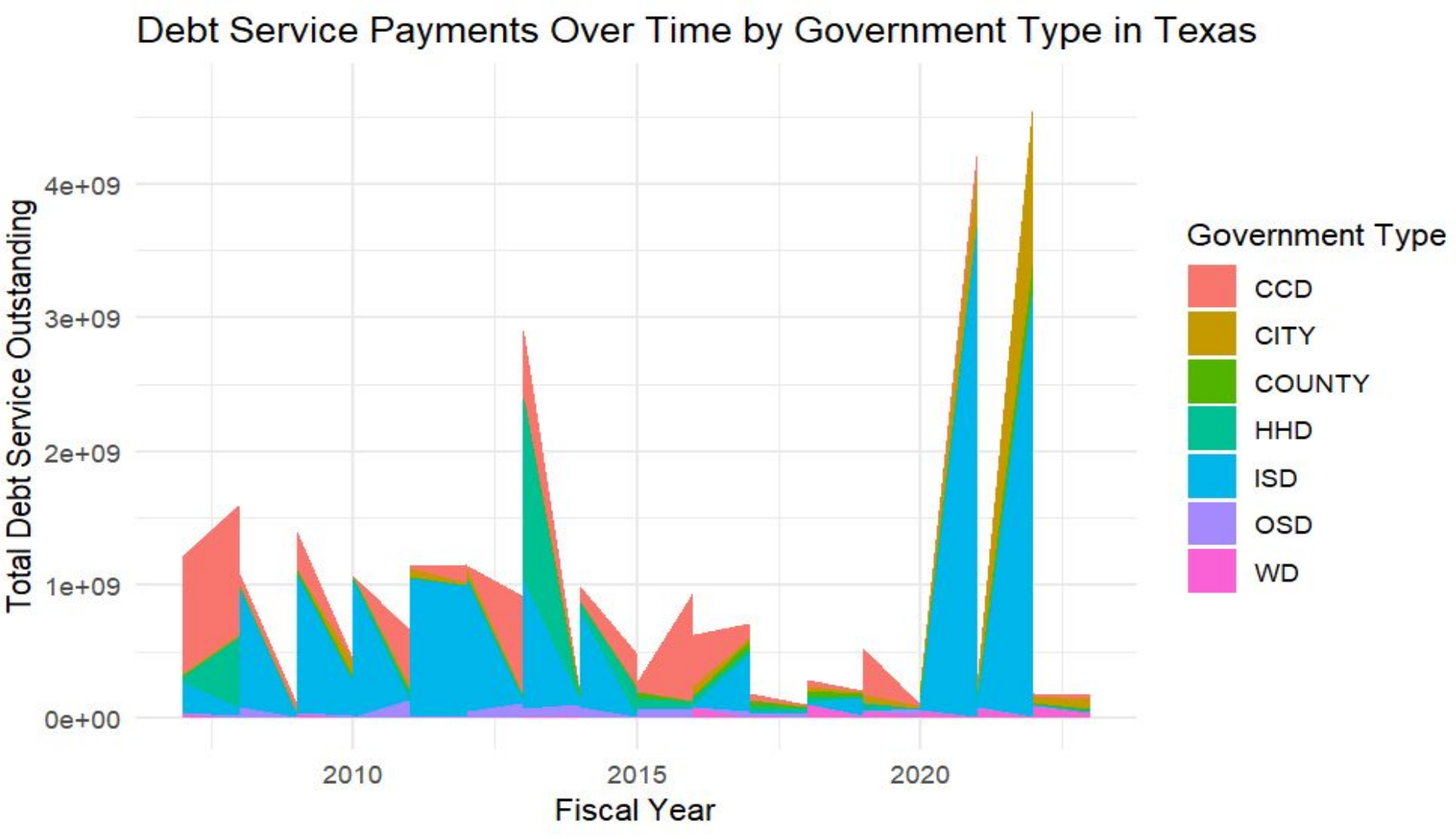
The stacked bar chart depicts the distribution of various types of referrals in Texas counties. Each bar represents a county, and the height shows the total number of referrals. The bars are color-coded to signify certain types of referrals, such as Violent Felony, Other Felony, Misdemeanor, Violation of Probation (VOP), Status offenses, and Other Conduct Needing Supervision (CINS). This graphic allows for quick comparison of referral categories across counties and identifies any trends or patterns in the referral distribution. Furthermore, the redesigned x-axis labels improve readability by presenting county names at a 45-degree angle and utilizing every fifth label to minimize overcrowding and ensure clarity.

Local Government Debt Analysis


Total Debt by Government Type in Texas
2.0e+12
1.5e+12
1.0e+12
5.0e+11
0.0e+00
Total Debt
ISD
CITY
WD
COUNTY
CCD
HHD
OSD
Government Type
Government Type
CCD
CITY
COUNTY
HHD
ISD
OSD
WD

Understanding the Total Debt by Government Type

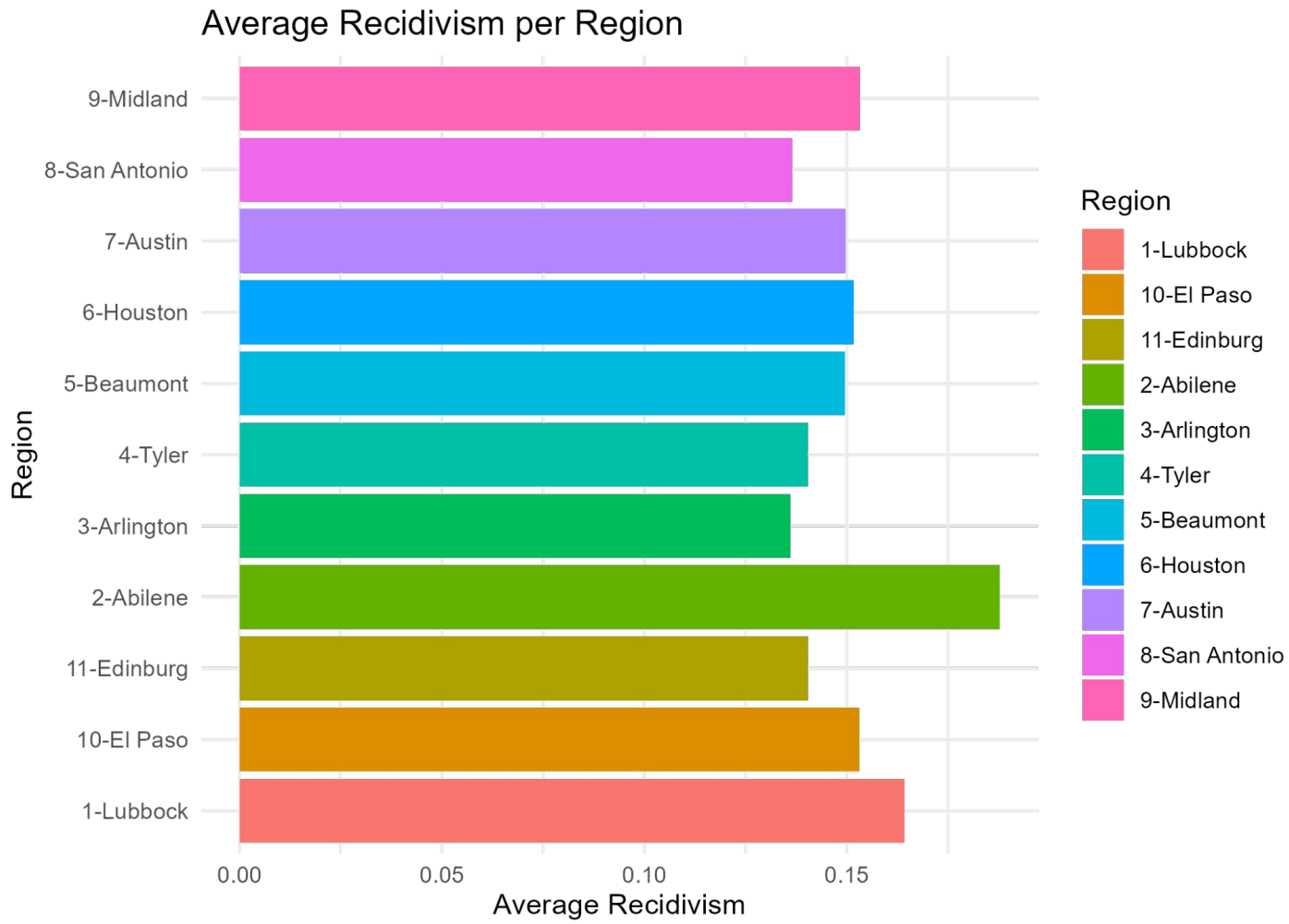
With the utilization of the data, Texas can better serve its citizens by distributing resources within the juvenile justice system in an efficient manner. Policymakers can determine which areas require certain interventions by examining referral distributions across counties and classifying them according to type. Counties with a high rate of violent felonies, for example, might need more law enforcement resources, but counties with a high rate of misdemeanor referrals might benefit from community-based initiatives. By focusing resources and assigning them according to the specific needs of each region, this targeted approach promotes equity in the distribution of services and improves outcomes throughout the state.


Debt Service Payments Over Time by Government Type in Texas
Total Debt Service Outstanding
4e+09
3e+09
2e+09
1e+09
0e+00
2010
2015
2020
Fiscal Year
Government Type
CCD
CITY
COUNTY
HHD
ISD
OSD
WD

Description of Stacked Area Plot Visualization

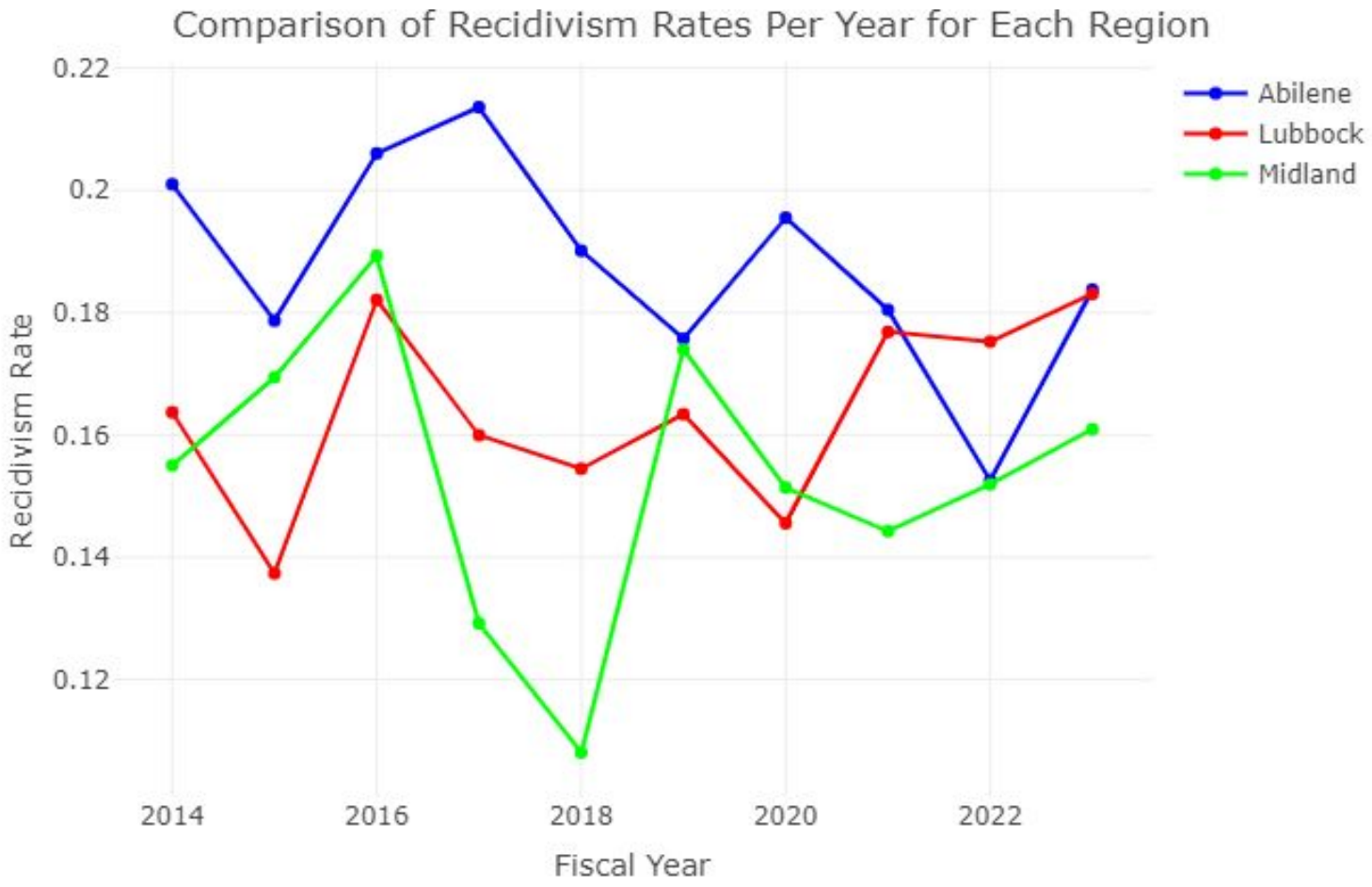
The trend of debt service payments for various government kinds in Texas throughout time is depicted by the stacked area plot. Every area that is colored corresponds to a certain sort of government, including school districts (ISD), water districts (WD), and cities (CITY). The stacked areas in the map represent the cumulative debt service payments made by each form of government, and it illustrates how the overall amount of outstanding debt service changes across fiscal years. This graphic makes it simple to compare debt service payments made by various state government bodies over time, indicating any changes or patterns in debt obligations.

Texas Recidivism Data Analysis


Average Recidivism per Region
9-Midland
8-San Antonio
7-Austin
6-Houston
5-Beaumont
4-Tyler
3-Arlington
2-Abilene
11-Edinburg
10-El Paso
1-Lubbock
Region
0.00
0.05
0.10
0.15
Average Recidivism
Region
1-Lubbock
10-El Paso
11-Edinburg
2-Abilene
3-Arlington
4-Tyler
5-Beaumont
6-Houston
7-Austin
8-San Antonio
9-Midland

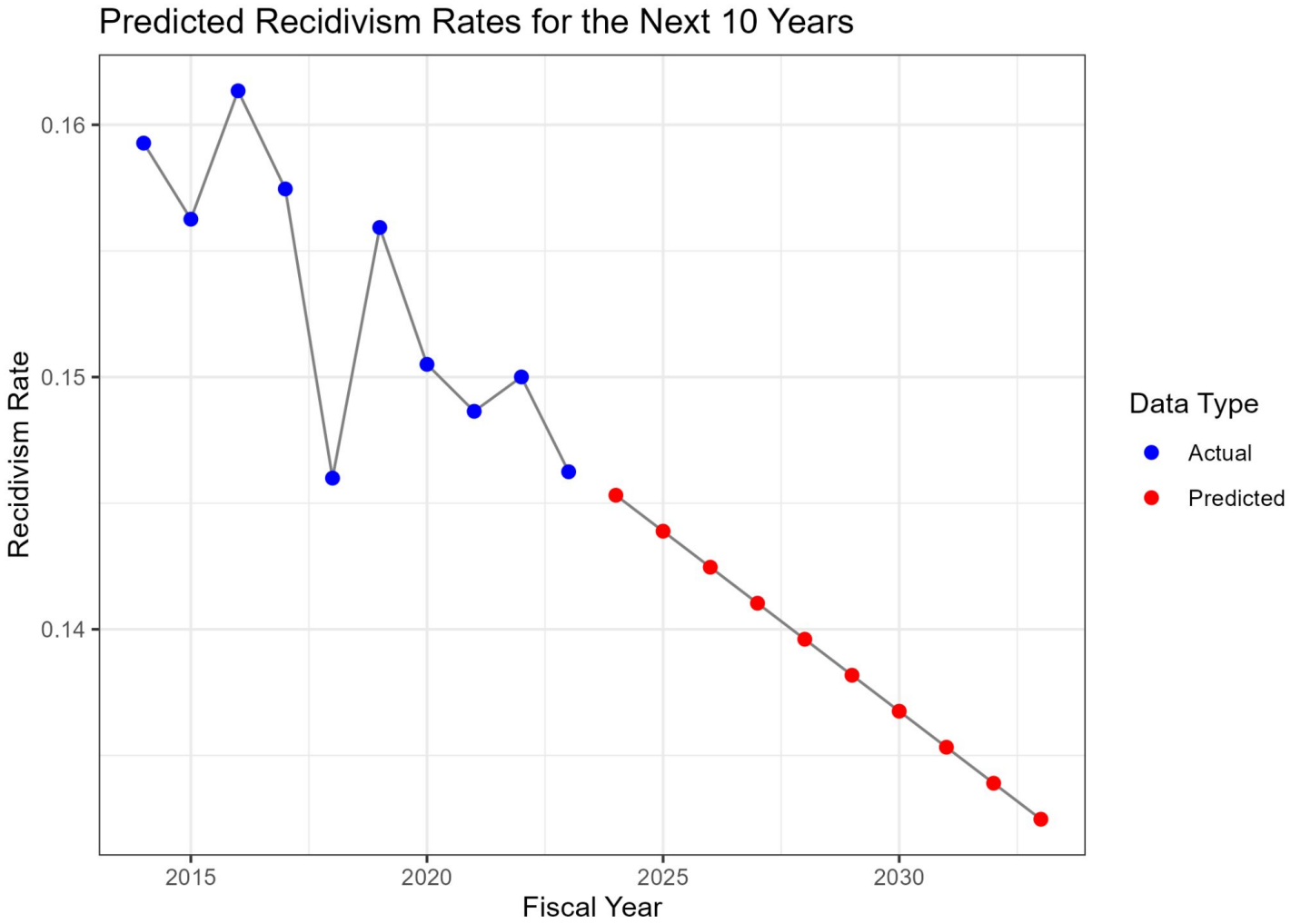
Understanding Average Recidivism Rates by Region

The plot provides a visual comparison of the average recidivism rates across different regions in Texas, highlighting potential areas where resources could be allocated more effectively. By identifying regions with higher average recidivism rates, policymakers and stakeholders can prioritize these areas for targeted interventions and support to reduce recidivism rates and improve outcomes for residents. This information can help guide resource allocation strategies to focus on regions most in need of support, ultimately leading to more efficient and effective use of resources to serve Texas residents. Regions such as Abilene, Lubbock and Midland need an improvement in resource allocations because they have the highests rates of recidivism in Texas.


Comparison of Recidivism Rates Per Year for Each Region
Recidivism Rate
0.22
0.2
0.18
0.16
0.14
0.12
2014
2016
2018
2020
2022
Fiscal Year
Abilene
Lubbock
Midland

Understanding the comparison of recidivism rates per year in regions with the highest rates of crime.

The plot compares recidivism rates across different regions in Texas, helping identify high-crime regions and trends that can guide resource allocation. Specifically, the visualization indicates that Lubbock, Midland, and Abilene have historically had the highest rates of recidivism. The positive trend of decreasing rates for each of these counties since 2017 suggests that current strategies or interventions may be effective and could be further supported or expanded. This information can aid policymakers in targeting resources towards these regions to sustain and potentially accelerate the decline in recidivism rates, ultimately serving residents better.


Predicted Recidivism Rates for the Next 10 Years
Recidivism Rate
0.16
0.15
0.14
2015
2020
2025
2030
Fiscal Year
Data Type
Actual
Predicted

Understanding Texas’ predicted recidivism rates for the next 10 years

The plot presents a forecast of Texas' recidivism rates for the next decade, aiding in resource allocation decisions to better serve residents. By visualizing the predicted decrease in recidivism rates, policymakers can prioritize funding and interventions in areas that historically exhibit higher rates, aiming to sustain or further reduce these rates. The graph's depiction of actual and projected trends informs resource planning, directing efforts towards strategies that align with the expected decrease, thus optimizing resource allocation for improved outcomes and services for Texas residents. As 2018 was the year with the highest rate of recidivism, there has been a steady decrease in recidivism since then and the predicted results show the same trends.

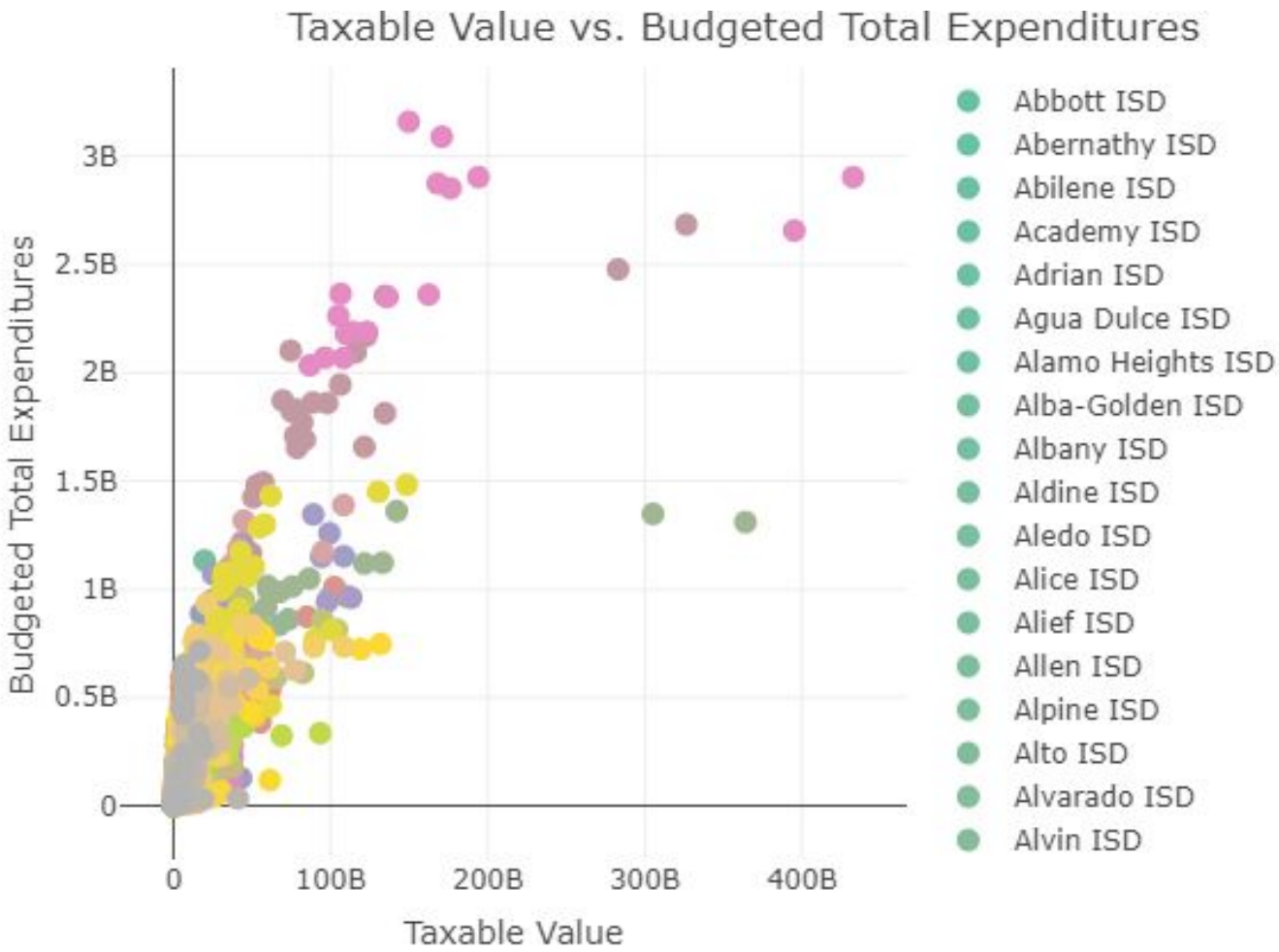
Texas School District Debt Data Analysis

Budgeted Total Expenditures by Government Name

Understanding Budgeted Total Expenditures by School District

The treemap provides insights into how Texas can better allocate its resources to serve residents by visualizing the distribution of budgeted total expenditures among different government entities. It highlights areas of high expenditure and allows policymakers to identify opportunities for optimization and reallocation of resources to areas with greater need.

Specifically, school districts like Houston ISD, Dallas ISD, Cypress Fairbanks, and Conroe ISD are showcased as they appear to be better allocating their spending to provide better resources for their students. This is indicated by their relatively larger rectangles in the treemap, suggesting higher total expenditures compared to other entities. This visualization can inform decision-makers about successful spending strategies in these districts that could be replicated or adapted in other regions to enhance resource allocation and improve services for residents.


Taxable Value vs. Budgeted Total Expenditures
Budgeted Total Expenditures
3B
2.5B
2B
1.5B
1B
0.5B
0
0
100B
200B
300B
400B
Taxable Value
Abbott ISD
Abernathy ISD
Abilene ISD
Academy ISD
Adrian ISD
Agua Dulce ISD
Alamo Heights ISD
Alba-Golden ISD
Albany ISD
Aldine ISD
Aledo ISD
Alice ISD
Alief ISD
Allen ISD
Alpine ISD
Alto ISD
Alvarado ISD
Alvin ISD

Understanding Taxable Value Vs. Budgeted Total Expenditures by School District

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Conclusion

To better allocate resources for its residents, Texas can adopt a targeted and strategic approach based on the insights gleaned from various data analyses. Firstly, addressing regional disparities in complaints and recidivism rates can guide resource allocation towards areas with higher needs, such as Harris, Dallas, Tarrant, Lubbock, and Midland counties. These regions may require more intensive interventions and support to tackle underlying issues effectively. Secondly, focusing on the top complaint categories, such as billing issues and provision/quality of service, can lead to improvements in transparency, customer education, and service quality, thereby enhancing resident satisfaction. Additionally, by analyzing graduation rates among colleges and universities, Texas can identify institutions in need of more resources, such as financial aid and academic support services, to improve student outcomes. Finally, examining referrals within the juvenile justice system can help direct resources towards interventions tailored to specific needs, whether law enforcement, community-based initiatives, or mental health care. By using data-driven insights to guide resource allocation, Texas can ensure that resources are allocated efficiently and effectively to meet the diverse needs of its residents.