



Commonwealth of Caladan



# PANDEMIC REGULATION POLICIES

By Team 5

# ROLES

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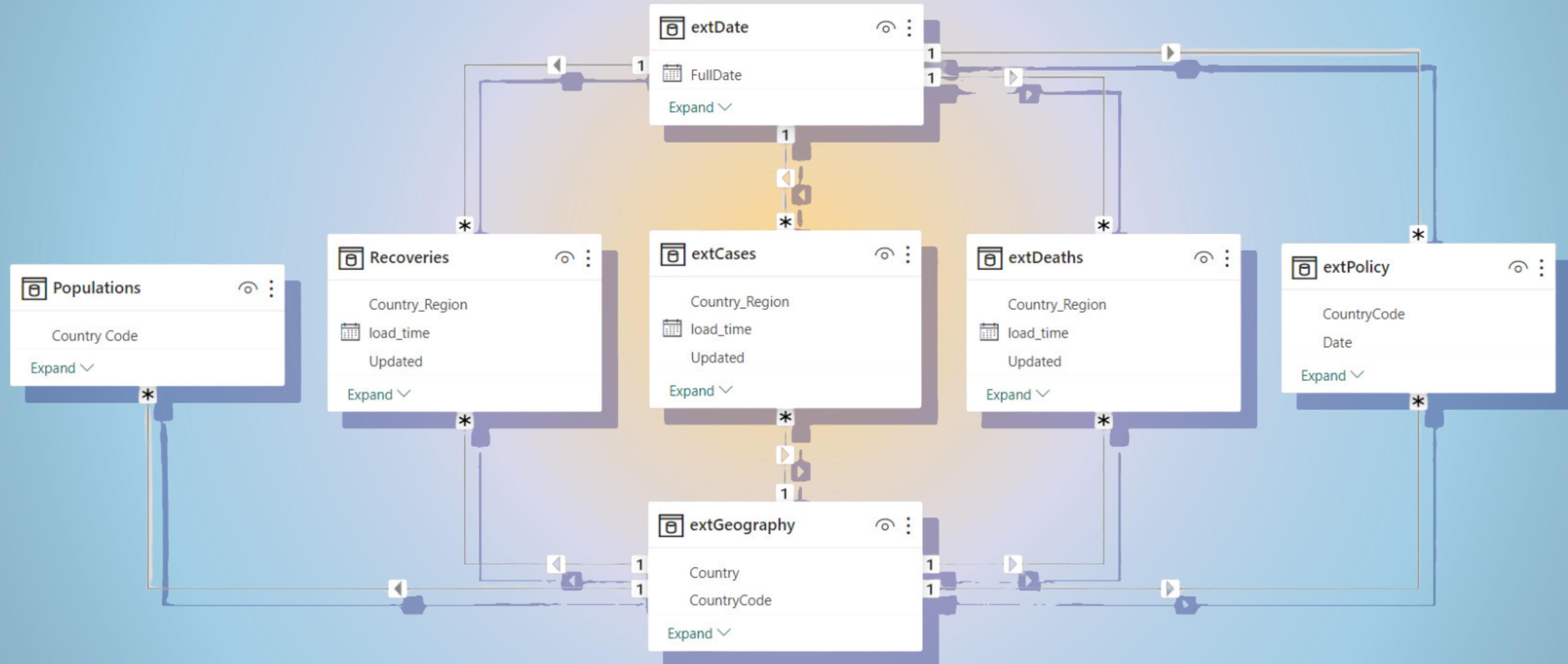


# OBJECTIVES

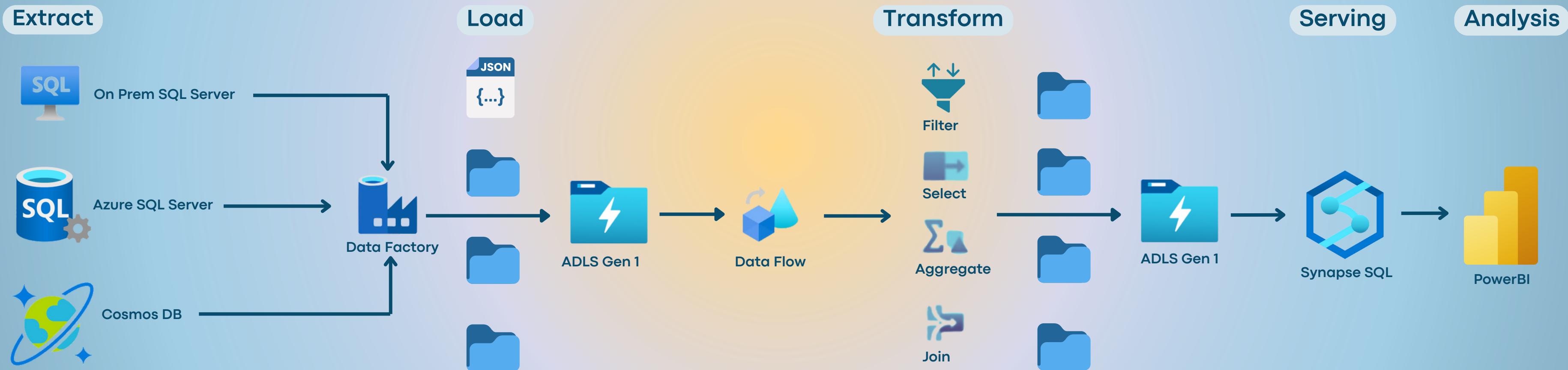
- **Subject:** Caladan, a country with a population of ~3 million needs strategies to prepare for the next COVID wave
- **Focus:** was to determine whether certain policies that other countries have implemented would be effective for Caladan
- **Success Metrics:**
  - ~ less than 1% growth rate of deaths
  - ~ less than 3% growth rate of new cases



# SCHEMA MODEL



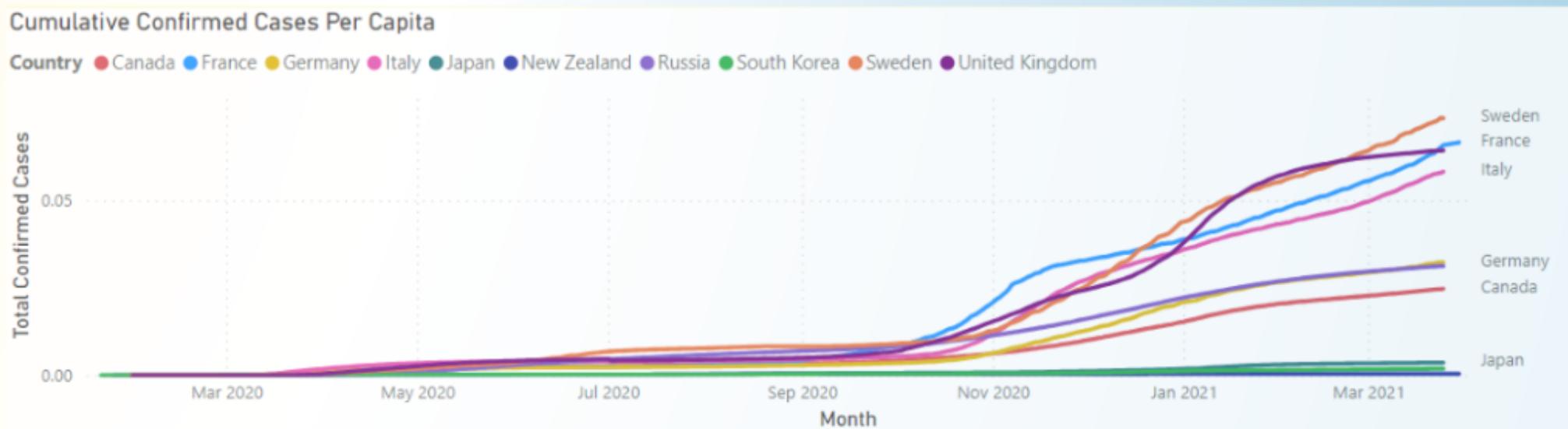
# ARCHITECTURAL OVERVIEW



# GLOBAL TRENDS

## GRAPH TRENDS

- Based on these graphs, COVID-19 cumulative cases were growing at a very slow rate until November 2020, when growth boomed - especially in countries such as Sweden, France, and Italy
- Countries such as New Zealand, Japan, and South Korea were extremely resistant to this rapid growth



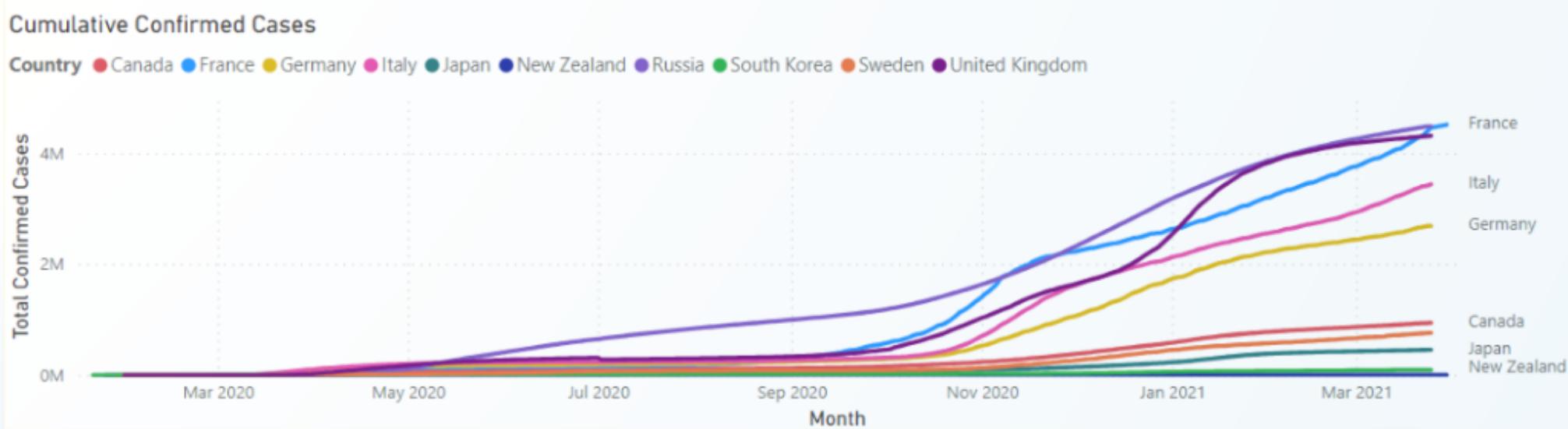
## COUNTRY ANALYSIS



### Key Reasons for Focusing on Sweden and New Zealand:

- Populations closest to Caladan (10.4m and 5.1m respectively)
- New Zealand was a global success in tackling COVID-19 as shown by such low confirmed cases per capita and cumulative confirmed cases
- Sweden had one of the highest cumulative confirmed cases per capita

Thus, we believe these 3 criteria will help us deduce the most effective policies to implement for a country like Caladan



# WORKPLACE CLOSING POLICY

## POLICY KEY

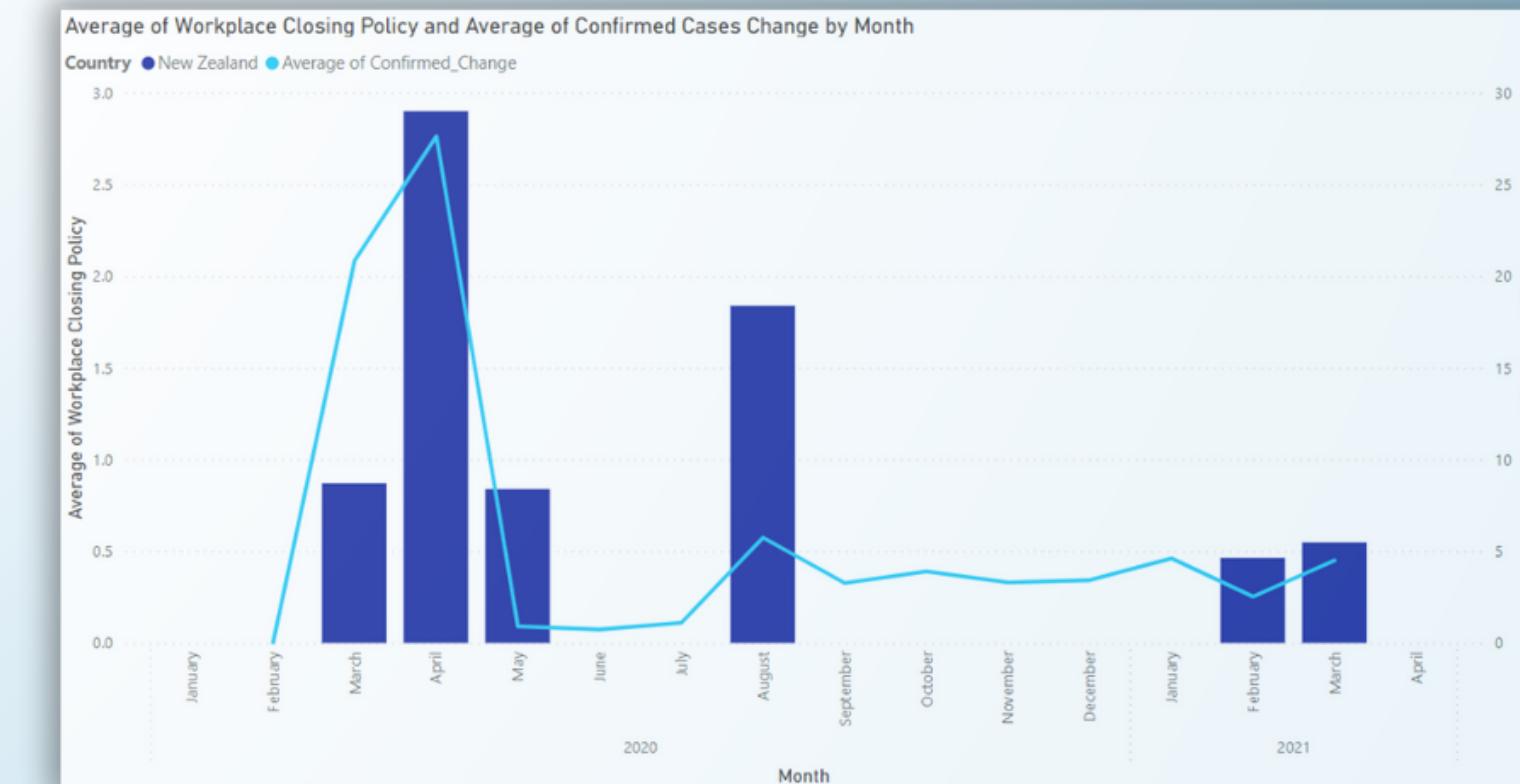
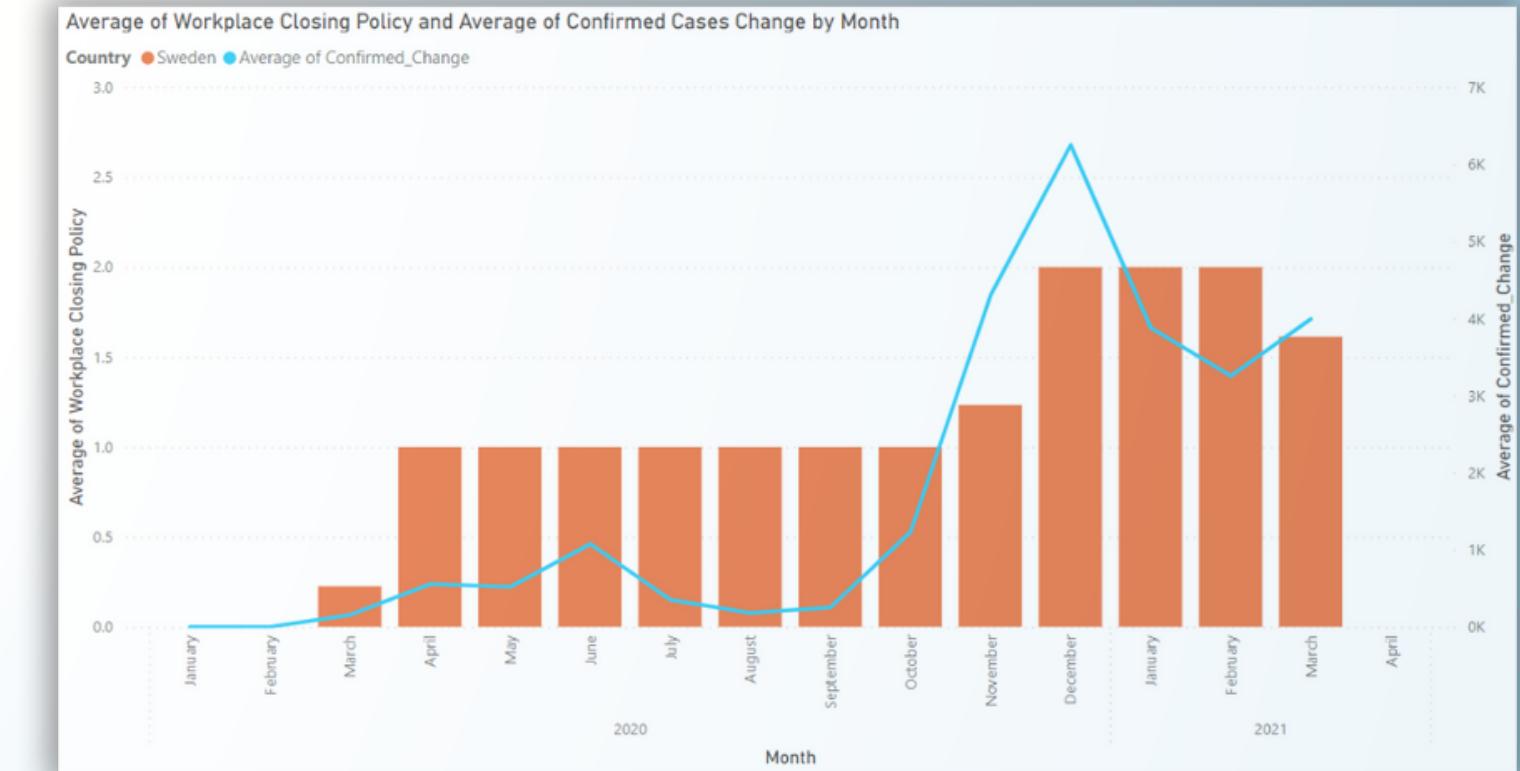
- 0 - No measures
- 1 - Recommend workplace closing
- 2 & 3: Require workplace for non-essentials

## SWEDEN

- Started off recommending workplace closing which kept the average of cases change between 500 and 1000 from March 2020 - October 2020
- When COVID peaked in November & December 2020, Sweden rapidly enforced the requirement for workplaces to close
- This caused an immediate decline in change in cases by ~45% in 2 months

## NEW ZEALAND

- Started off enforcing aggressive workplace closing requirements which saw change in cases drop by ~96%
- This allowed them to have much lighter/no restrictions in future
- Change in cases after initial aggressive closing remained consistent at around 5/day for remainder of pandemic



# INCOME SUPPORT POLICY

## POLICY KEY

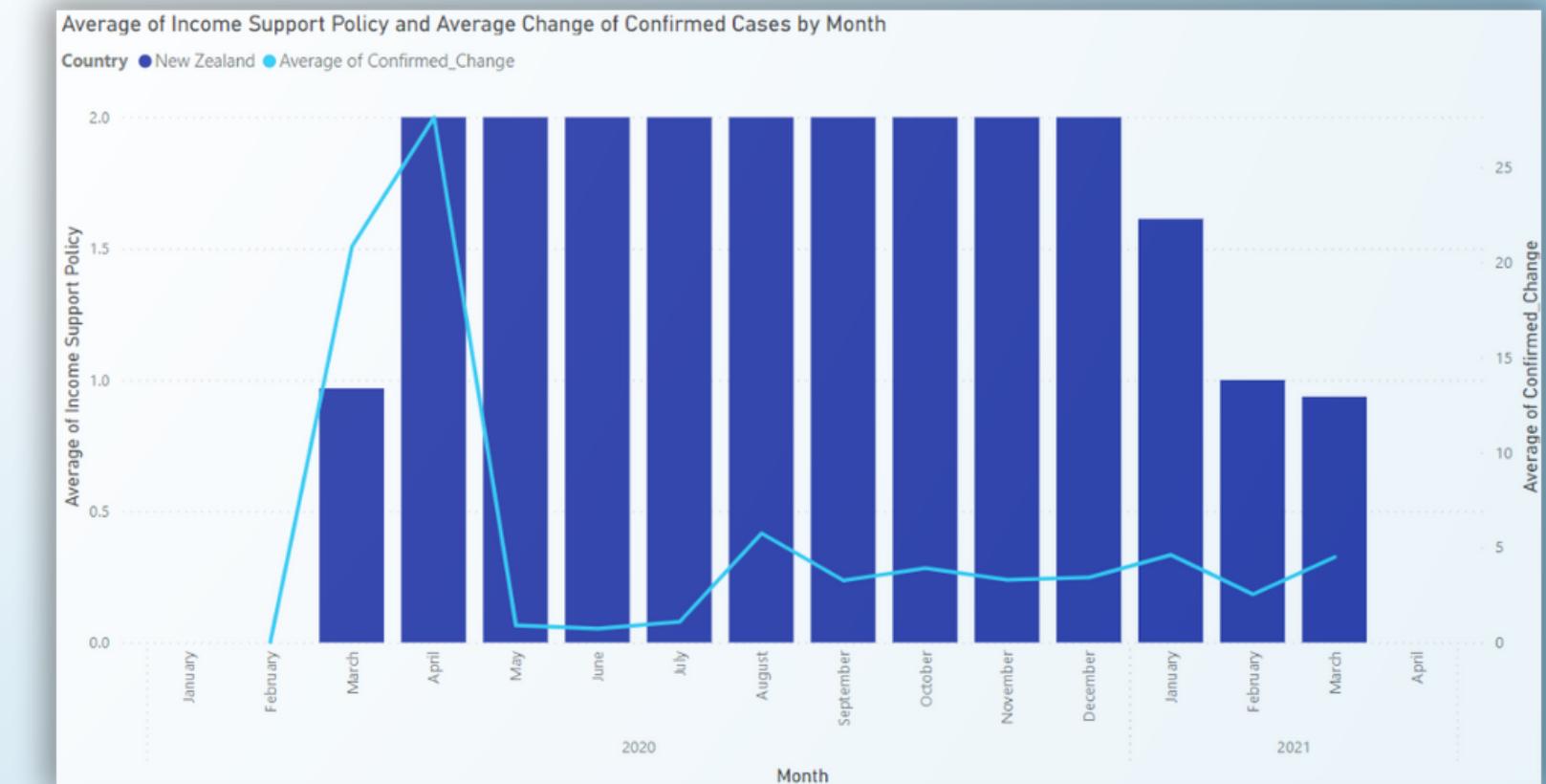
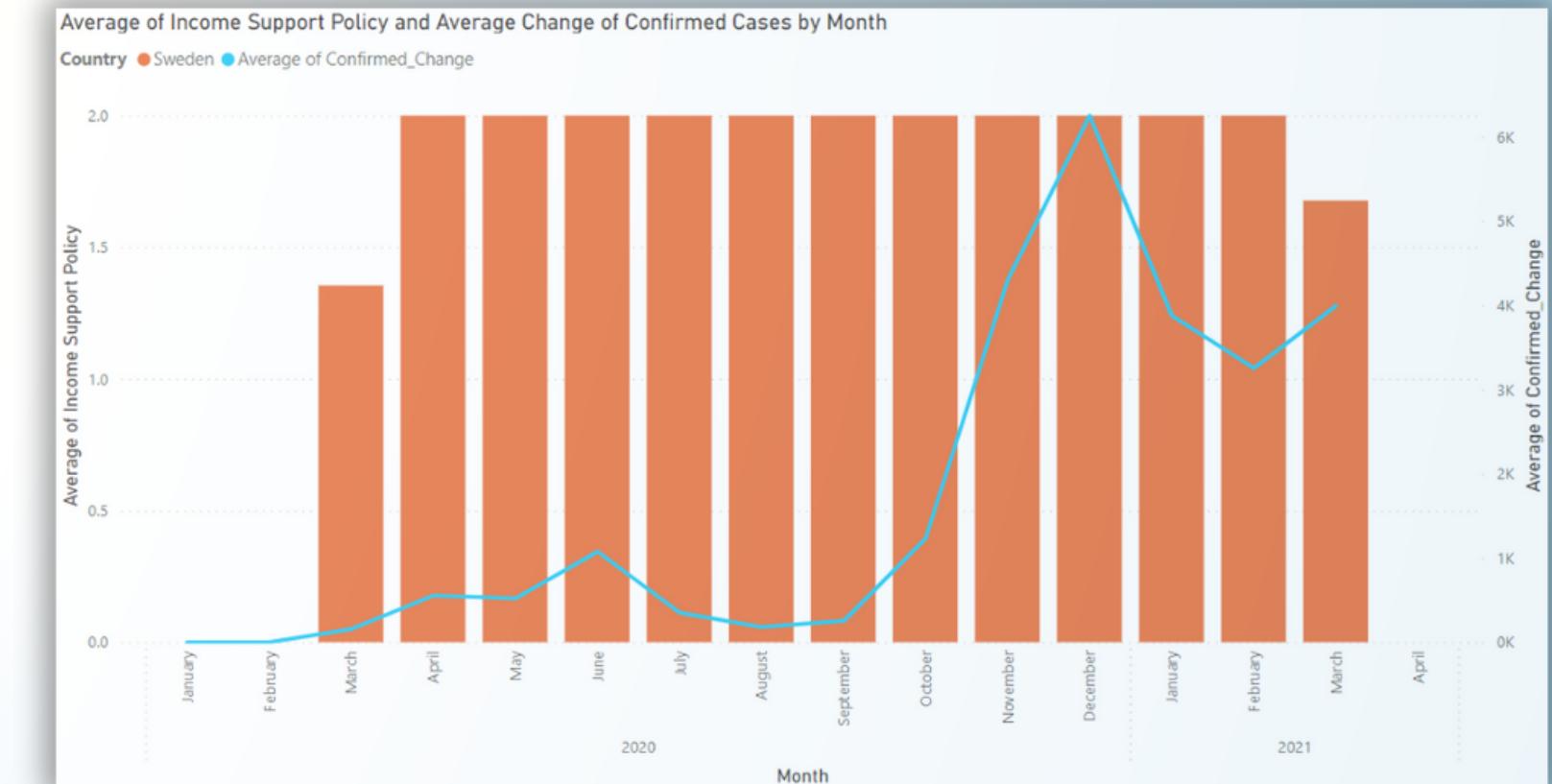
- 0 - no income support
- 1- government is replacing less than 50% of lost salary (or if a flat sum, it is less than 50% median salary)
- 2 - government is replacing 50% or more of lost salary (or if a flat sum, it is greater than 50% median salary)

## SWEDEN

- Replaced over 50% of individuals' lost salaries from March 2020-March 2021
- This policy had no affect as cases increased overall

## NEW ZEALAND

- Replaced over 50% of individuals' lost salaries from April 2020-January 2021
- Although cases dropped after the policy was implemented, this does not suggest a direct causal relationship.



# INTERNATIONAL TRAVEL CONTROL

## POLICY KEY

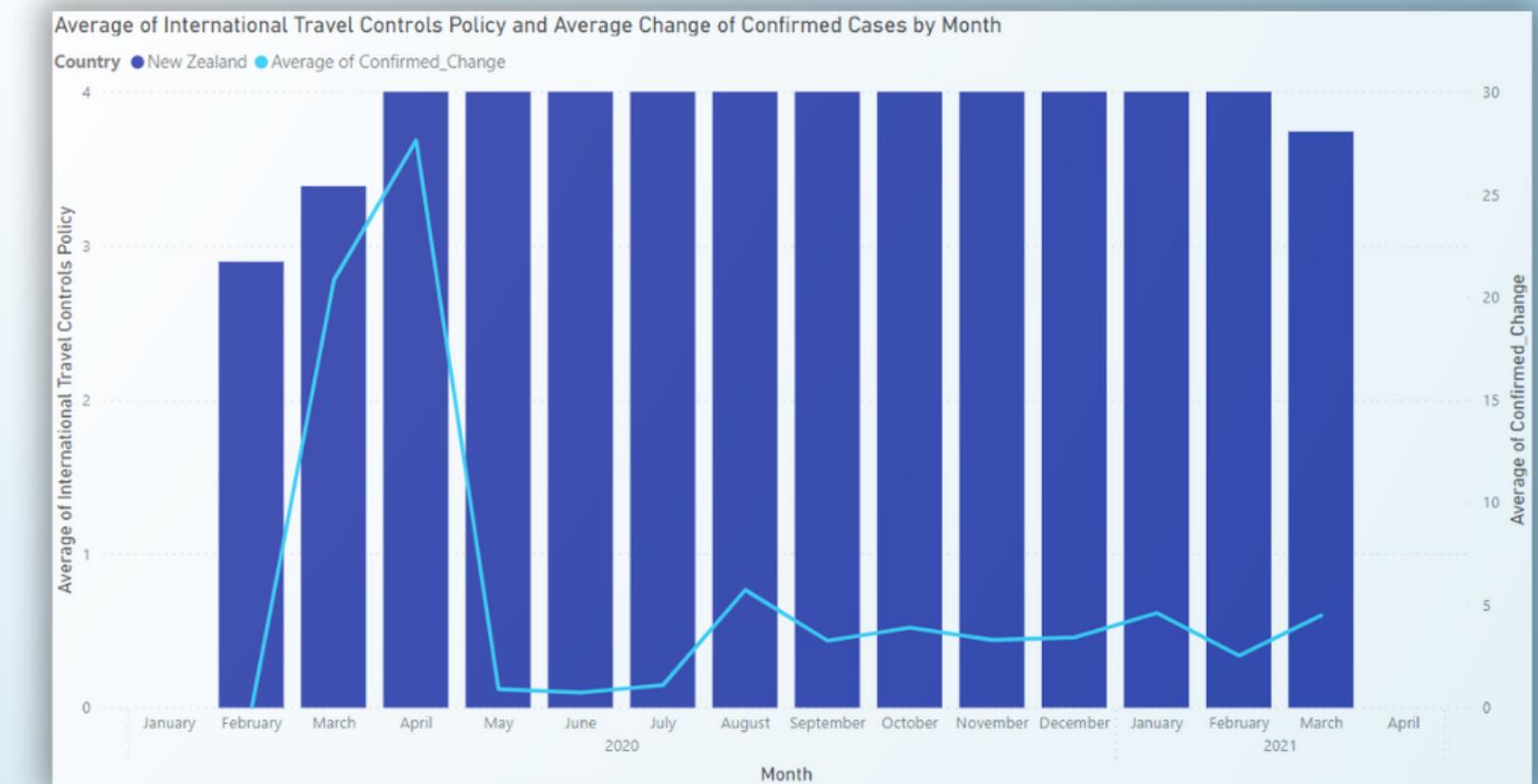
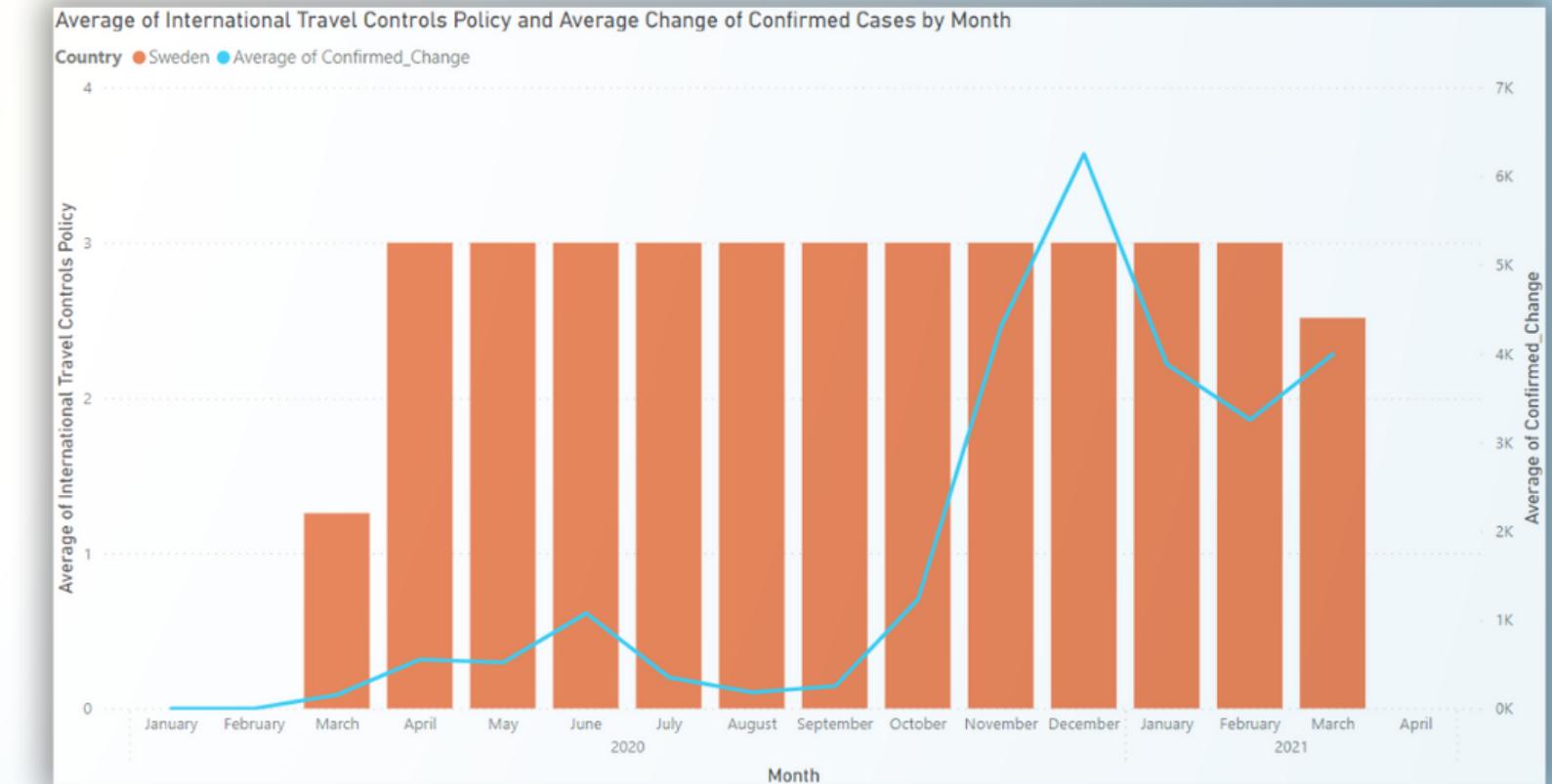
- 0 - No restrictions
- 1 - Screening on arrivals
- 2 - Quarantine on arrival from certain regions
- 3 - Ban arrivals from certain regions
- 4 - Ban arrivals from all regions

## SWEDEN

- Implemented banning on arrival from certain regions early on and maintained this policy for the entirety of pandemic before decreasing international traveling restrictions in Spring 2021
- Despite this, the average change of cases fluctuated, showing banning certain regions does not prevent long term spike in change in cases

## NEW ZEALAND

- Increased international travel control from quarantine on arrival to banning entry from all regions within 3 months
- This immediately saw a decline in change in cases
- Remained this policy for entirety of the pandemic before slowly allowing travel from certain regions in Spring 2021



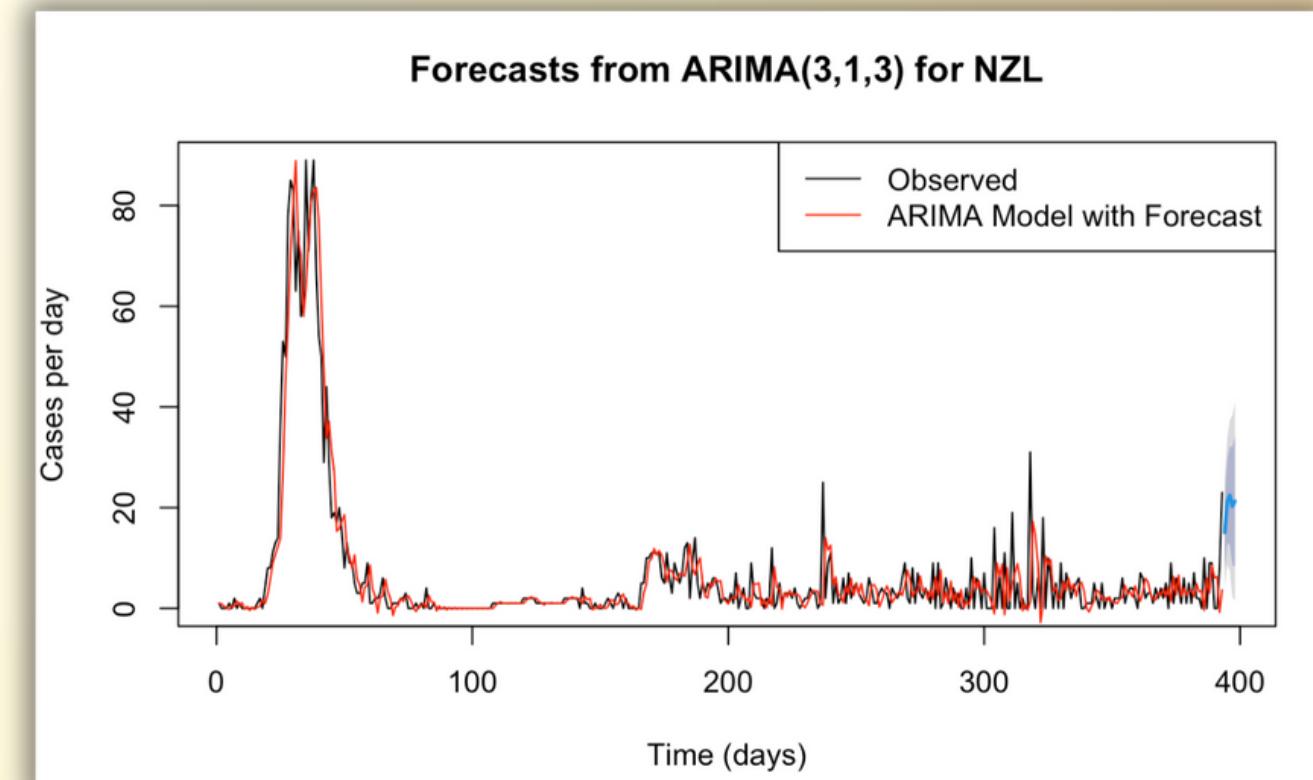
# PREDICTIVE MODELING

## ARIMA/SARIMA

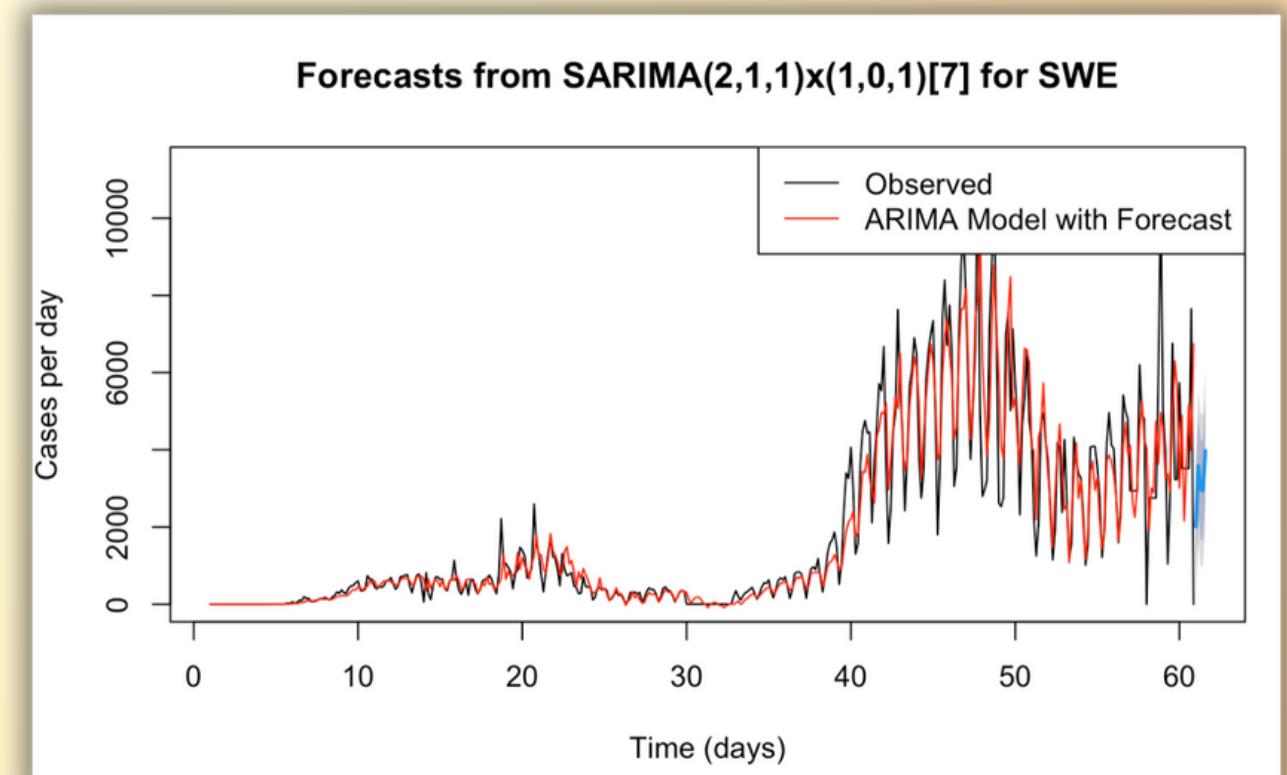


- Fitting an Autoregressive Integrated Moving Average (ARIMA) or Seasonal ARIMA (SARIMA) model to the time series of the daily cases in New Zealand and Sweden gives us the capability to predict the number of daily cases for the future days in the data.
  - Check for unit roots using UR tests to ensure validity of forecast
  - Use spectral analysis to check for seasonal components.
    - Sweden has weekly seasonality.
    - New Zealand does not have seasonality.

New Zealand:



Sweden:



# COMPARATIVE MODELING

## POISSON REGRESSION



- Can we compare case numbers for different population sizes?
- We can attempt to tackle this problem with a Generalized Linear Model (GLM) coerced to fit a Poisson regression with an “offset” term
  - The offset term includes the log population of a country
  - The offset term gives us some statistical power to analyze case numbers from different population sizes
- In our case, Sweden has a slope estimate of 0.001141 New Zealand has 0.0027734
  - Therefore, the cases in New Zealand grew faster.

Sweden:

```
Call:  
glm(formula = Sum.of.Confirmed ~ timeSw, family = poisson, data = swe_data,  
    offset = log_swe)  
  
Deviance Residuals:  
      Min        1Q     Median       3Q      Max  
-188.381  -106.156   -7.717    66.434  151.173  
  
Coefficients:  
              Estimate Std. Error z value Pr(>|z|)  
(Intercept) -7.152e+00 4.834e-04 -14798 <2e-16 ***  
timeSw       1.141e-02 1.399e-06    8152 <2e-16 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

New Zealand:

```
Call:  
glm(formula = Sum.of.Confirmed ~ timeZl, family = poisson, data = nzl_data,  
    offset = log_nzl)  
  
Deviance Residuals:  
      Min        1Q     Median       3Q      Max  
-43.507   -1.512    2.270    4.381   10.456  
  
Coefficients:  
              Estimate Std. Error z value Pr(>|z|)  
(Intercept) -8.5812425 0.0028508 -3010.1 <2e-16 ***  
timeZl       0.0027734 0.0000111   249.9 <2e-16 ***  
---  
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

# LIMITATIONS & RISKS

## Delay/Lag in Policy Effects

- There is uncertainty on how long after implementation and execution of policy will output significant results, if any
- If a policy takes significant amount of time to actually work and produce positive results, it may be worth reconsidering as an effective policy

## Multiple Policies At Once

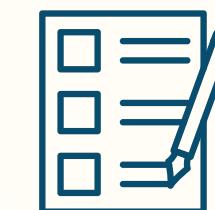
- Countries often implement multiple policies at once
- This creates difficulty and inaccuracy in determining if a policy truly has an effect
- This can also make it difficult to assess the efficiency and success rate of a single policy at a given time

## Long Term Impact on Nation

- While certain policies may have strong results, it could impact country's long term growth
- Certain policies, despite efficacy, may also be heavily disfavorable amongst citizens
- Thus, it is crucial to find policies that take all this into account



# RECOMMENDATIONS



## GLOBAL TRENDS

New Zealand is similar in size to Caladan and has had success in rapidly reducing cases, making it a viable model when assessing pandemic policies. Sweden's success in combatting the pandemic can also be attributed to their strategic policies

## SUCCESSFUL STRATEGIES

An aggressive workplace closing policy contributed to a rapid decline in the case growth rate for New Zealand. When Sweden increased workplace restrictions, the case growth rate also fell.

## OBSERVATIONS

Income support did not affect case growth rate directly. When considering policies, the geographic location of the country is important; no universal strategy can be applied

## CONCLUSIONS

Overall, Caladan should implement a policy plan similar to that of New Zealand's to mitigate the upcoming wave of the Coronavirus