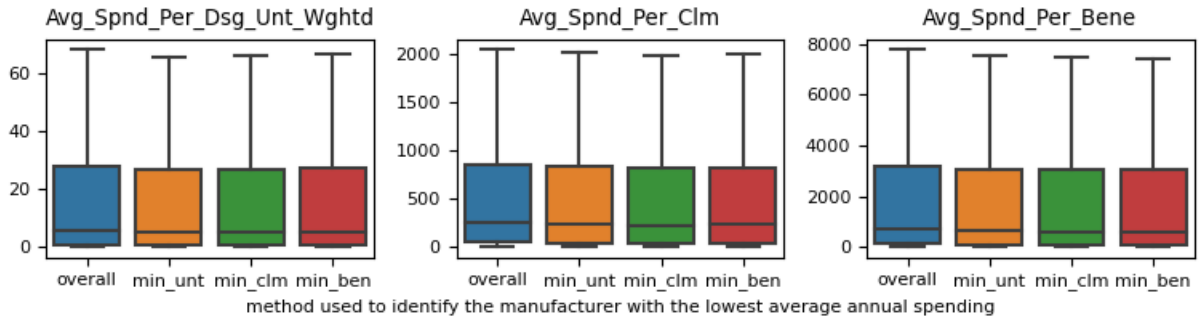
Reducing Prescription Drug Costs: An Analysis of Medicare Part D Spending by Drug and Drug Manufacturer

The Medicare Part D Spending by Drug dataset is published on Data.CMS.gov and contains "information on spending for drugs prescribed to Medicare beneficiaries enrolled in Part D" including average spending per dosage unit, claim, and beneficiary by drug as well as by drug and manufacturer. Below, the summary statistics are displayed for each variable.

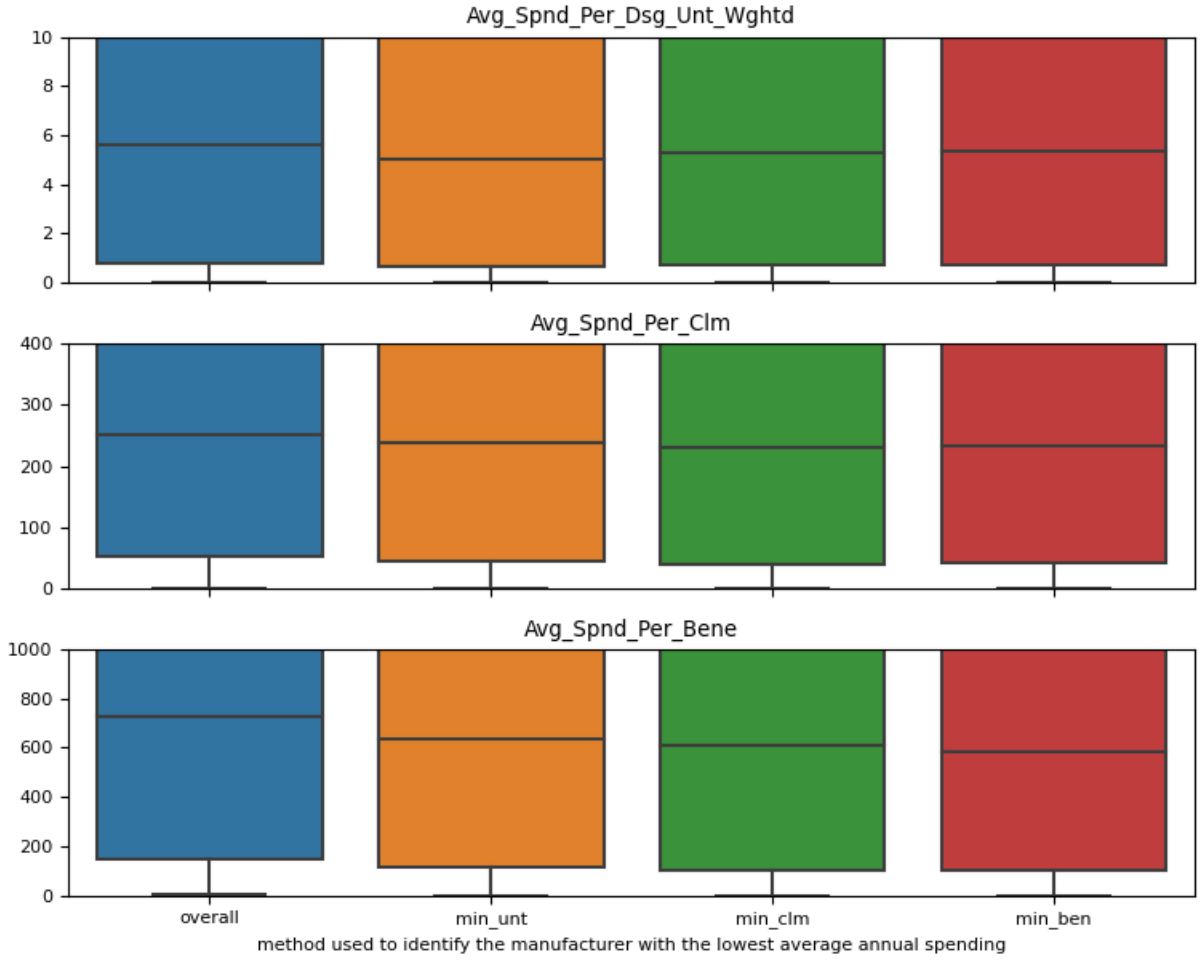
Variable	Mean	S.D.	Q1	Median	Q3
Tot_Spndng	55507690.218	29671698592.705	200611.405	2550334.16	23186500.98
Tot_Dsg_Unts	35097436.774	23431830223.488	27514.0	285114.5	4158715.73
Tot_Clms	483154.854	305971203.892	650.0	5774.0	74836.5
Tot_Benes	132217.617	75990722.051	223.0	1729.5	20356.0
Avg_Spnd_Per_Dsg_Unt_Wghtd	249.803	211697.671	0.809	5.632	27.78
Avg_Spnd_Per_Clm	1997.876	886033.613	52.386	249.824	855.496
Avg_Spnd_Per_Bene	11292.738	6659632.723	144.202	728.114	3210.986

Additionally, nine metrics were calculated to quantify the manufacturer of each drug with the lowest average spending. The method used to identify the manufacturer with the lowest average spending is appended to the end of each variable name in lower case letters. The options are _min_unt, _min_clm, and _min_ben for Avg_Spnd_Per_Dsg_Unt_Wghtd, Avg_Spnd_Per_Clm, and Avg_Spnd_Per_Bene respectively. The table below displays the summary statistics for the newly calcualted variables.

Variable	Mean	S.D	Q1	Median	Q3
Avg_Spnd_Per_Dsg_Unt_Wghtd_min_unt	248.765	211697.539	0.645	5.041	5.041
Avg_Spnd_Per_Dsg_Unt_Wghtd_min_clm	248.967	211695.01	0.695	5.309	5.309
Avg_Spnd_Per_Dsg_Unt_Wghtd_min_ben	249.114	211694.613	0.708	5.345	5.345
Avg_Spnd_Per_Clm_min_unt	1976.948	884788.527	44.769	237.282	237.282
Avg_Spnd_Per_Clm_min_clm	1969.733	884795.099	41.107	230.655	230.655
Avg_Spnd_Per_Clm_min_ben	1975.4	885087.837	42.683	233.87	233.87
Avg_Spnd_Per_Bene_min_unt	11114.111	6653892.074	113.788	635.645	635.645
Avg_Spnd_Per_Bene_min_clm	11100.828	6654741.004	104.671	610.16	610.16
Avg_Spnd_Per_Bene_min_ben	11065.572	6653013.086	99.228	585.196	585.196



The above figure displays each of the three original average spending metrics: Avg_Spnd_Per_Dsg_Unt_Wghtd, Avg_Spnd_Per_Clm, and Avg_Spnd_Per_Bene; along with the same metric calculated using the three minimum manufacturer calculations: min_unt, min_clm, and min_ben. Note that statistical outliers, calcualted as values greater than or equal to quartile three plus 1.5 times the Intra-Quartile Range, have been excluded to aid in visualization. Because of the wide spread in each set, it is somewhat dificult to see that all three metrics are reduced when using the manufacturer with the lowest annual average spending, regardless of the metric used to calculate the lowest spending. The next set of figures displays the same three boxplots, zoomed in to to better view the reduction in spending.



Research Question:

Is there a significant reduction in spending when prescriptions are only sourced through drug manufacturers with the lowest average spending for each drug?

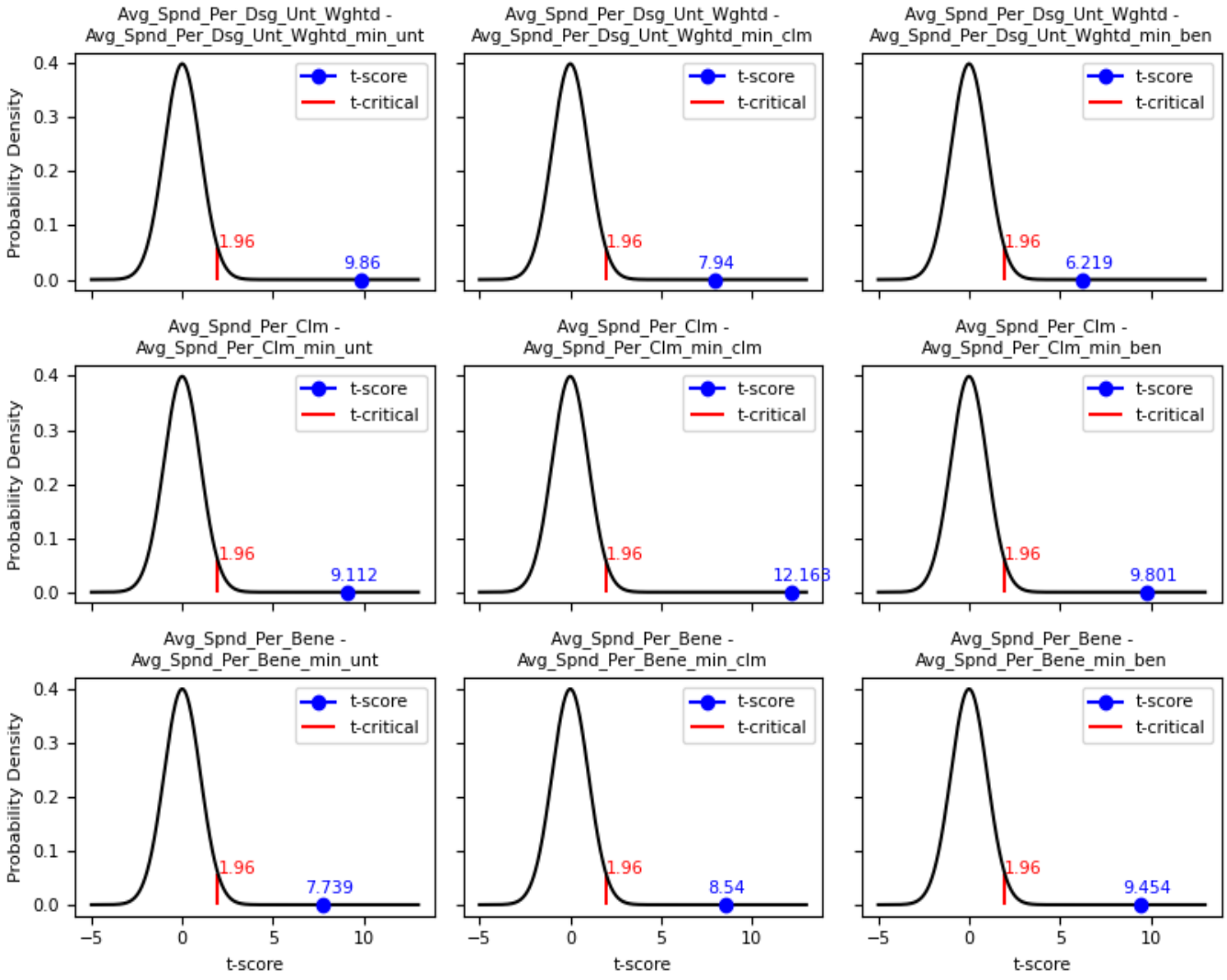
Hypothesis:

Prescription drug spending costs can be lowered by utilizing the drug manufacturer associated with the lowest average annual prescription drug spending.

Methodology:

This analysis will use inferential statistics to test whether the differences identified are significant. Specifically, a one-tailed (negative) paired t-test will be performed. A paired t-test will be used to meet the assumption that the two groups are dependent on one another. The test will be one-tailed in the negative direction because the minimum spending is, by definition, lower than overall spending. To test the hypothesis, the following null-hypothesis will be used: Mean drug spending for the manufacturer with the lowest associated annual spending will be greater than or equal to overall mean spending. An alpha of 0.05 will be used to determine significance. If the resulting p-value is below alpha, the null hypothesis will be rejected and the alternate hypothesis, listed above, will be accepted.

Results:



The figure above displays the t-distribution resulting from this dataset along with the critical t-score and actual t-scores for each test that was performed. It can be seen that using any combination of the selected metrics renders a statistically significant difference in the mean average annual spending by drug with t-scores ranging from 6.219 to 12.163. Full results are displayed in the next table.

Variable	Method	Mean Difference/SE	Significance	95% Confidence
Avg_Spnd_Per_Dsg_Unt_Wghtd	min_unt	M=1.038, SE=0.105	t(15163)=9.86, p=3.6223446471795764e-23	[0.832, 1.245]
Avg_Spnd_Per_Dsg_Unt_Wghtd	min_clm	M=0.836, SE=0.105	t(15163)=7.94, p=1.07712262296526e-15	[0.629, 1.042]
Avg_Spnd_Per_Dsg_Unt_Wghtd	min_ben	M=0.689, SE=0.111	t(15163)=6.219, p=2.572918688493695e-10	[0.472, 0.906]
Avg_Spnd_Per_Clm	min_unt	M=20.928, SE=2.297	t(15163)=9.112, p=4.5517519367998277e-20	[16.426, 25.43]
Avg_Spnd_Per_Clm	min_clm	M=28.142, SE=2.314	t(15163)=12.163, p=3.501344526157018e-34	[23.607, 32.677]
Avg_Spnd_Per_Clm	min_ben	M=22.476, SE=2.293	t(15163)=9.801, p=6.511914053706355e-23	[17.981, 26.971]
Avg_Spnd_Per_Bene	min_unt	M=178.627, SE=23.081	t(15163)=7.739, p=5.312685700421358e-15	[133.387, 223.868]
Avg_Spnd_Per_Bene	min_clm	M=191.911, SE=22.471	t(15163)=8.54, p=7.319198063014794e-18	[147.865, 235.957]
Avg_Spnd_Per_Bene	min_ben	M=227.166, SE=24.03	t(15163)=9.454, p=1.872866568051703e-21	[180.065, 274.268]

Conclusion:

The t-test results indicate that, no matter which of the three methods are used to identify the manufacturer with the lowest annual spending per drug, the difference is statistically significant. The comparisons resulted in an average savings of $0.47 to $1.25 per dosage unit, $16.45 to $32.68 per claim, and $133.39 to $274.27 per beneficiary for each drug annually. These results suggest that there are missed opportunities for prescription drug savings within the Medicare Part D program. If these savings were to be realized, this could result in a large reduction in government spending on senior prescription drug coverage.