

MathWorks Math Modelling Challenge 2019

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Introduction and Background

- ▶ Our entry analyzed projected cigarette & electronic cigarette use over the next 10 years, created a simulation of 300 high school seniors and predicts market share of Nicotine, Marijauna, alcohol, & unprescribed opioids, and developed a comprehensive metric to calculate the impact of substance abuse.
- ▶ Data Sources:
 - ▶ High School Vaping Data
 - ▶ NIH - DrugTrends - Data Sheet
 - ▶ Historical Cigarette Consumption
- ▶ Over the past 50 years, cigarette use has continued to decrease because of multiple efforts to improve legislature, broadcast health detriments, and help smokers become non-smokers.
- ▶ Over the past year, vaping use has increased by 50%.

Procedures

- ▶ Darth Vapor
 - ▶ We exported cigarette and e-cigarette usage data in 8th, 10th, & 12th graders from 'NIH Drug Trends' for the years 2015 - 2018. Then, we performed a simple linear regression analysis. Finally, we extrapolated this model from 2015 to 2028.
- ▶ Above or Under the Influence
 - ▶ For this simulation, we assumed that the drugs were not mutually exclusive and we ignored all external factors. We calculated the rates of Nicotine, Marijuana, Alcohol, and Unprescribed Opioids for seniors, and then performed a random simulation of 300 high school seniors. By using a combination of `rand()` and `if()` functions, we were able to develop a relatively accurate simulation.

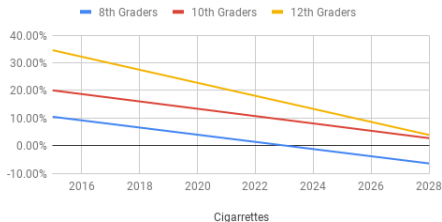
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¹Steward, Ian. Report: Americans Are Now More Likely To Die Of An Opioid Overdose Than On The Road. National Public Radio, 2019.

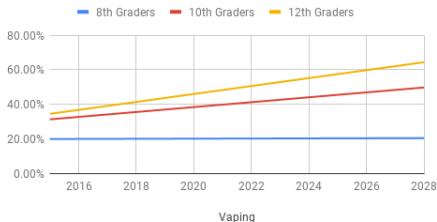
Analysis: DARTH Vapor

- ▶ As displayed in the graphs below, projected cigarette use in the next 10 years continues to decrease in 8th, 10th, & 12th graders whilst vaping increases in 10th & 12th graders.
- ▶ In this projection, vaping rates in 8th graders do not change a statistically significant amount in the next 10 years.

Cigarettes in 8th , 10th, & 12th Graders- Forecasted



Vaping in 8th, 10th, & 12th Graders - Forecasted

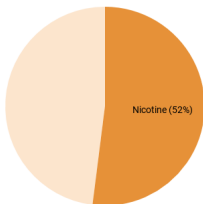


Analysis: Above or Under the Influence?

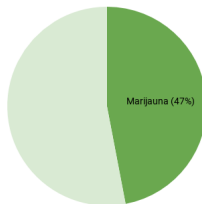
- ▶ In a simulation of 300 high school seniors, we observed the following:
 - ▶ 156 seniors used Nicotine (52%).
 - ▶ 141 seniors used Marijuana (47%).
 - ▶ 195 seniors used Alcohol (65%).
 - ▶ 54 seniors used Unprescribed Opioids (18%).

Analysis: Above or Under the Influence? - Cont.

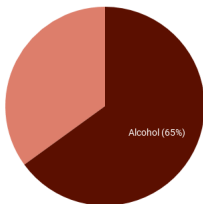
Nicotine Use in 300 Seniors



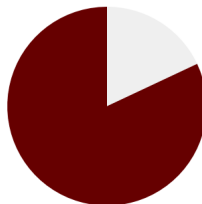
Marijuana Use in 300 Seniors



Alcohol Use in 300 Seniors



Unprescribed Opioid Use in 300 Seniors



Analysis: Ripples

- ▶ We send out an annual survey to 8th - 12th graders. This survey takes into account drug usage in teens and average socioeconomic status of families in a specific district.
- ▶ Various statistical tests can then be used to calculate the impact of the specified drug.

Conclusion

- ▶ Vaping will increase over the next 10 years, and cigarette use will continue to decrease.
- ▶ Seniors in high school are over 50% likely to use nicotine, marijuana, and/or alcohol.
- ▶ If we had more time to continue this project, we would like to apply multiple logistic functions to our data to better represent trend lines in Darth Vapor.
- ▶ Likewise, in Above or Under the Influence, we would like to find a better way to simulate the probabilities of seniors to use nicotine, marijuana, alcohol, and unprescribed opioids.