Bending the Curve: A Mathematical Model to Predict the Impact of a Novel Approach to Mitigate the Opioid Crisis

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Opioid Crisis

❖ Every day, around 130 lives are lost in the United States to opioid overdoses
➢ Amounts to 47,000+ lives lost every year
❖ More than 10 million individuals misuse prescription opioids in the US every year
❖ 1 in 3 people in the US knows someone struggling with an opioid use disorder
❖ PA has the 4th highest rate in the US in terms of opioid use disorders
❖ More than 1,000 lives were lost since 2015 to opioid overdose in Lehigh and Northampton counties

Statistics from the National Center for Biotechnology Information (NCBI), American Psychiatric Association, Centers for Disease Control and Prevention (CDC)
Objectives

❖ Opioid crisis has always been considered as an adult problem that only adults can solve
  ➢ Teenagers currently passive bystanders

❖ Adult efforts have flattened the curve (at 47,000+ lives lost to opioid overdose) but society needs more action to bend the curve and save even more lives

❖ Focus: predict how additional intervention can further change the trajectory of the crisis by devising mathematical models to prove and put into perspective the extent to which the current initiatives have affected the opioid crisis
Hypothesis

- **Hypothesis:** Society can bend the curve faster if methods exist for teenagers to actively intervene and help adults combat the opioid crisis
  - Not about teenagers avoiding opioids
  - *Premise is that society can empower teenagers to assist friends and family members struggling with opioid use disorders*
  - Novel idea as teenagers are currently not involved in trying to mitigate the opioid crisis
Methods – Fitting Equations and Trendlines

- Major initiatives to address the opioid crisis not taken until after 2017
- Trendlines formed to measure the effectiveness of current interventions
  - Measured the number of lives lost from opioid overdose from 1999 to 2017
  - All polynomial equations as they best account for the inflection points found in the data
  - $R^2$ value indicates the relative accuracy of the model (1.00 is most accurate)

The above graph indicates that the national opioid crisis peaked in more recent years, with a general increasing trend affecting more lives.
Methods - Fitting Equations and Trendlines

The above graph is specific to each opioid - demonstrates that because each opioid had its own peak in the crisis, the graph with the number of overall overdoses takes into account the patterns of each opioid to generate an overall trend.

PA has the 4th highest rate in the country in terms of opioid use disorders - graph compares the national rate of deaths from opioid use disorders with Pennsylvania’s rate. This graph is per 100,000 individuals in the respective populations.
Effect of Current Intervention

❖ Trendline equations used to predict the number of opioid overdose deaths for the subsequent years had there not been any interventions

❖ These models indicate that while a significant number of lives from opioid overdoses have been saved since 2017, those numbers have remained flat

➢ Additional intervention is then needed to bend the curve
Results - The Power of Teenage Intervention

These graphs highlight that if teenagers were to intervene by helping a loved one battle an opioid use disorder, more lives would be saved and the opioid crisis curve would be significantly bent. Note that these values already take into account the continual implementation of already existing initiatives.
Opioid Crisis Toolkit for Teenagers

How to Help a Loved One Struggling with an Opioid Use Disorder

A TOOLKIT FOR TEENAGERS

Opioids
- Powerful drugs prescribed for injuries, surgeries, or illnesses
  - Can be addictive and cause dependence
- Common opioid prescription drugs: morphine, hydrocodone - Vicodin, codeine, Oxycodone, fentanyl

Opioid Use Disorder (OUD)
- A dangerous cycle where people need to constantly use opioids to relieve pain or some have injections to stop feeling like any other medical disease that does NOT happen by change and can be professionally treated

Fast Stats
Every day around 10 lives are lost in the United States to opioid overdoses
22,5 million people in the US are currently in long-term recovery from a substance use disorder
1 out of 3 people in the US know someone with an opioid use disorder

Economy has taken a huge toll: opioid crises cost $56 billion in 2017 alone, and $220 billion in 2017

Website link: www.toolkitforteens.wixsite.com/opioidcrisis
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- TEDx Talk: https://www.youtube.com/watch?v=dhjD7eD57Go
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Thank you!

*The power lies in teenagers*: we can make a difference and we do have the potential to help save a loved one’s life

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