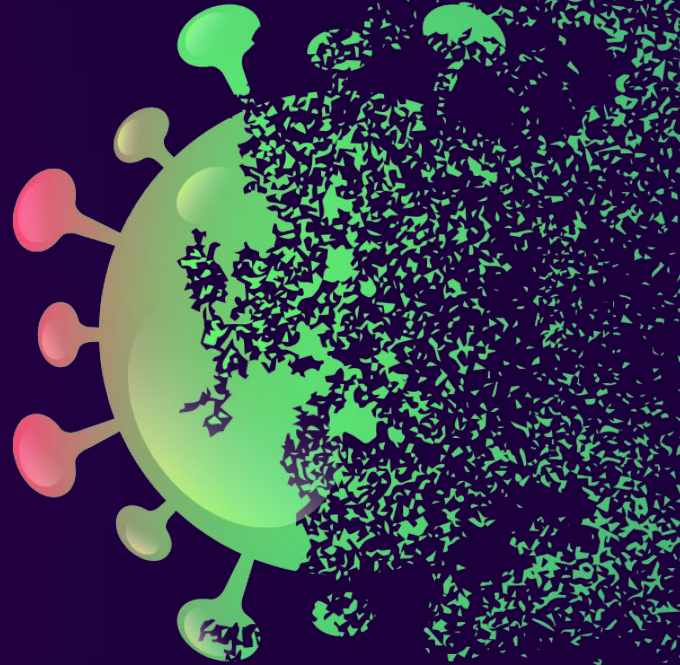# Covid in Caladan

Team 25: Sean Tomany, Sean Salvador, Krisma Bajaj, Sohail Mohammed, Abdul Rafay

01

The Policies

What We Recommend

The Issue: The 3.2 Million population of Caladan has not yet been hit by Covid going into Spring, but it is soon to come. The goal for the Commonwealth is to keep the 30 day rolling average for cases under 3% and the deaths under 1%

Close All Schools

Disease spreads fast around campuses so closing at least some levels of schools minimizes that risk.

Forced Remote Work

Forcing people online harms them economically, but large gatherings at offices spread disease fast

Stay At Home Requirements

People enjoy time outdoors however only the essentials are necessary when it comes to preventing the spread of disease

Gathering Restrictions

Large gatherings are not needed when it comes to minimizing the spread of disease.

2020 April	
Average of SAHReqs	2.00
Average of RestrictionsOnGatherings	4.00
Average of SchoolClose	2.93
Average of Growth Rate	0.98%
Average of Growth Rate	12.63%

Why We Chose Them

Close All Schools

**Forced Remote Work**

Stay At Home Requirements

Gathering Restrictions

Caladan is a country that has yet to experience COVID. The policies that we chose are all policies that restrict the gathering of people. That stops the spread and the risk of infection. Providing income support is great, however that does nothing to aid in prevention of infection and the data proves that. We want to take as much action as soon as possible to make sure that the case rates drop below the 3% and deaths stay below 1%.

To identify which exact policies to focus on, we used a mix of common sense, graphical analysis and variable selection to determine which policies impacted the growth rate of new cases and deaths the most. Moreover, we chose to emulate the two countries New Zealand and Sweden (5.1 million and 10.5 million).
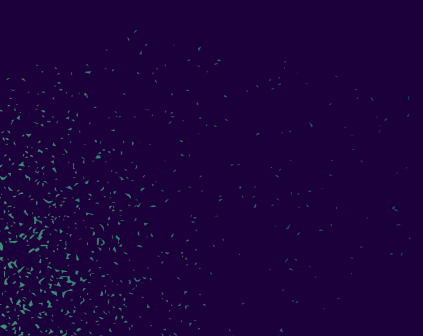
When to do What?
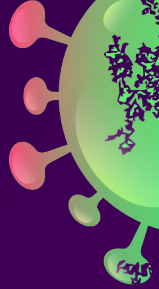
Stage One

The first stage we outline is from February 1st to July 31st

Stage Two

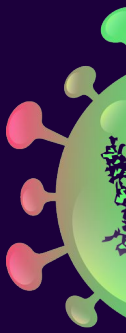The second stage we outline is from August 1st to December 31st

Stage One

Country: New Zealand

- The large jump in cases in March is product of a level of unpreparedness and lack of data for NZ

- End of March to April brought in many restrictions on gathering of people lowering the spread and leading to negative growth in May

- This allowed them to be less restrictive going into June as people need some sort of freedoms

Stage One

Country: Sweden

- The large jump in cases in March is product of a level of unpreparedness and lack of data for SWE

- Extreme Restriction on gatherings and immediate closing of schools led to a 18% drop in the rolling average for cases

- To stay below 0% on the growth rate, they kept their policies. An alteration in Gathering restrictions led to an increase in cases showing how necessary that policy is
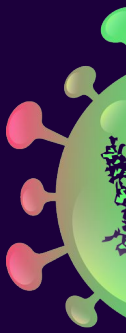
Stage Two

The second stage we outlined is from
August 1st to December 31st

Case Study: New Zealand.

- In August, a significant escalation in policies, including Stay-at-Home Requirements, Restrictions on Gatherings, and School Closures, was accompanied by a marked decrease in the growth rates of both cases and deaths in the following months, demonstrating the effectiveness of measures.

- Despite a removal of Schools and Housing gathering restrictions, the average growth and case rate reduced. However, a lenient reduction and then removal of Gatherings in October to November had a slight increase in the rate of the parameters to 0%.
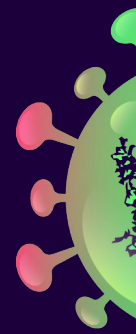
Stage Two

The second stage we outlined is from
August 1st to December 31st

Country: Sweden

- The restrictions on schools were de-escalated in the month of August to November, which increased death rates to 2.01% and cases to 5.35%. A strict measures on gathering was implemented by November.

- The effectiveness of the strict restrictions was proved by a decrease in both parameters by December, underscoring the significance of immediate and decisive policy changes for effective pandemic management.

ML Implementation

Load/Preprocessing

EDA 1: Correlation Matrices

Model Preparation

ML 1: Random Forest Regression

EDA 2: Feature Engineering

ML 2: Linear Regression

Model Evaluations

Analysis
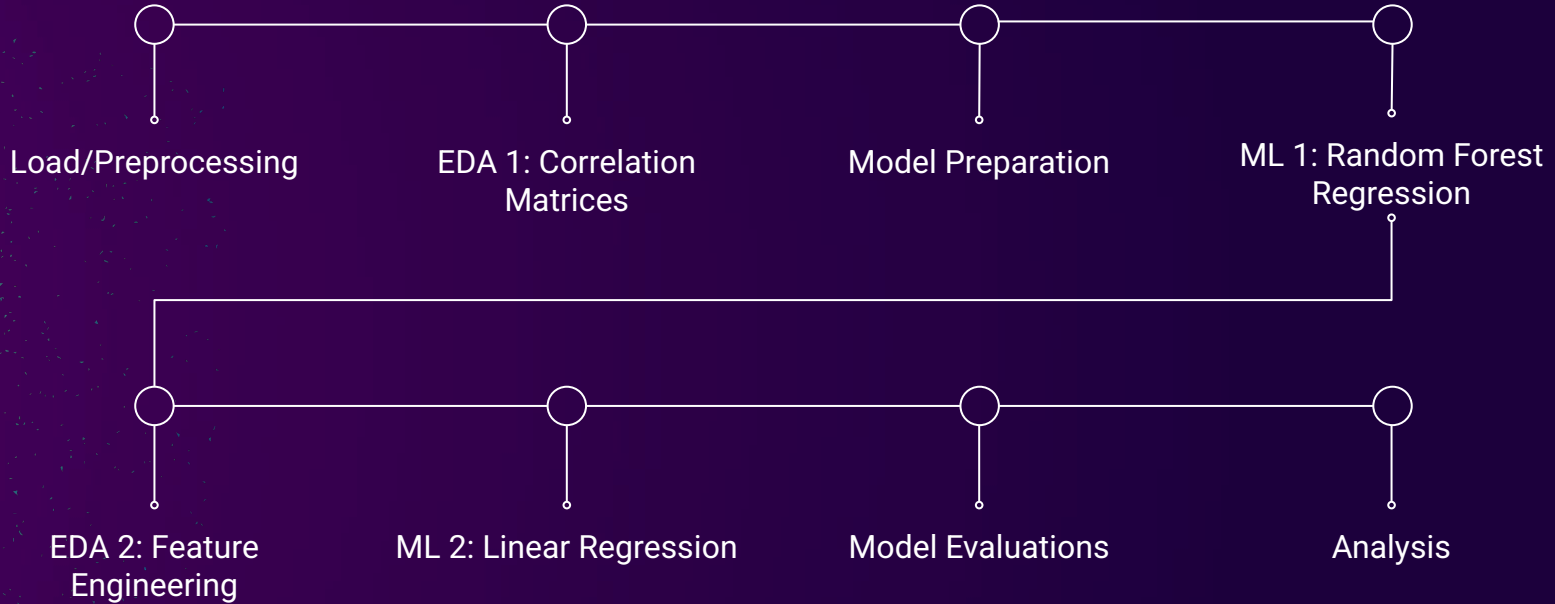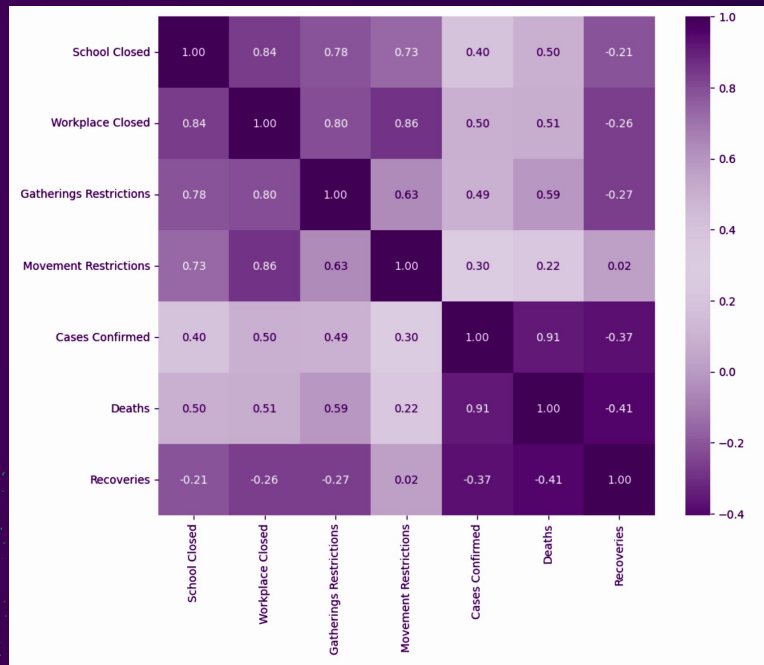
EDA 1 : Correlation Matrices

Heat map correlation matrices of data columns were created to visualize the potentially beneficial relationships for model training.
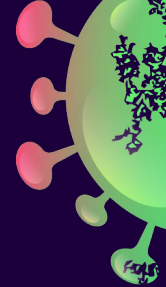
ML 1 : Random Forest

Random Forest Implementation : Target Variable : Cases Confirmed
Model was trained to determine the importance of each policies as features.

Actual vs. Predicted Values
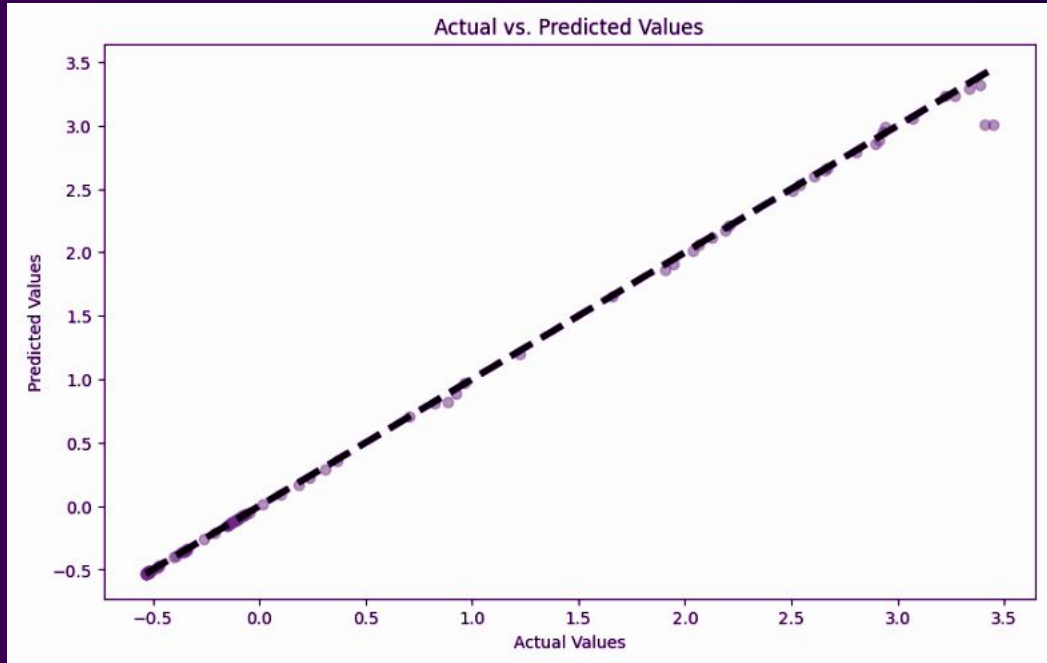
EDA 2 : Feature Engineering

Random Forest Implementation : Target Variable : Cases Confirmed
Using the trained model, policy importance were evaluated. New Zealand and Sweden
differed in the importance of policies.
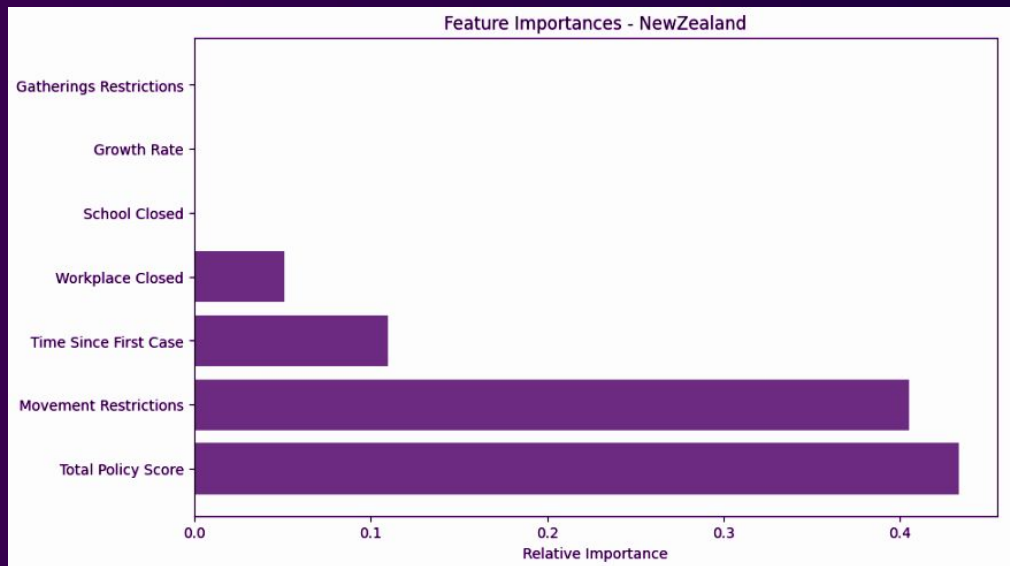
ML 2 : Linear Regression

Baseline Model Implementation : Target Variable : Cases Confirmed.
MSE : 0.13719480339889007

Actual vs. Predicted Values

Model Evaluation

Linear Regression: Target Variable : Cases Confirmed
Coefficients given in OLS results significant. Thus, model used for further predictions.
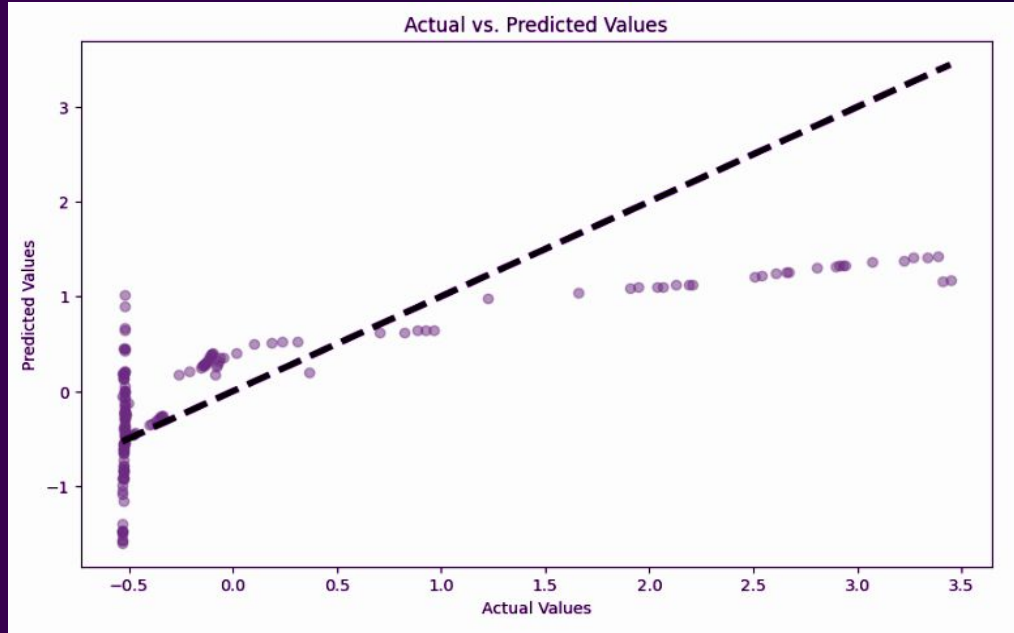
```
                           OLS Regression Results
==============================================================================
Dep. Variable:        Cases Confirmed   R-squared:                       0.514
Model:                            OLS   Adj. R-squared:                  0.513
Method:                 Least Squares   F-statistic:                     428.3
Date:                Sat, 04 May 2024   Prob (F-statistic):          1.39e-127
Time:                        23:48:32   Log-Likelihood:                 -858.99
No. Observations:                 812   AIC:                             1724.
Df Residuals:                     809   BIC:                             1738.
Df Model:                           2
Covariance Type:            nonrobust
==============================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const                 -1.5494      0.059    -26.289      0.000      -1.665      -1.434
Total Policy Score     0.1244      0.006     19.582      0.000       0.112       0.137
Time Since First Case  0.0045      0.000     21.622      0.000       0.004       0.005
==============================================================================
Omnibus:                       44.628   Durbin-Watson:                   2.803
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               57.034
Skew:                           0.506   Prob(JB):                     4.12e-13
Kurtosis:                       3.814   Cond. No.                         592.
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```
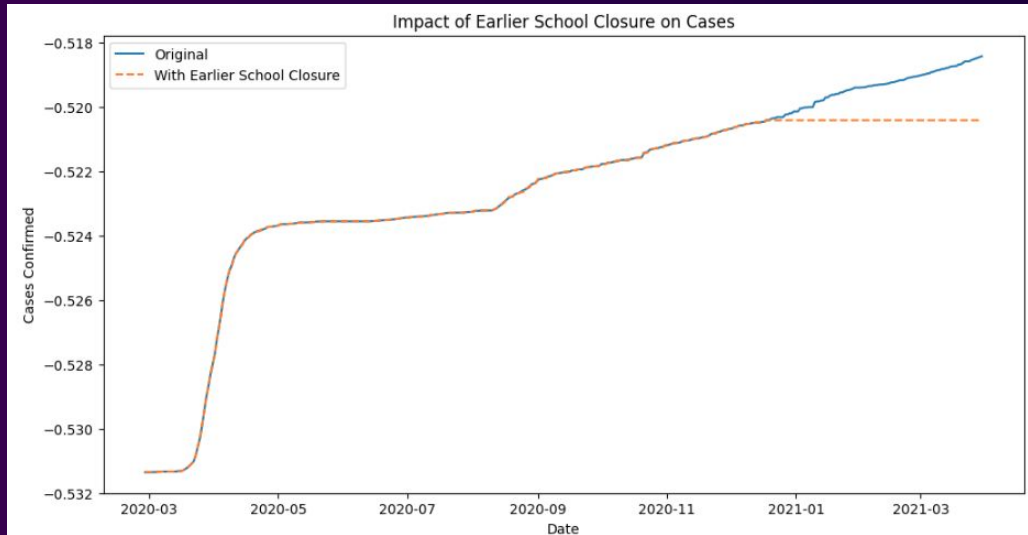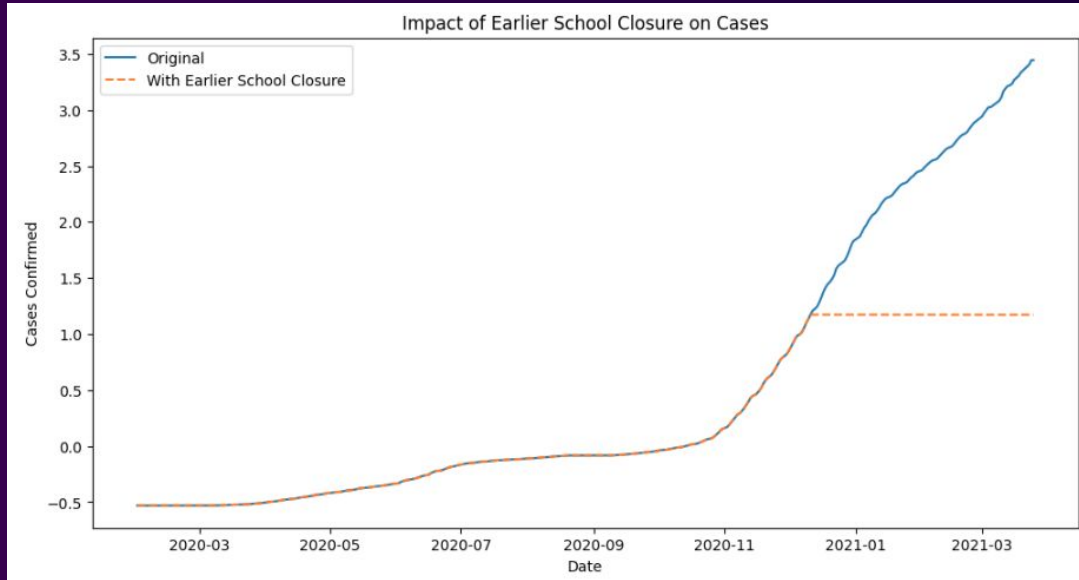
Time Series Visualization

Trained model was used to predict trends in-relation to time series if closure happened earlier. New Zealand ; Due to same initial date of work and school closure, workplace closure prediction was same as the graph below. Decline in growth rate around 2020-12-26.
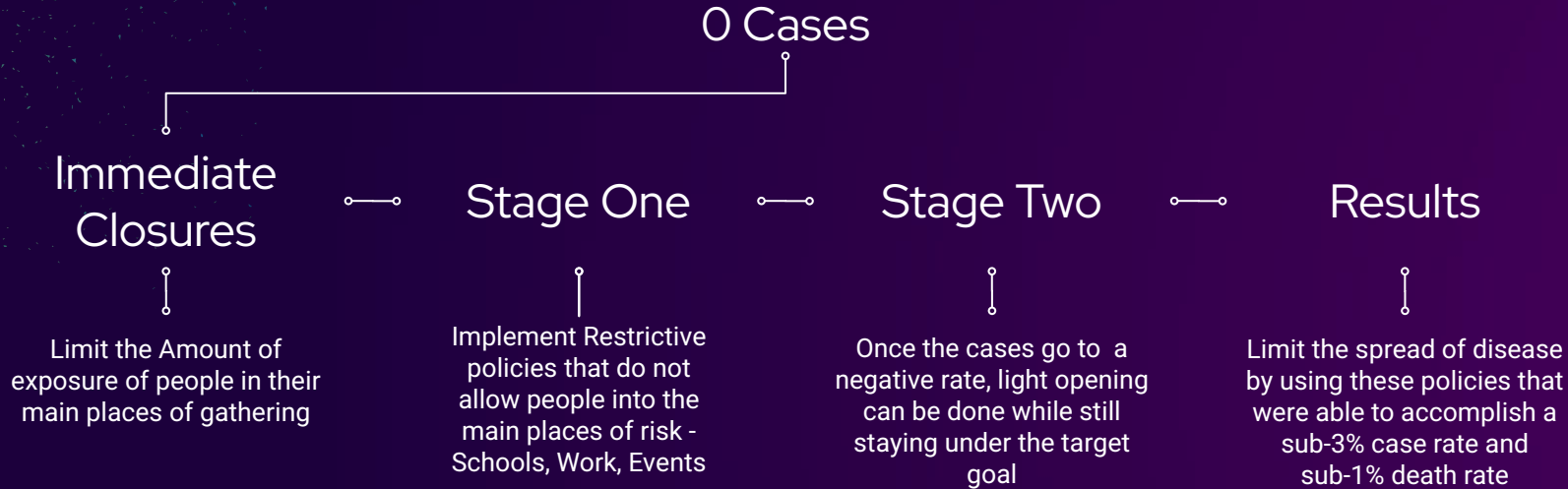
Time Series Visualization

Sweden ; Due to same initial date of work and school closure, workplace closure prediction was same as the graph below. Decline in growth rate around 2020-12-14.

Impact of Earlier School Closure on Cases

Conclusions

0 Cases

Immediate Closures

Limit the Amount of exposure of people in their main places of gathering

Stage One

Implement Restrictive policies that do not allow people into the main places of risk - Schools, Work, Events

Stage Two

Once the cases go to a negative rate, light opening can be done while still staying under the target goal

Results

Limit the spread of disease by using these policies that were able to accomplish a sub-3% case rate and sub-1% death rate

Ensuring the Safety of Caladan Citizens