Pymaceuticals Analysis and Findings

Alexis Perumal, 12/16/19
UCSD Data Science Bootcamp, HW#5 Matplotlib

Summary

The growing Pymaceuticals Inc., has 3 drugs in the development pipeline that they want to analyze for efficacy in arresting cancer. A placebo is included as a control. Timeseries data over a 45-day treatment period has been provided for three key indicators: tumor volume, # of metastatic sites, and survival rates.

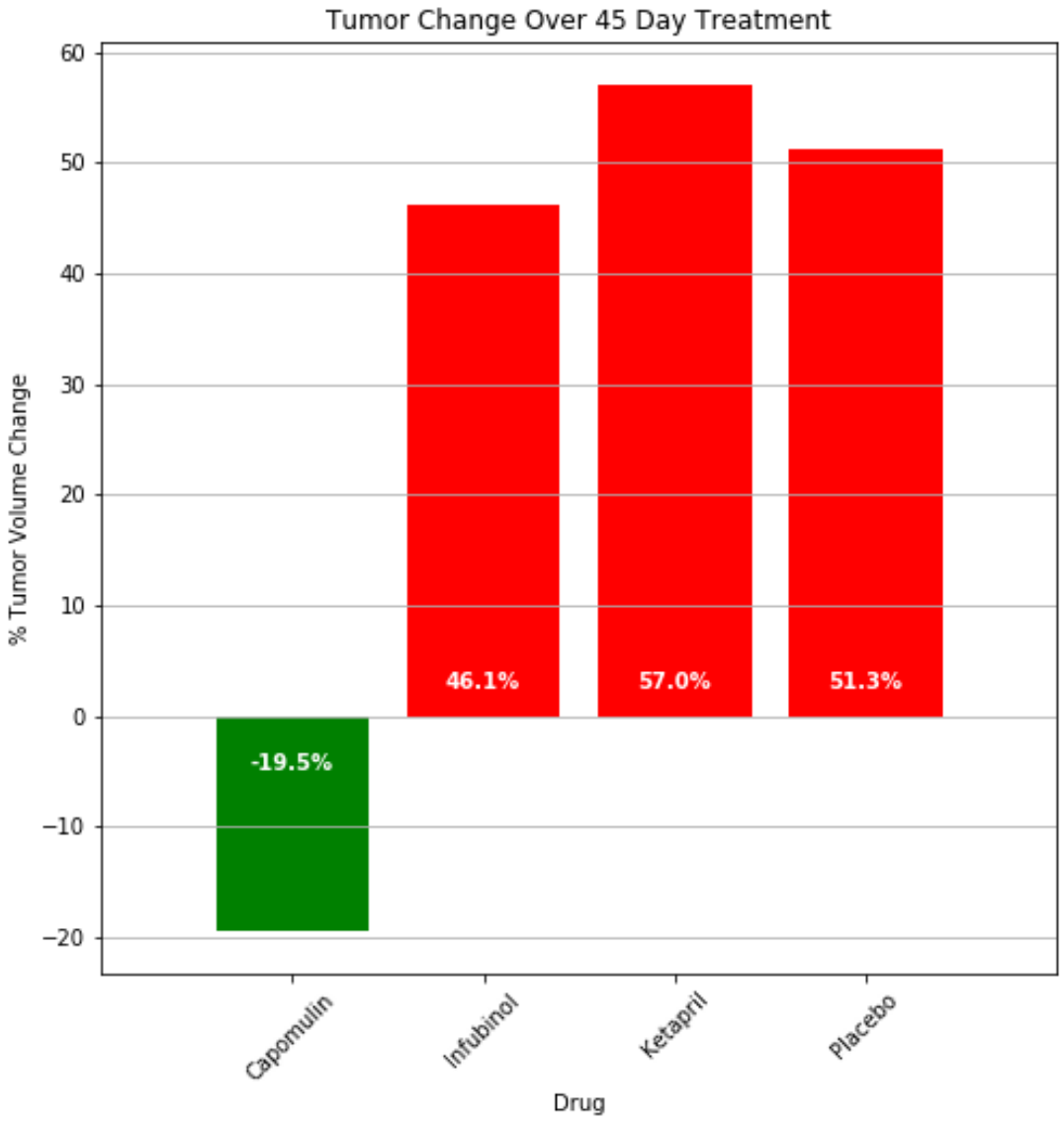
Approach

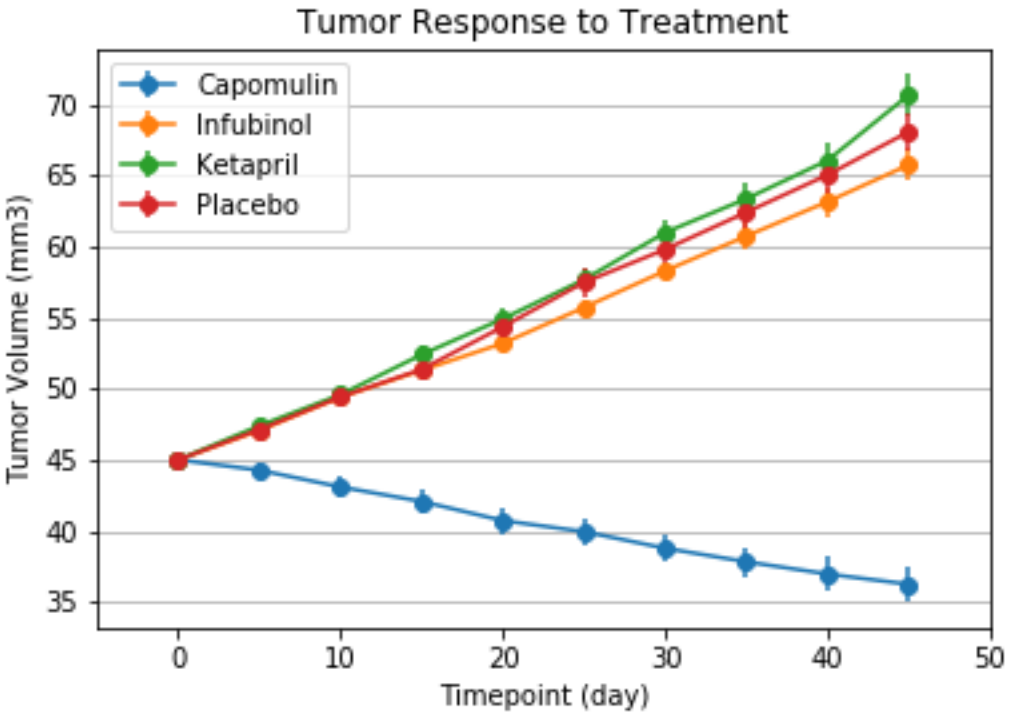
Analysis involved creating a jupyter notebook file and using Python, pandas and matplotlib to analyze the CSV dataset, generating tabular outputs and charts for the aforementioned indicators. Compounds studied include: Capomulin, Infubinol, Ketapril.

Findings

1. **Tumor volume: Capomulin (19.5% reduction), demonstrated statistically significant (95% confidence) reduction in tumor volume over the 45-day day period vs. growth for the other two drugs and placebo.**

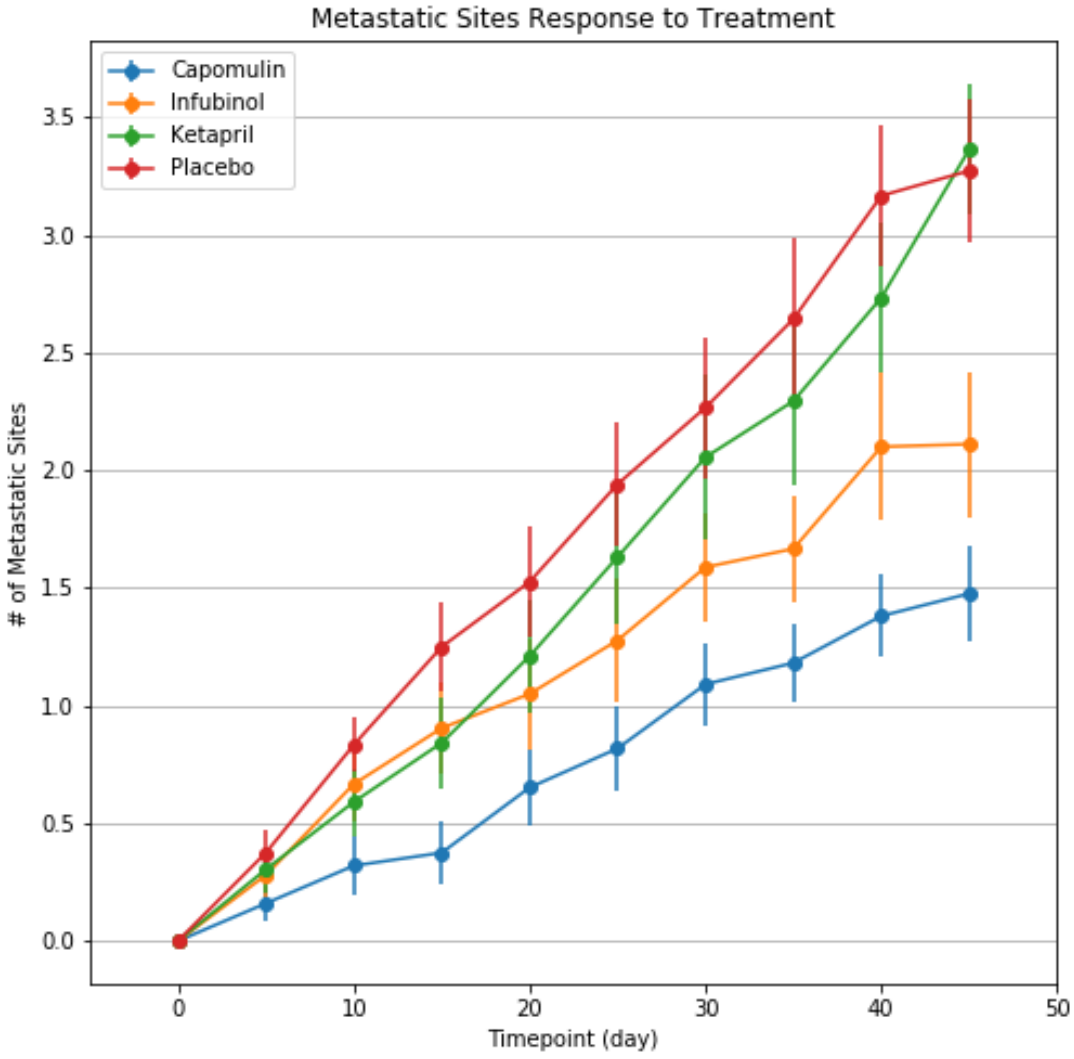
   All other treatments, including the control, showed an *increase* in tumor volume between **46.1%** and **57.0%**.


Tumor Change Over 45 Day Treatment
% Tumor Volume Change
60
50
40
30
20
10
0
−10
−20
-19.5%
46.1%
57.0%
51.3%
Capomulin
Infubinol
Ketapril
Placebo
Drug


Tumor Response to Treatment
Capomulin
Infubinol
Ketapril
Placebo
Tumor Volume (mm3)
70
65
60
55
50
45
40
35
0
10
20
30
40
50
Timepoint (day)

2. **Metastatic sites: All compounds and the placebo showed an increase in metastatic sites over the trial period. Capomulin had the lowest growth.**

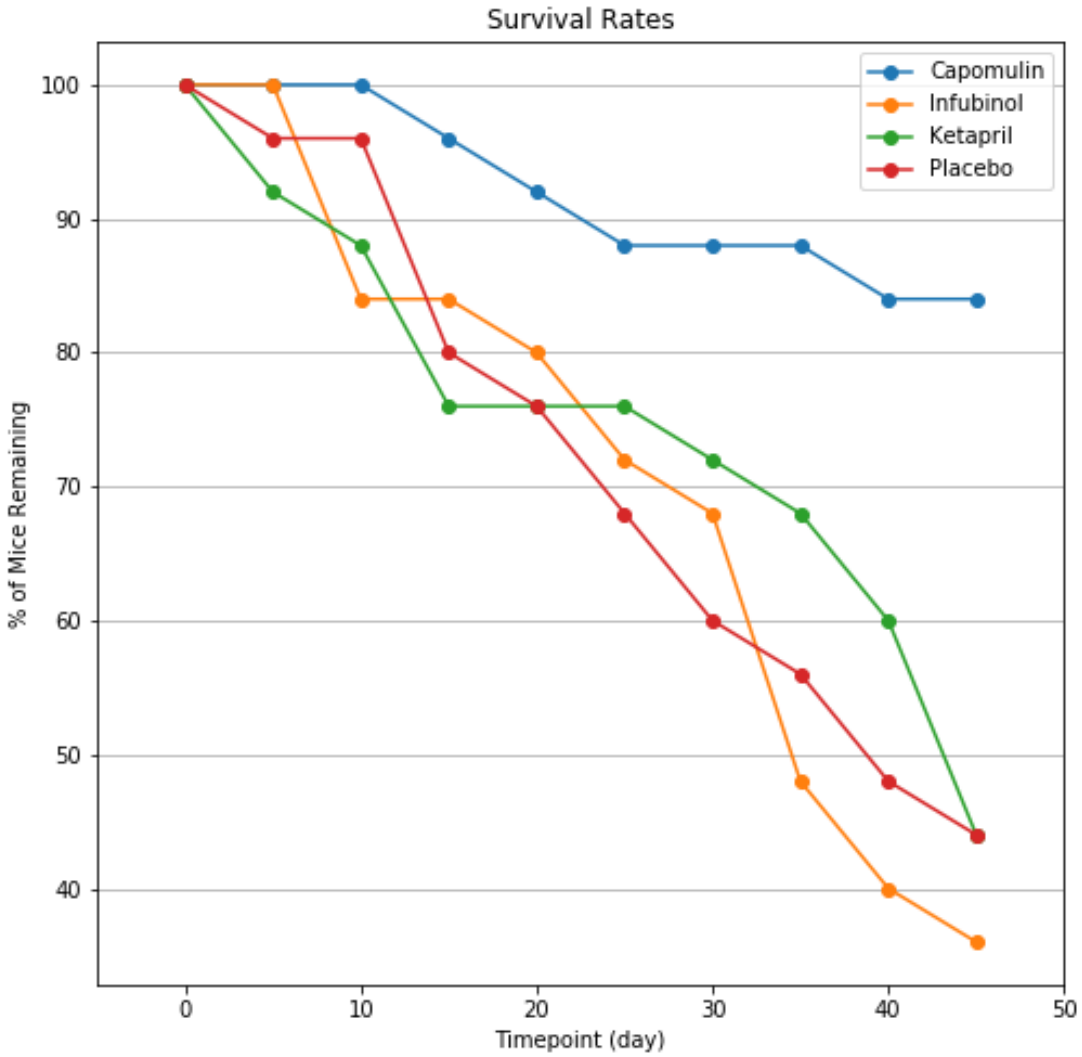
   Metastatic site growth with **Capomulin** was lower with statistical significance than the placebo and other two drugs. **Infubinol** was lower than the placebo and Ketapril with statistical significance. **Ketapril** did not have a statistically significant difference from the placebo.



3. **Survival Rates: None of the drugs, nor the control, resulted in full survival. Capomulin had the highest survival rate at 84%.**

   Those survival rates compare with all the other treatments ranged from **36%** to **44%**.

   Since the survival rate was simply the number of mice from an original pool of 25 per treatment, and there were not multiple trials, a standard error measurement and confidence interval of the mean for hypothesis testing was not calculated. Therefore, these findings are not statistically significant without further experimentation and analysis.



Conclusion and Recommendations

1. **Capomulin** showed materially better results across tumor volume reduction and slower growth in metastatic sites with statistical significance. Additionally, it also demonstrated the highest survival rates although the statistical significance of that difference can't be evaluated. *Overall, we recommend continued aggressive evaluation of Capomulin*.

2. **Infubinol** demonstrated a weaker, but still statistically significant beneficial response on metastatic site response but had the lowest survival rate.

See the Jupyter Notebook for detailed analysis and dataset tables.