ENLACE 2021
Summer Research Experience

# PROJECT-19

## SPATIAL, TEMPORAL, AND PHYLOGENETIC ANALYSIS OF COVID-19 SPREAD

Project summary


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8/13/2021

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# PROJECT DESCRIPTION

# GENERAL OBJECTIVE OF THE PROJECT

Develop a spatial, temporal and phylogenetic analysis in Python, on the spread of COVID-19 in Mexico and the influence of socio-demographic and economic factors, health conditions, mobility, virus variants, for the dynamics of cases.

# Weekly project tasks

ENLACE - PROJECT 19

# Conducting Research

BY DR. PETER ROSE

**01** COVID-19 cases and deaths State and Municipality analyzes

**02** Reading a census file and correlation with case/death rate at State level

**03** Variables data re-collection (Age, comorbidities, mobility, population)

**04** Geographic State and Municipality space analyzes

**05** Correlation COVID cases and death rates with social determinants of health and comorbidities.

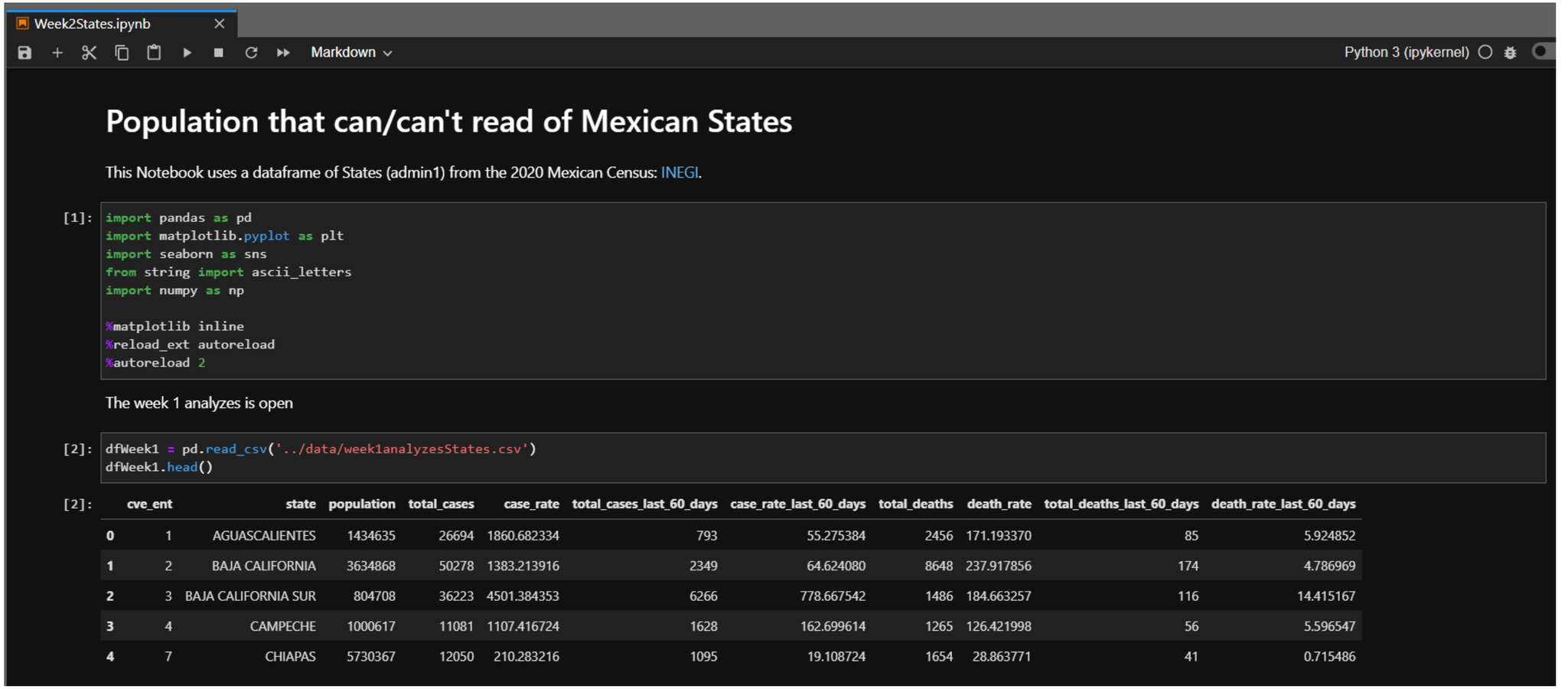
**06** Analysis of SARS-CoV-2 variants distributed in Mexico ar over time.

**07** Wrap up the analyzes and finalize the documentation

**08** Final presentation

# TOOLS AND ABILITIES LEARN

# Jupyter notebook example




## Population that can/can't read of Mexican States

This Notebook uses a dataframe of States (admin1) from the 2020 Mexican Census: INEGI.

[1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from string import ascii_letters
import numpy as np

%matplotlib inline
%reload_ext autoreload
%autoreload 2
```

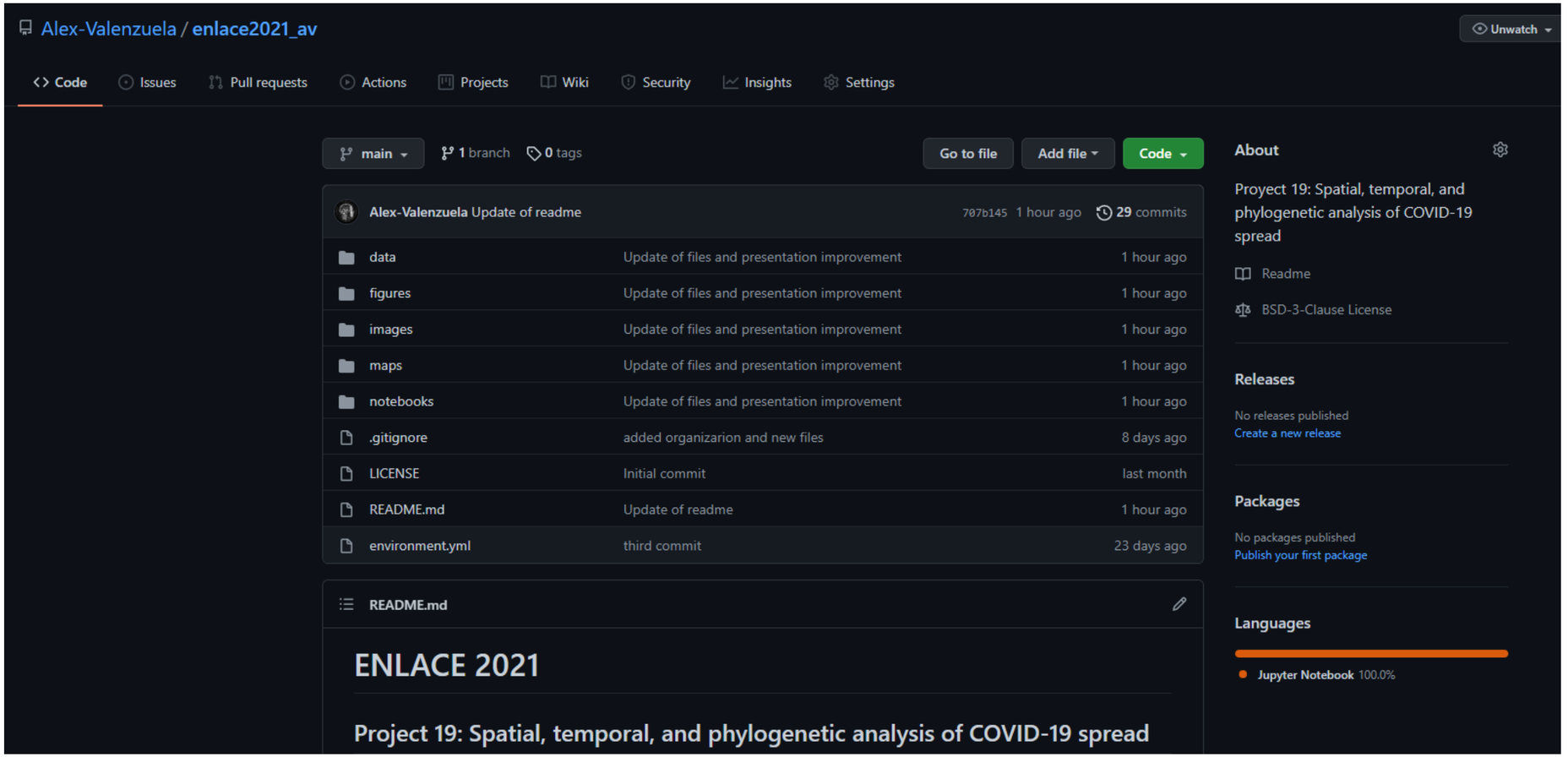
The week 1 analyzes is open

[2]:
```
dfWeek1 = pd.read_csv('../data/week1analyzesStates.csv')
dfWeek1.head()
```

[2]:

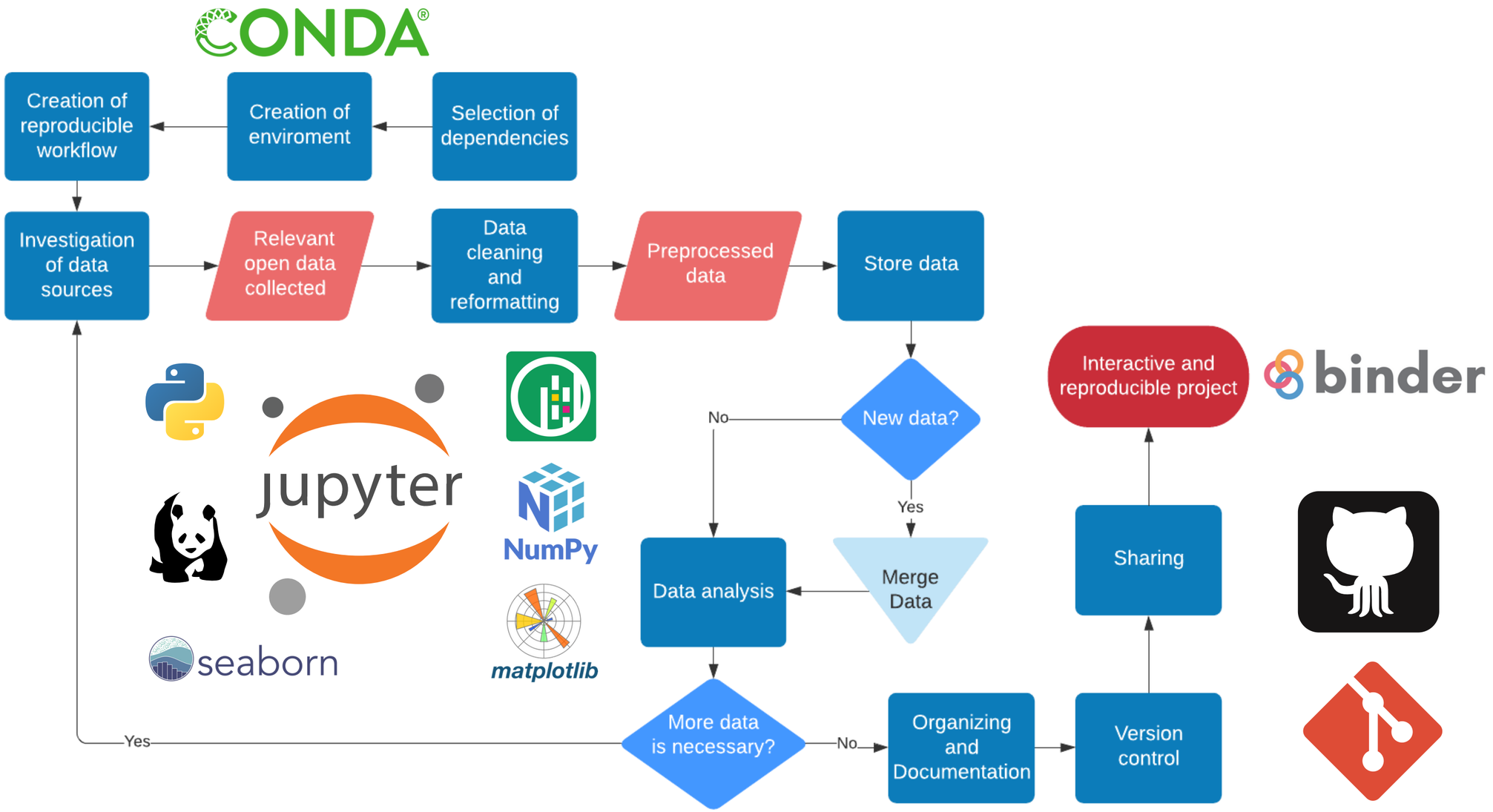
| | cve_ent | state | population | total_cases | case_rate | total_cases_last_60_days | case_rate_last_60_days | total_deaths | death_rate | total_deaths_last_60_days | death_rate_last_60_days |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | AGUASCALIENTES | 1434635 | 26694 | 1860.682334 | 793 | 55.275384 | 2456 | 171.193370 | 85 | 5.924852 |
| 1 | 2 | BAJA CALIFORNIA | 3634868 | 50278 | 1383.213916 | 2349 | 64.624080 | 8648 | 237.917856 | 174 | 4.786969 |
| 2 | 3 | BAJA CALIFORNIA SUR | 804708 | 36223 | 4501.384353 | 6266 | 778.667542 | 1486 | 184.663257 | 116 | 14.415167 |
| 3 | 4 | CAMPECHE | 1000617 | 11081 | 1107.416724 | 1628 | 162.699614 | 1265 | 126.421998 | 56 | 5.596547 |
| 4 | 7 | CHIAPAS | 5730367 | 12050 | 210.283216 | 1095 | 19.108724 | 1654 | 28.863771 | 41 | 0.715486 |

# GitHub repository example




Link of repository: https://github.com/Alex-Valenzuela/enlace2021_av

# Workflow and Tools used and learned

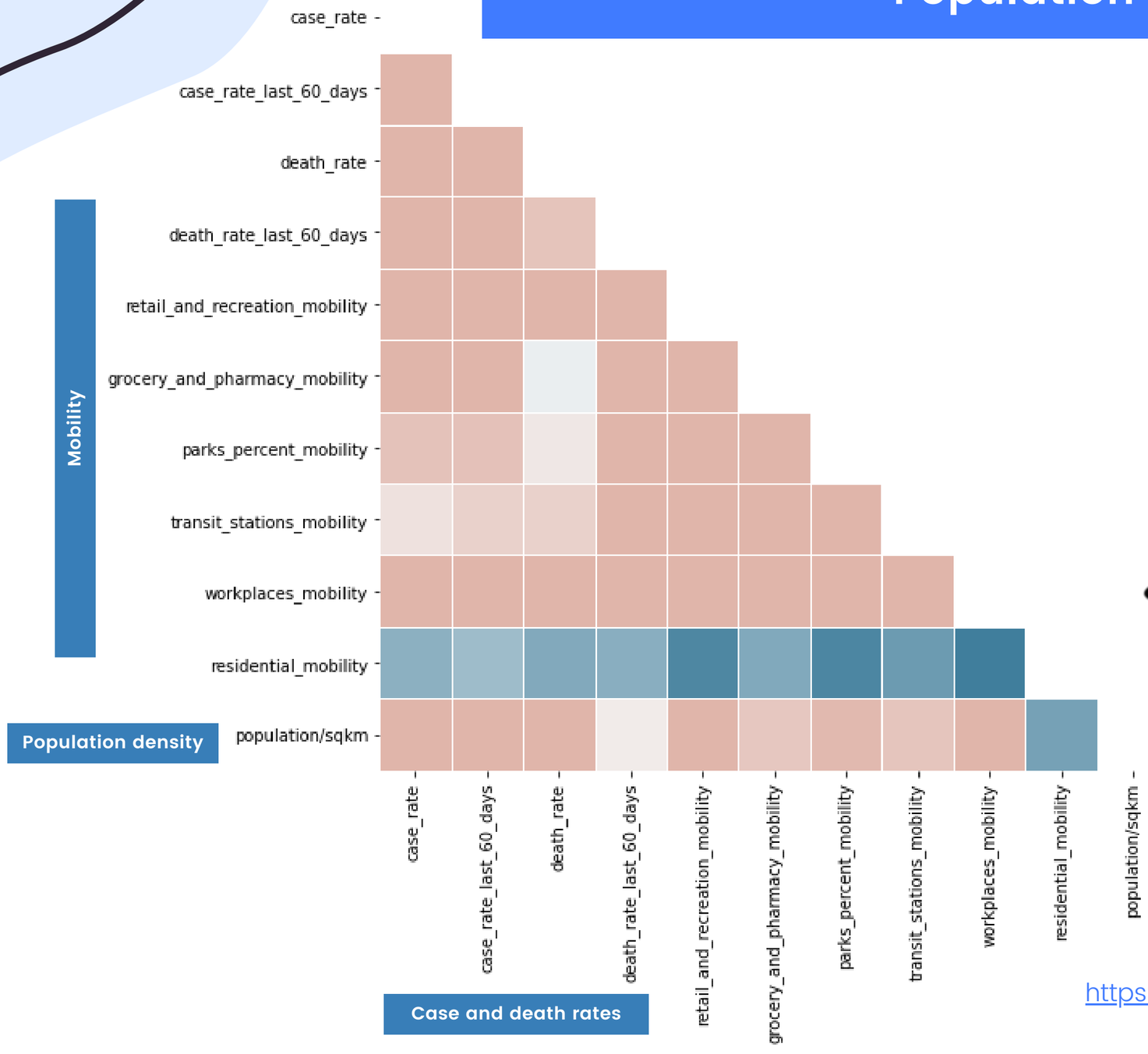



Link of project: https://github.com/Alex-Valenzuela/enlace2021_av

Reproducible project: https://mybinder.org/v2/gh/Alex-Valenzuela/enlace2021_av/HEAD?filepath=notebooks&urlpath=lab

# DIVERSE FACTORS CORRELATION WITH COVID-19 ANALYSIS

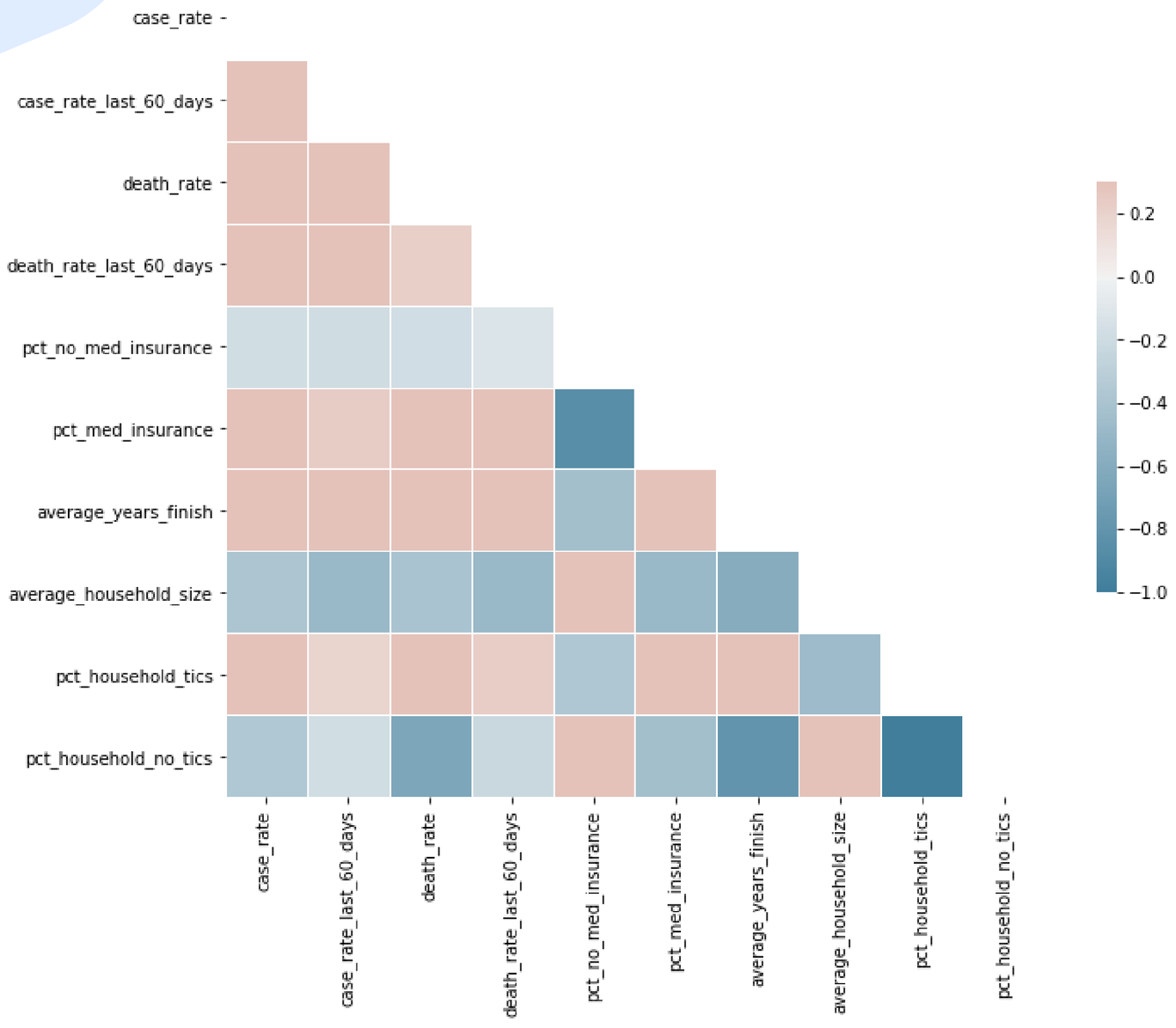
# Population



High mobility and population density is correlated with a higher case rate.

Data sources:
https://www.google.com/covid19/mobility/?hl=en
https://www.inegi.org.mx/temas/mg/

# Socioeconomic and education

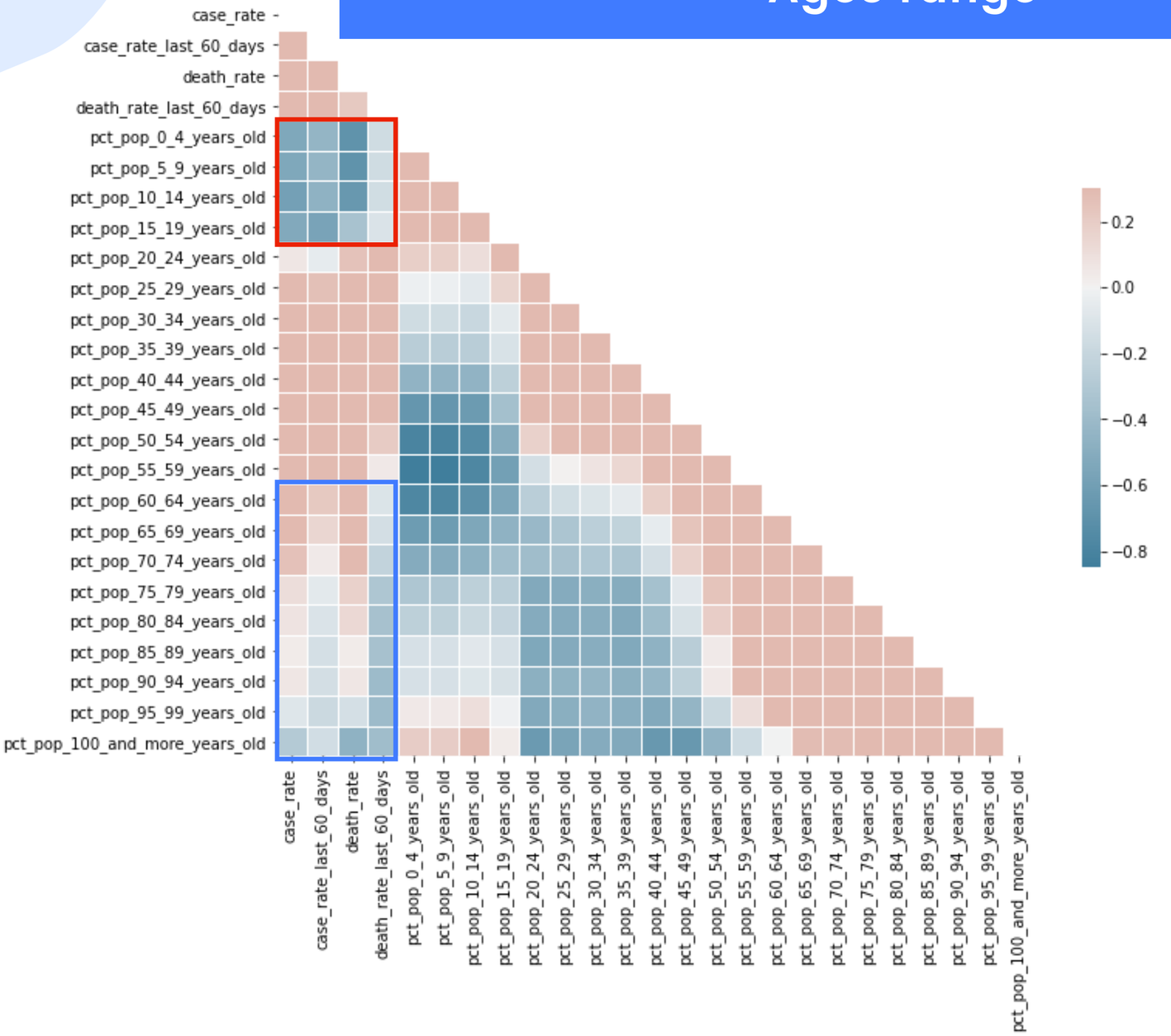



Case and death rates

Better education and access to medical insurance and TIC equals a more urban lifestyle, surrounded by a greater amount of people.

Data sources:
https://inegi.org.mx/programas/ccpv/2020/#Datos_abiertos

# Ages range

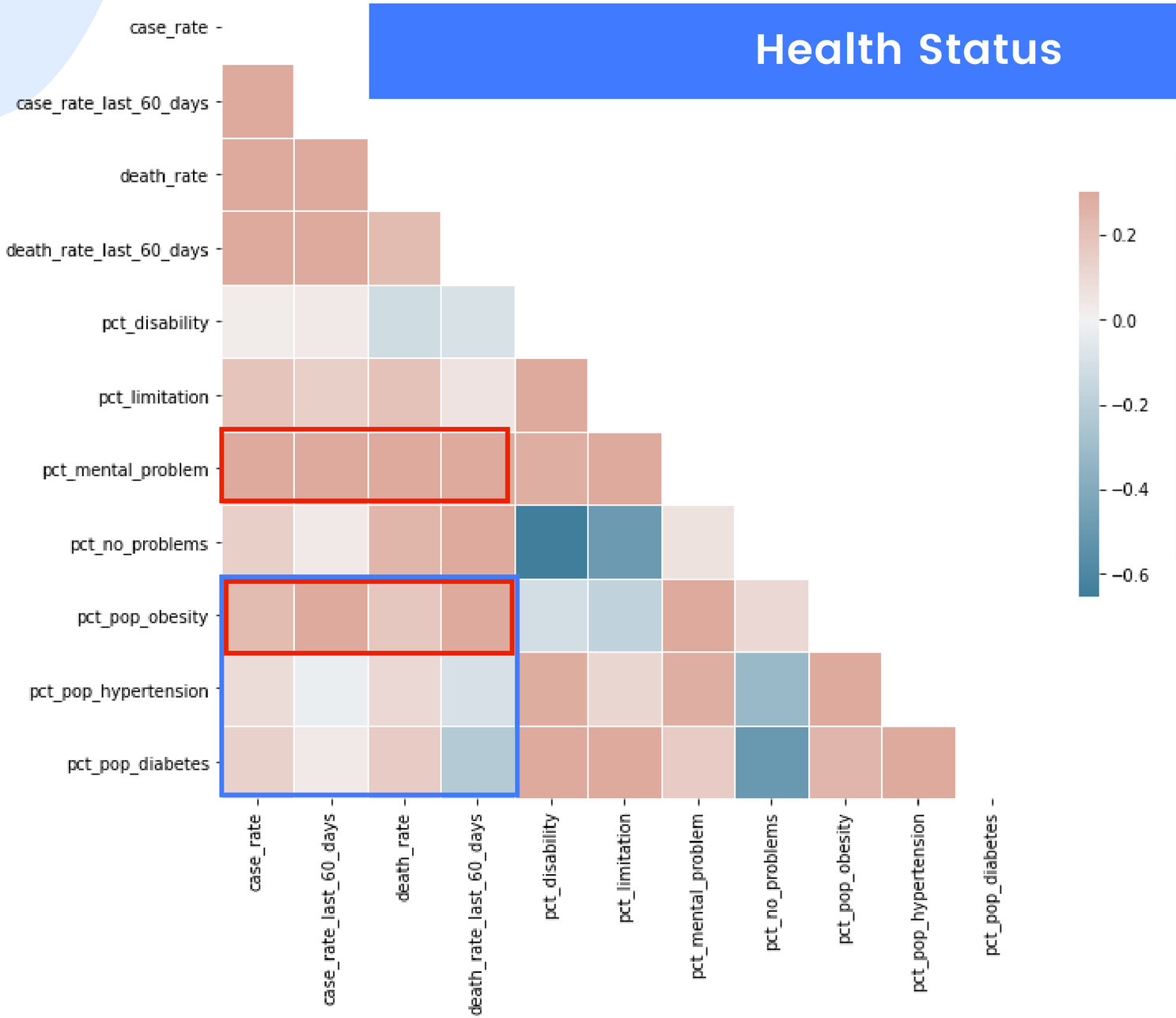



- People age 0-19 have a lower case and death rate due to remote learning.
- People age 75+ are more likely to be vaccinated, or have lower mobility.
- People age 20 - 59 are more mobile making them have a higher risk.

Data sources:

https://www.inegi.org.mx/app/tabulados/interactivos/?pxq=Poblacion_Poblacion_01_e60cd8cf-927f-4b94-823e-972457a12d4b

# Health Status




Poor mental and physical status, feeds to a higher risk of being deeply affected by COVID-19.

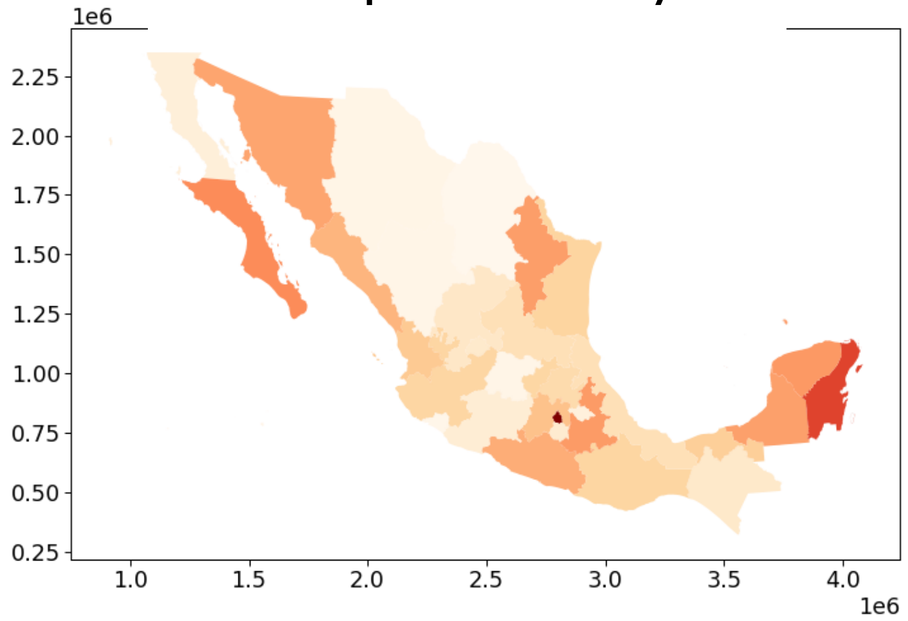
People with comorbidities are more likely to have complications from COVID-19, particularly people with obesity.

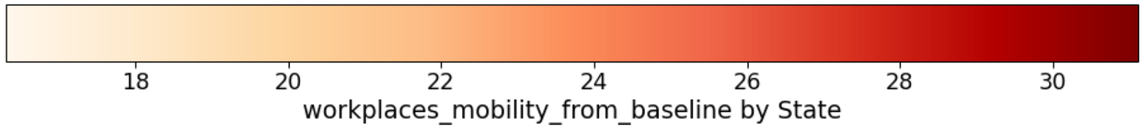
Data sources:
https://inegi.org.mx/programas/ccpv/2020/#Datos_abiertos
https://www.inegi.org.mx/investigacion/pohd/2018/#Tabulados

# SPATIAL ANALYSIS FOR DIVERSE FACTORS

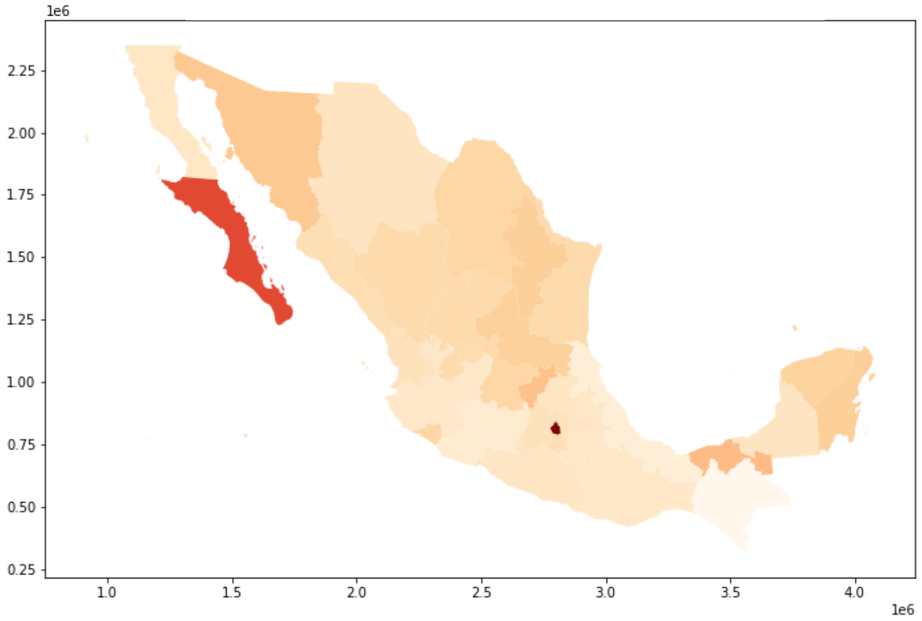
# COVID-19 cases and Community Mobility in the states of Mexico

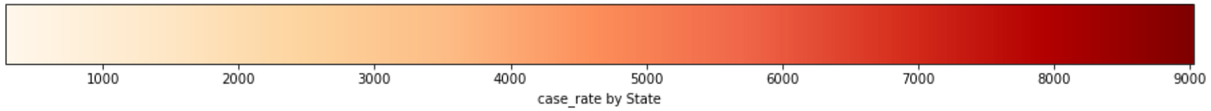
**Workplaces mobility**




**Case rate**



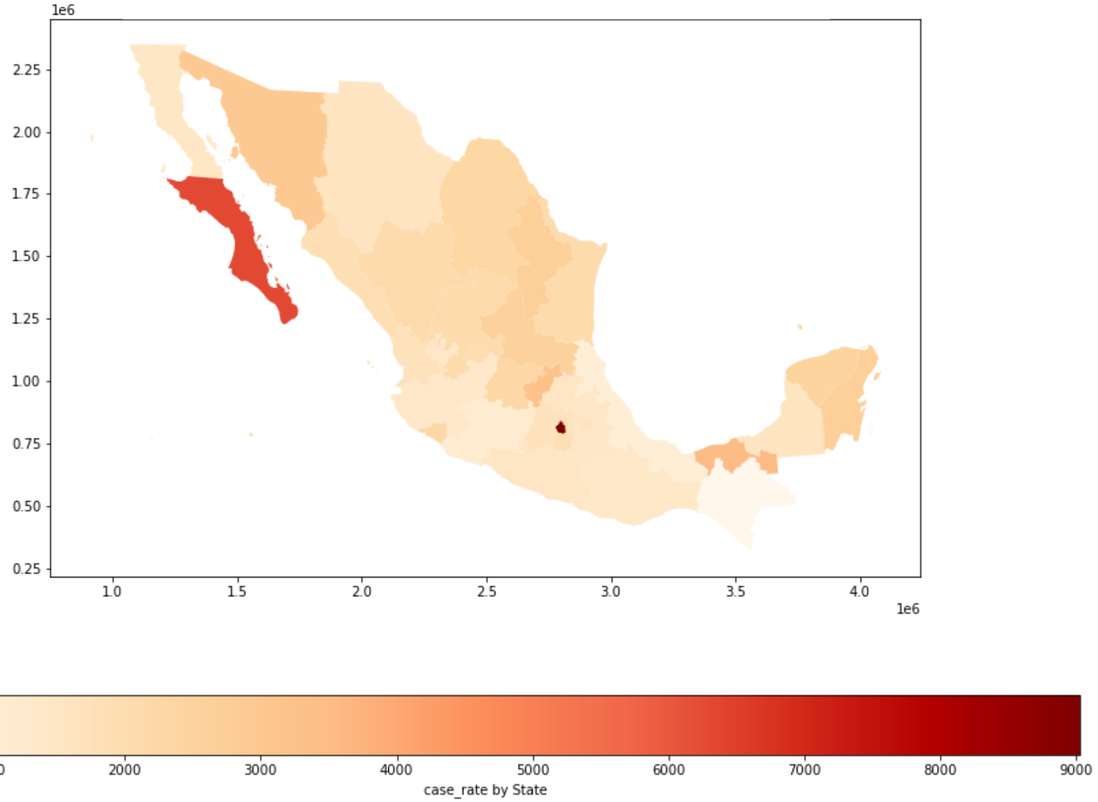

Higher mobility = Higher case rate

Data sources:
https://www.google.com/covid19/mobility/?hl=en
https://datos.covid-19.conacyt.mx/#DownZCSV

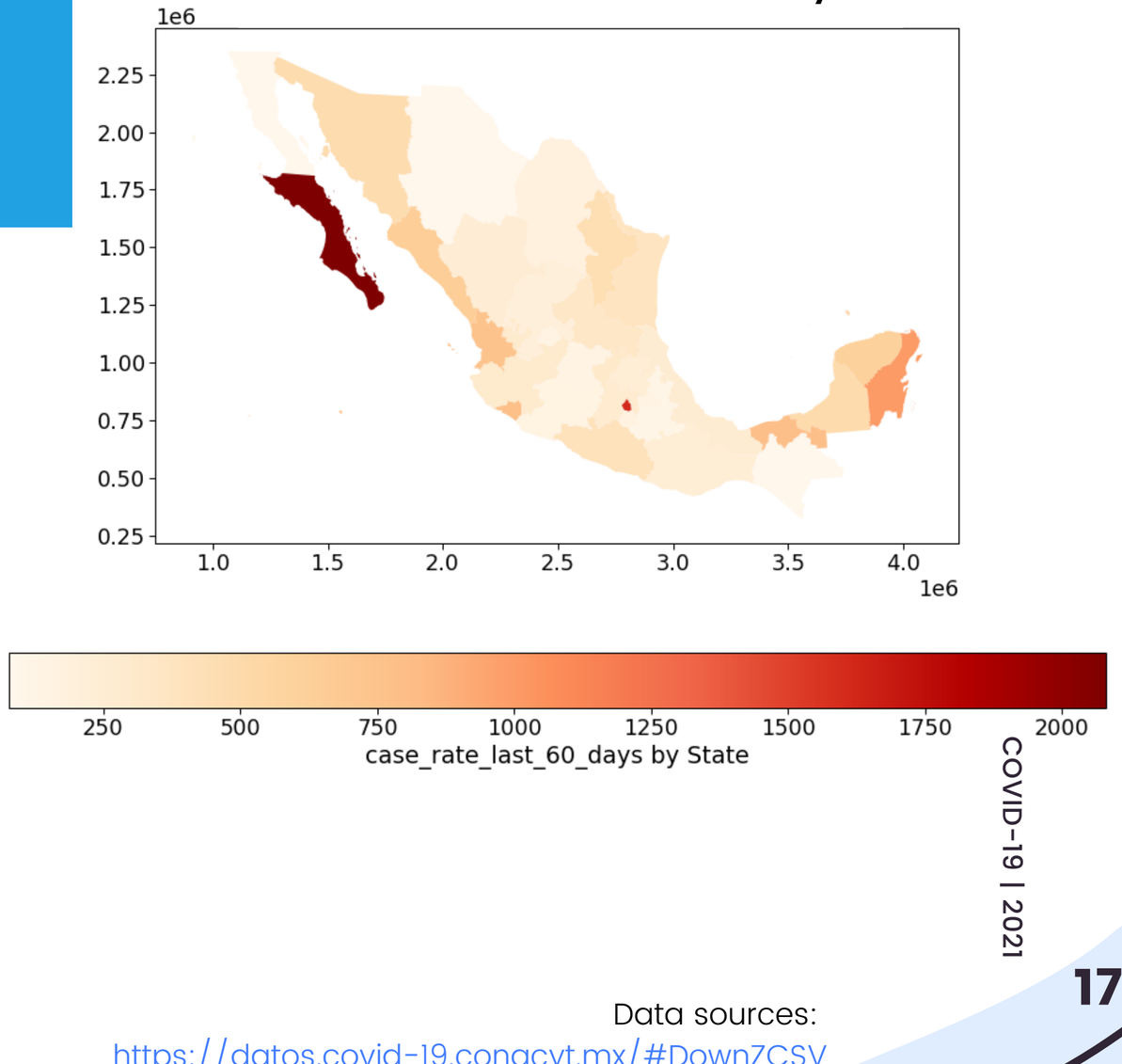
# COVID-19 case rate in the states of Mexico

- Mexico City holds the highest case rate.
- Tourist destinations also have higher case rates.
- More tourism has led to a higher case rate in the last 60 days.

## Case rates in all the pandemic



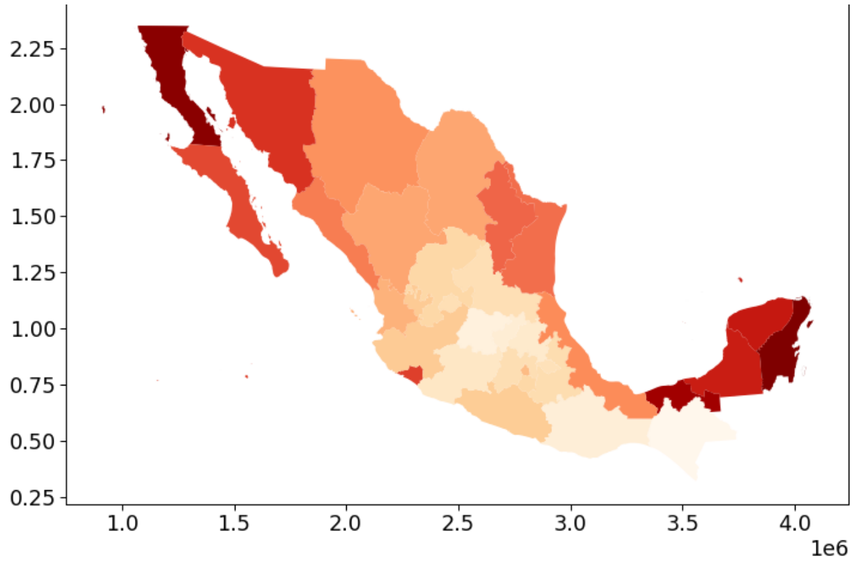

## Case rates in the last 60 days

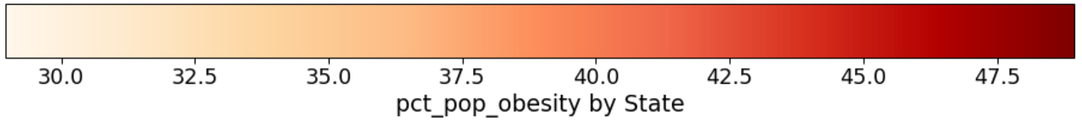



Data sources:
https://datos.covid-19.conacyt.mx/#DownZCSV

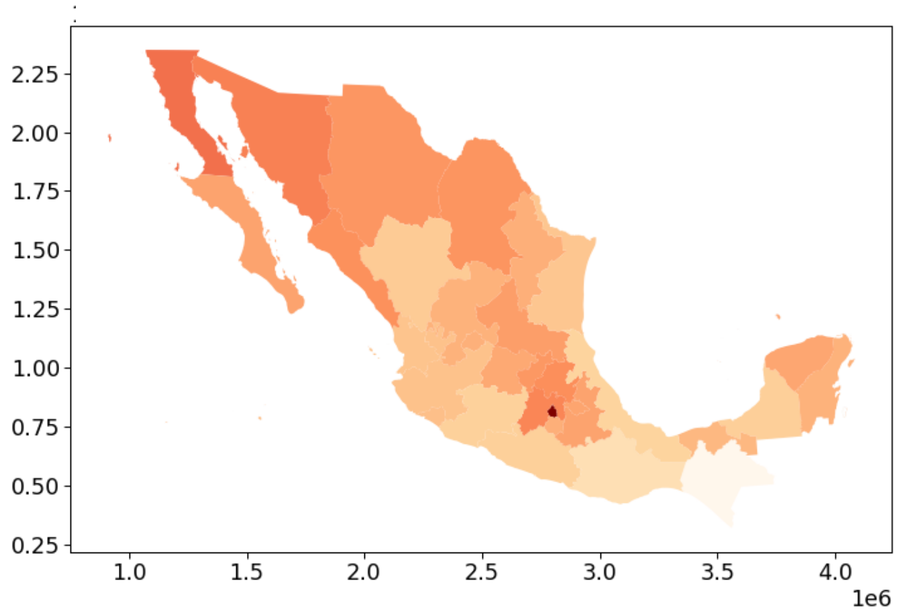
# COVID-19 deaths and Obesity in the states of Mexico

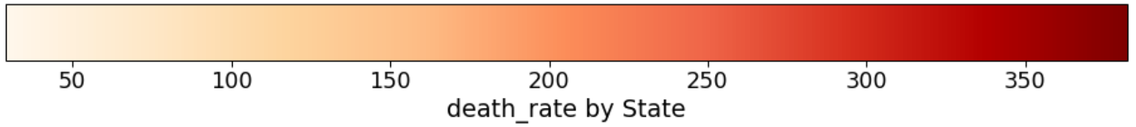
**Population percentage wit obesity**




**Death rate**

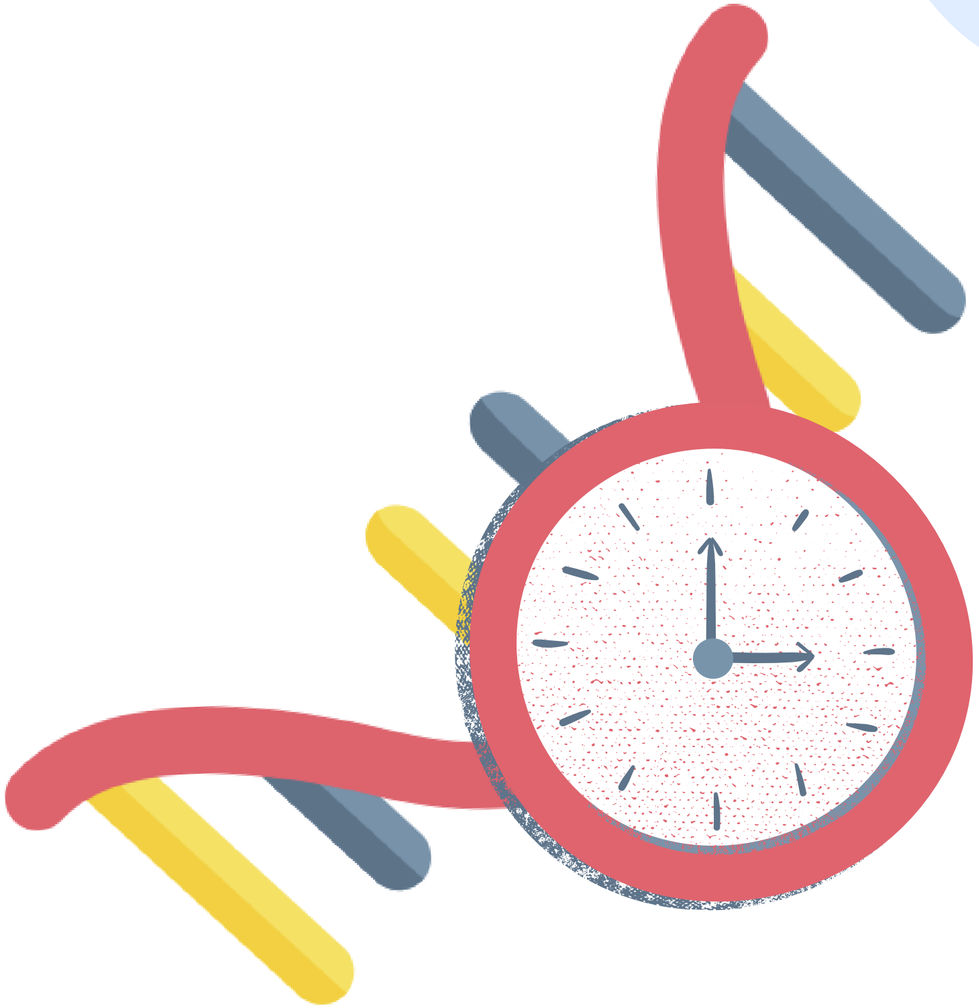


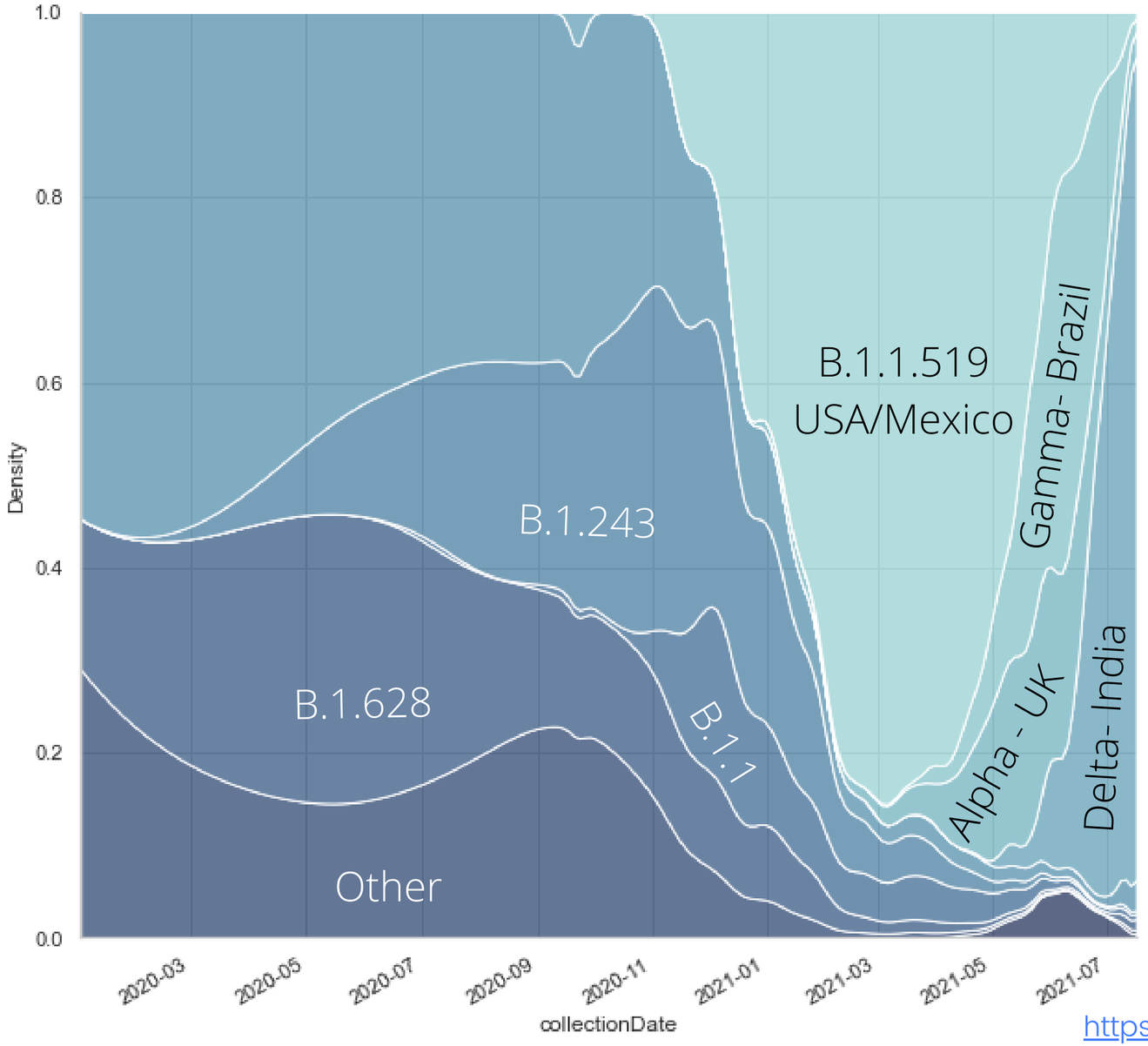

The obesity factor contributes to the number of deaths from COVID-19.

Data sources:
https://www.inegi.org.mx/investigacion/pohd/2018/#Tabulados
https://datos.covid-19.conacyt.mx/#DownZCSV

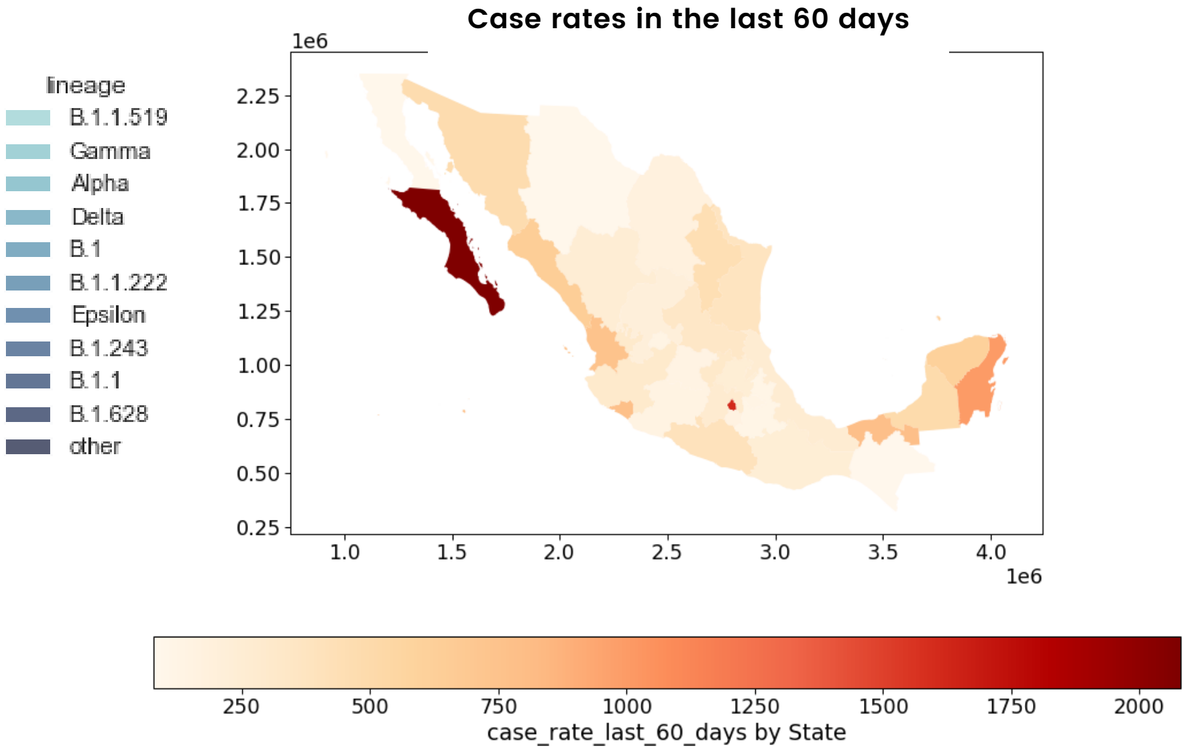
# TEMPORAL AND PHYLOGENETIC ANALYSIS OF SARS-COV-2



# COVID-19 cases relation with variants in Mexico




Similarly, mobility in the different states of Mexico, contribute greatly to the number of cases recorded




Data sources:

https://ngdc.cncb.ac.cn/ncov/release_genome?lang=en

https://cov-lineages.org/lineage_list.html

https://datos.covid-19.conacyt.mx/#DownZCSV

# SUMMARY

Project:

- Open source code
- Reproducible
- Interactive

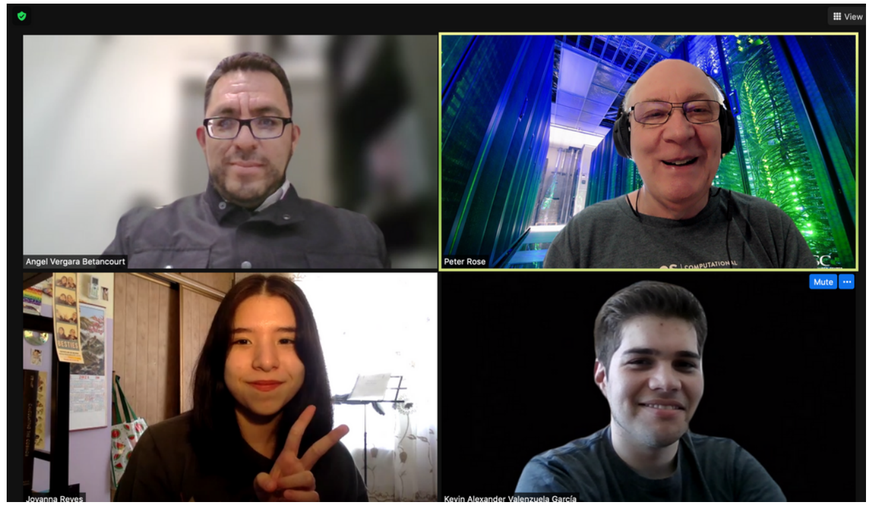
Risk Factors:

- High mobility
- Urban areas
- Obesity
- Age

# ACKNOWLEDGEMENTS

DR. OLIVIA GRAEVE

DR. PETER ROSE

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# CONTACT INFO, GIT REPOSITORIES AND BINDER

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# THANK YOU!