



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 02 03 04 05 06 07 08

- COVID-19 cases and deaths
State and Municipality analyzes
- Reading a census file and correlation with case/death rate at State level
- Variables data re-collection (Age, comorbidities, mobility, population)
- Geographic State and Municipality space analyzes
- Correlation COVID cases and death rates with social determinants of health and comorbidities.
- Analysis of SARS-CoV-2 variants distributed in Mexico ar over time.
- Wrap up the analyzes and finalize the documentation
- Final presentation

TOOLS AND ABILITIES LEARN



Jupyter notebook example

Week2States.ipynb Python 3 (ipykernel)

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()
```

	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

Alex-Valenzuela / enlace2021_av

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

main 1 branch 0 tags

Go to file Add file Code

Alex-Valenzuela Update of readme 707b145 1 hour ago 29 commits

data	Update of files and presentation improvement	1 hour ago
figures	Update of files and presentation improvement	1 hour ago
images	Update of files and presentation improvement	1 hour ago
maps	Update of files and presentation improvement	1 hour ago
notebooks	Update of files and presentation improvement	1 hour ago
.gitignore	added organization and new files	8 days ago
LICENSE	Initial commit	last month
README.md	Update of readme	1 hour ago
environment.yml	third commit	23 days ago

README.md

ENLACE 2021

Project 19: Spatial, temporal, and phylogenetic analysis of COVID-19 spread

About

Project 19: Spatial, temporal, and phylogenetic analysis of COVID-19 spread

Readme

BSD-3-Clause License

Releases

No releases published

Create a new release

Packages

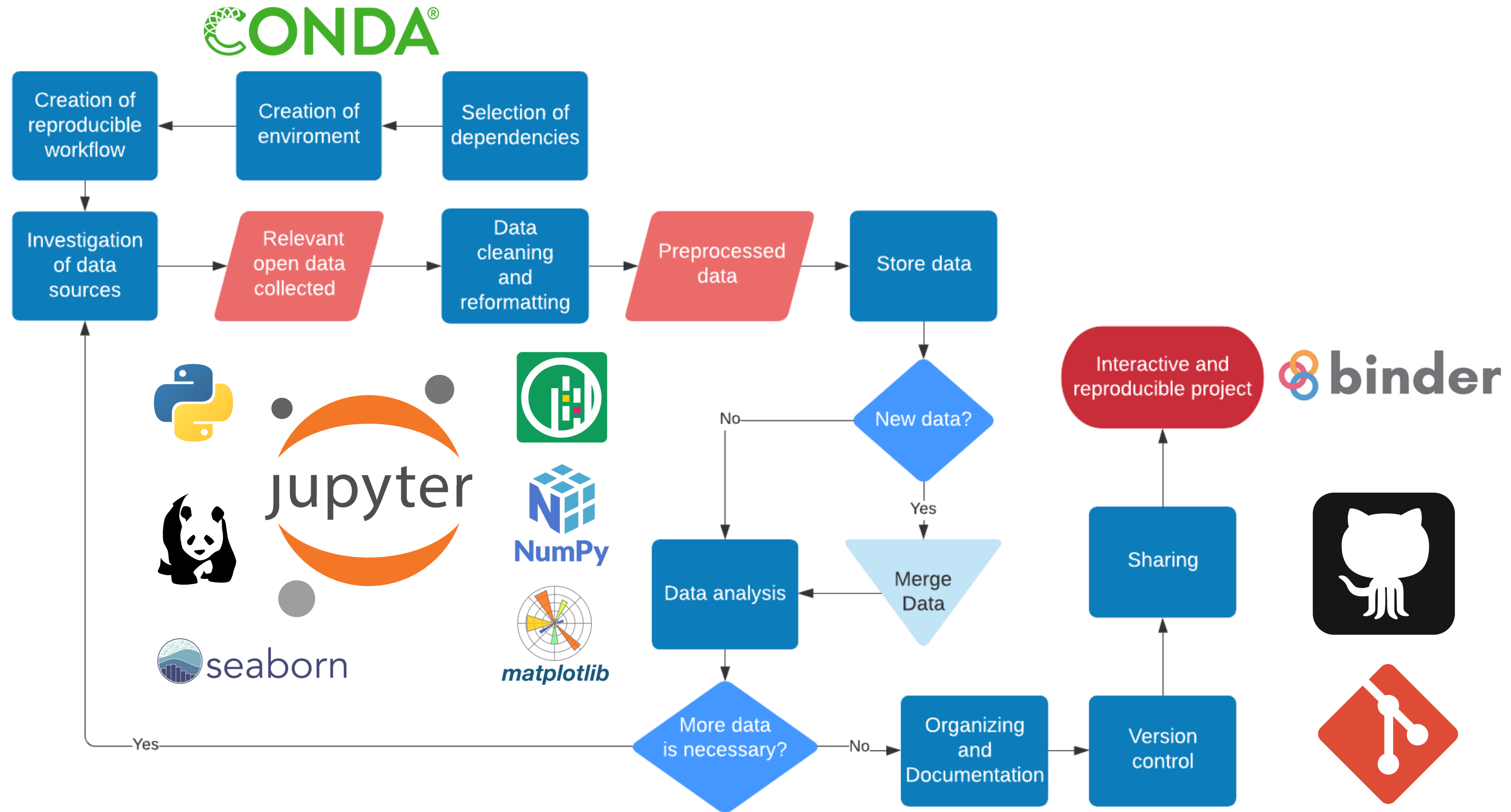
No packages published

Publish your first package

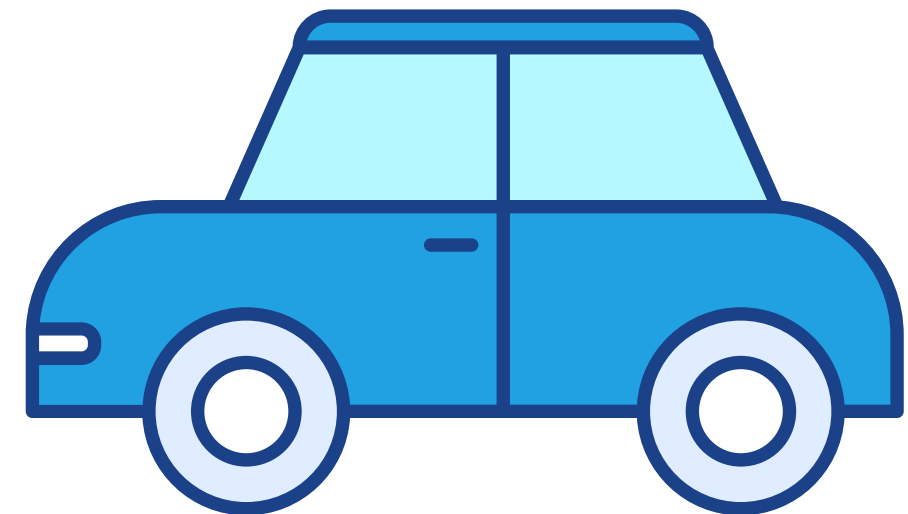
Languages

Jupyter Notebook 100.0%

Workflow and Tools used and learned



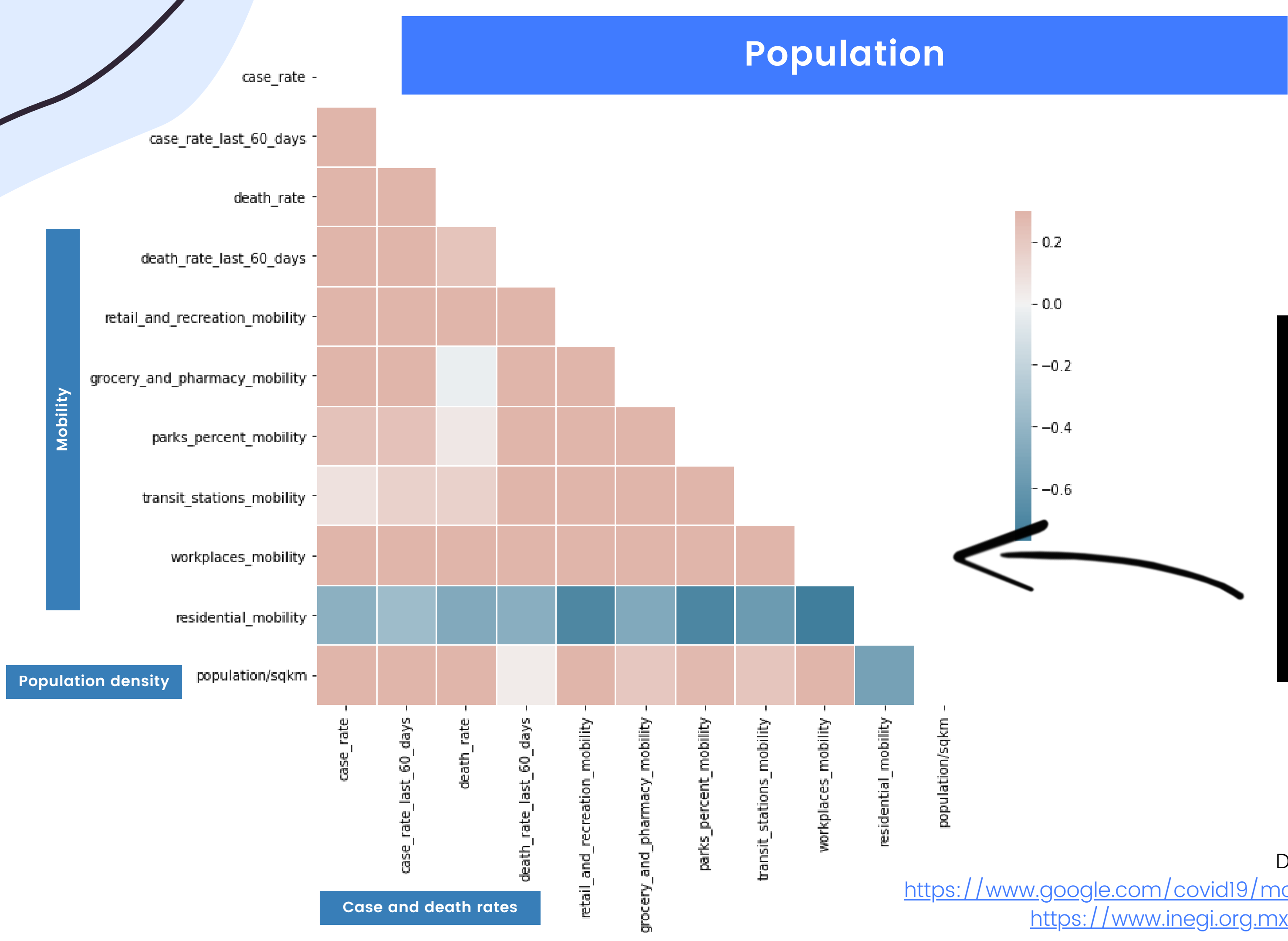
DIVERSE FACTORS CORRELATION WITH COVID-19 ANALYSIS



Population

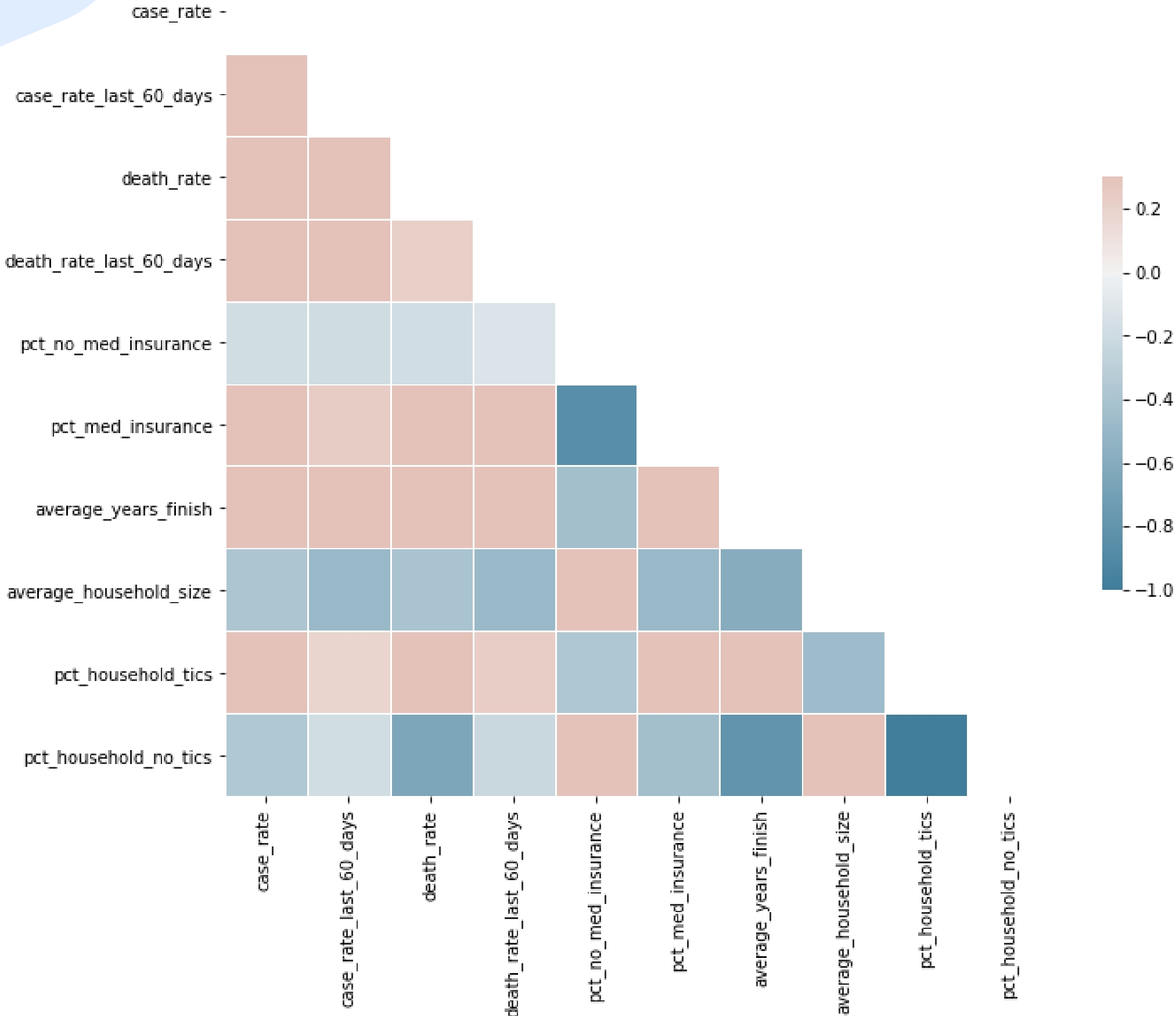


High mobility and population density is correlated with a higher case rate.



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

Socioeconomic and education

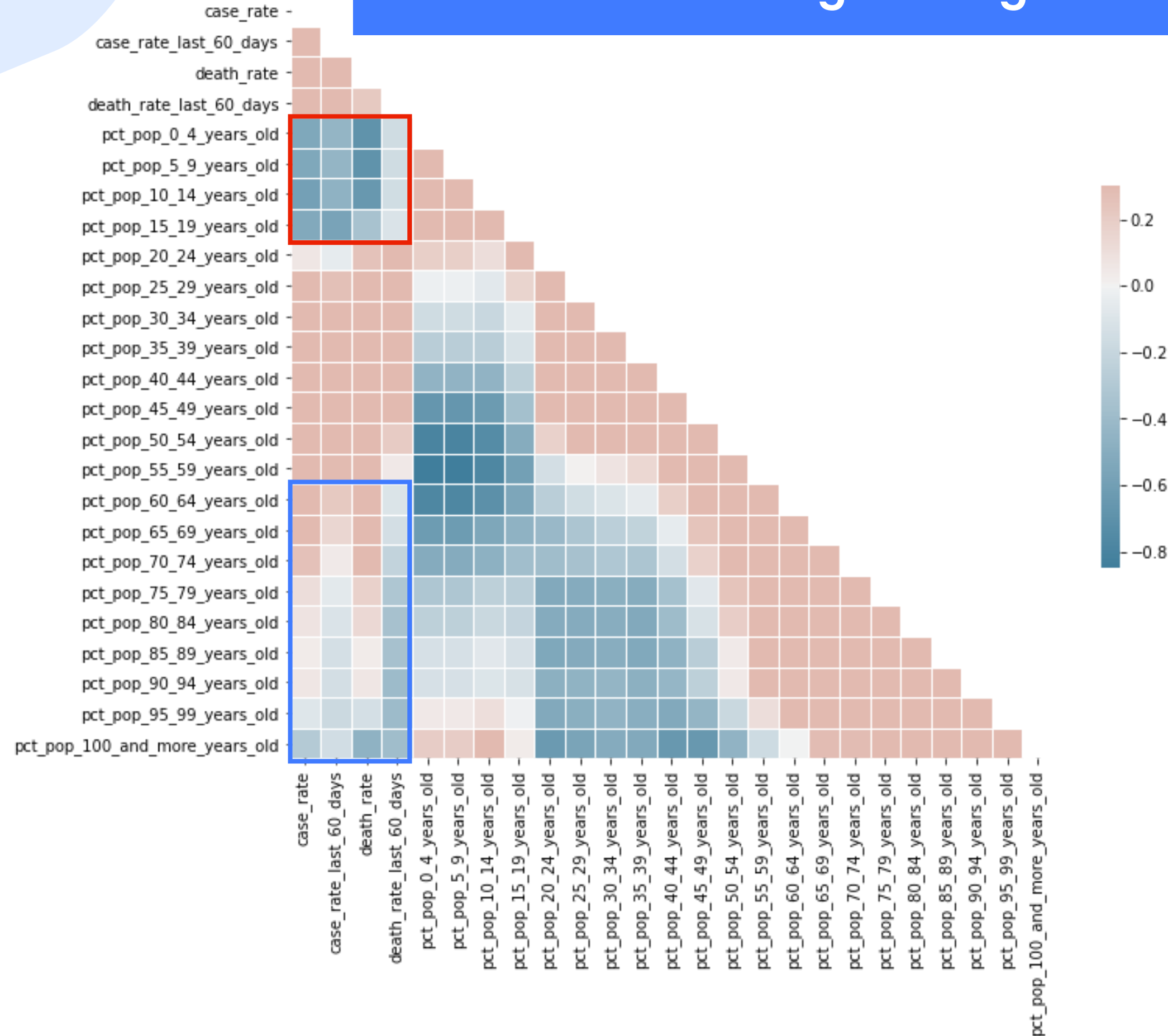


Better education and access to medical insurance and TIC equals a more urban lifestyle, surrounded by a greater amount of people.

Case and death rates

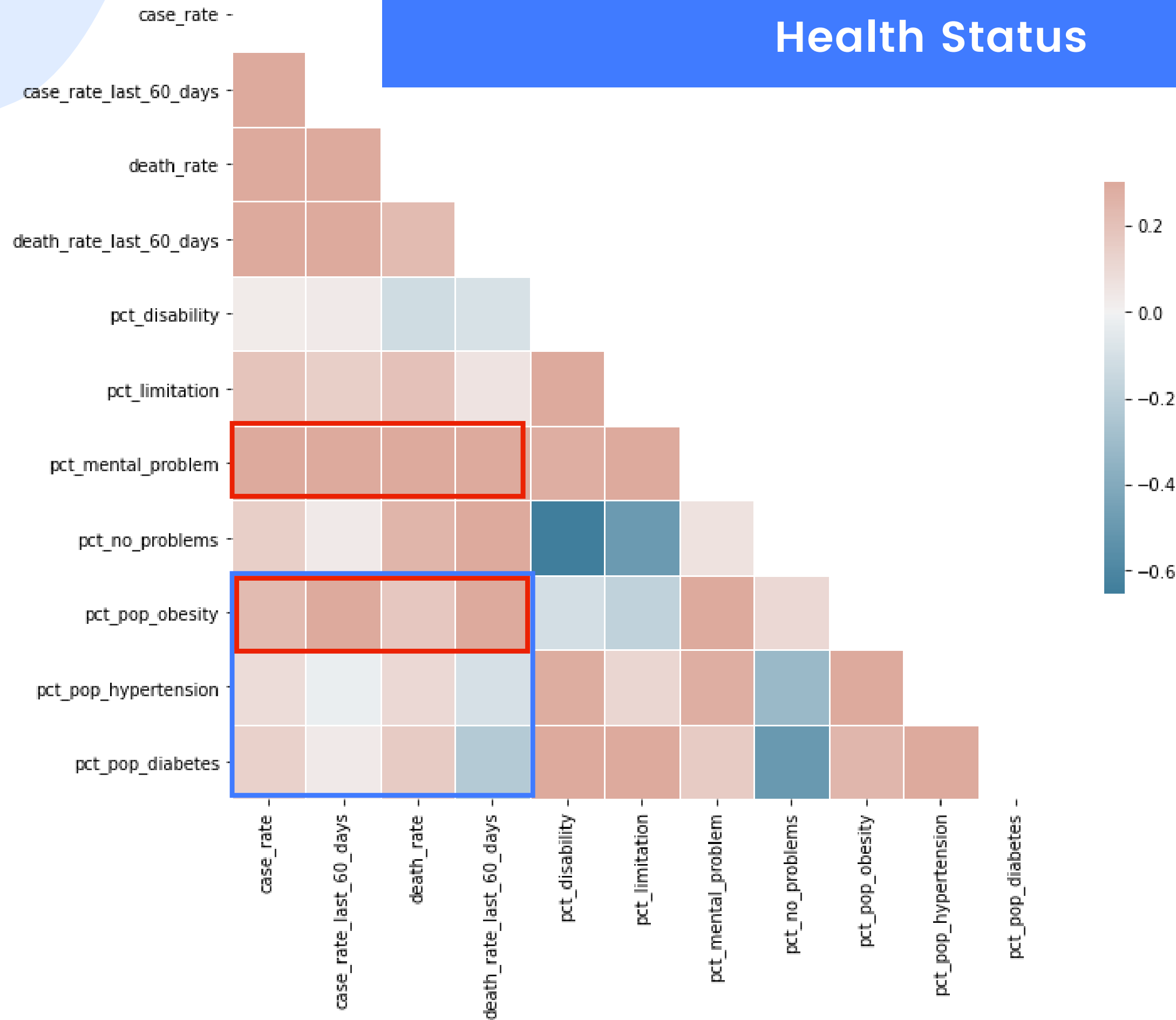
Data sources:
https://inegi.org.mx/programas/ccpv/2020/#Datos_abiertos

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.

Health Status



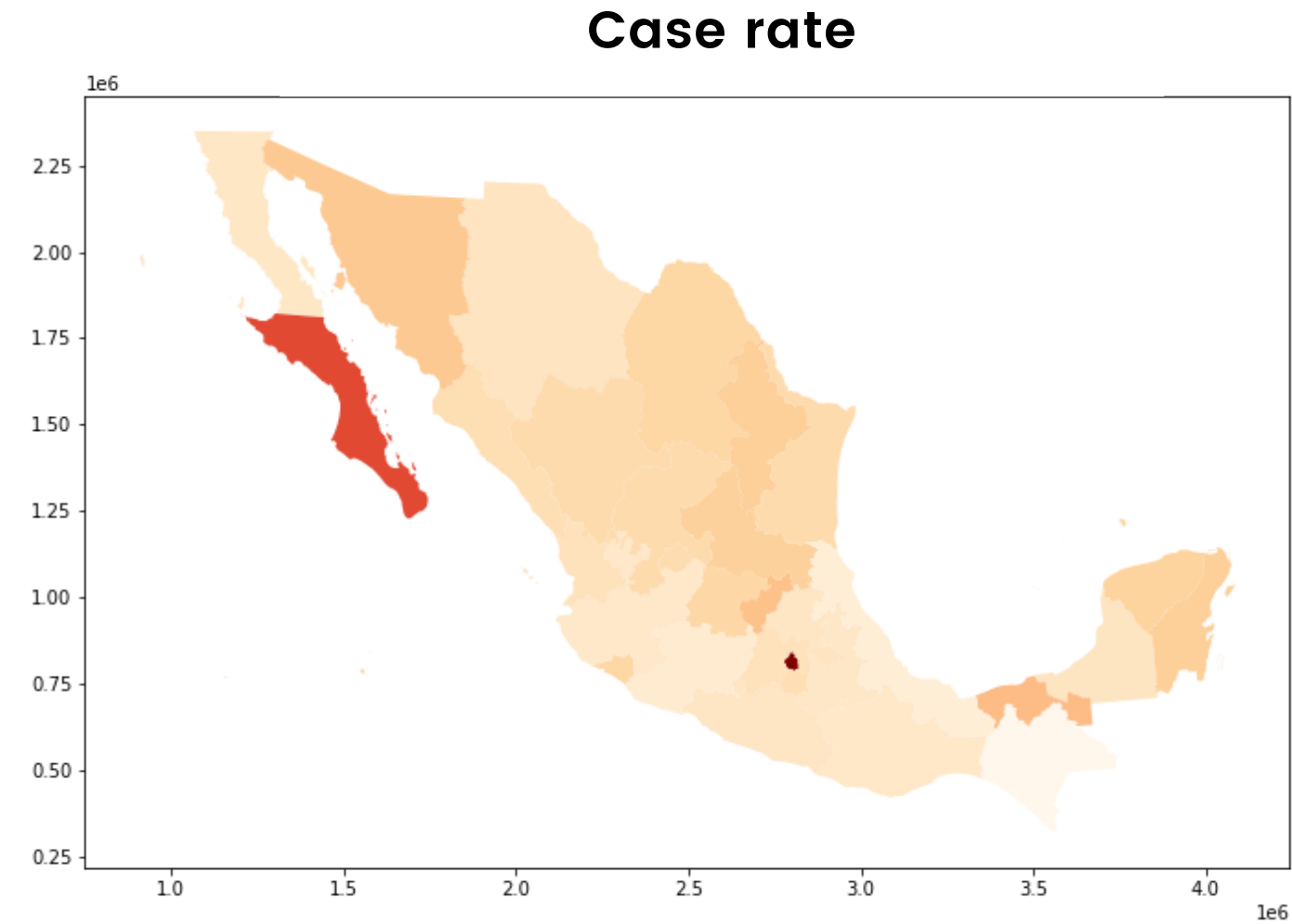
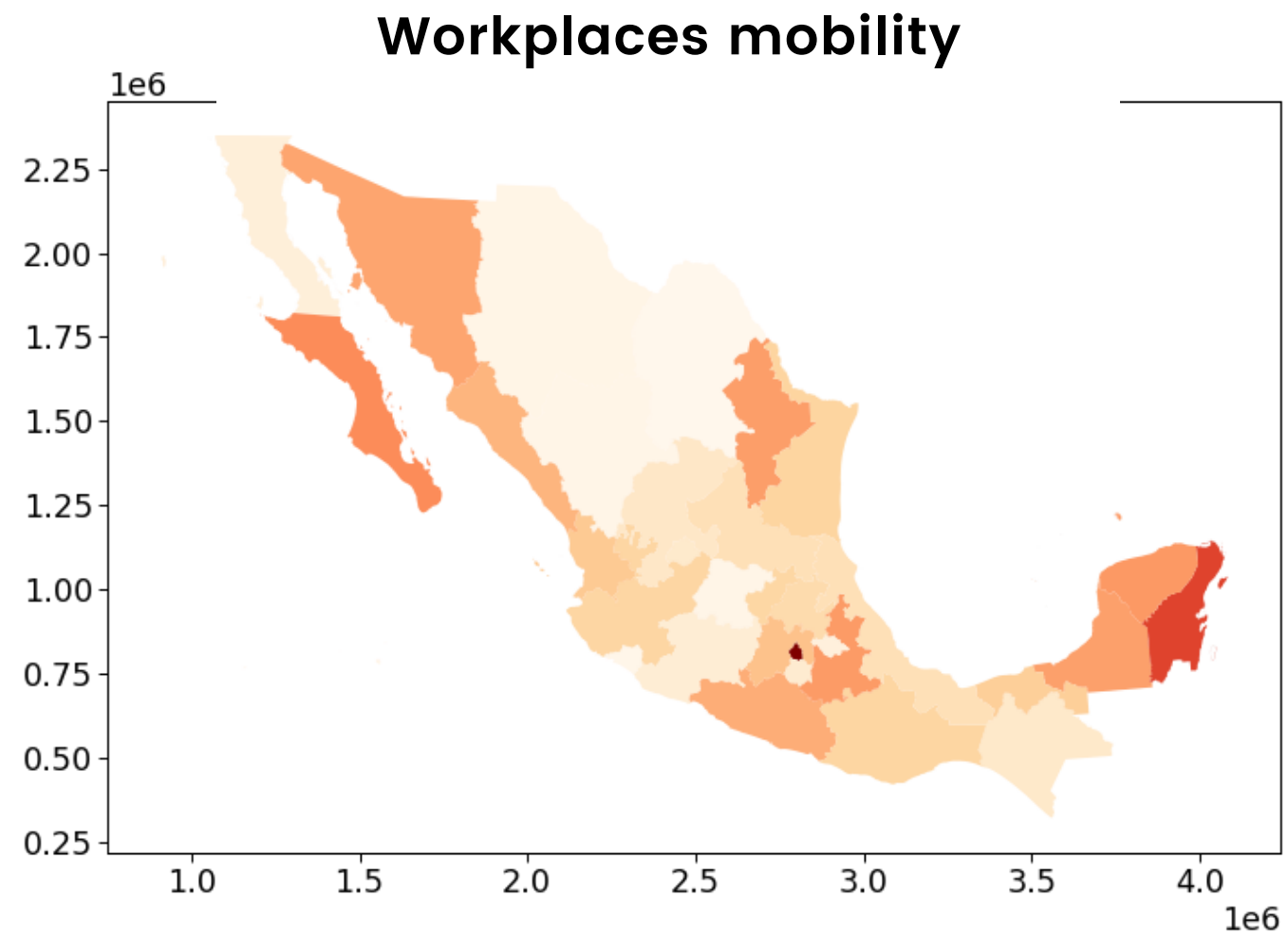
Poor mental and physical status, feeds to a higher risk of being deeply affected by COVID-19.

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

SPATIAL ANALYSIS FOR DIVERSE FACTORS



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



18 20 22 24 26 28 30

workplaces_mobility_from_baseline by State

1000 2000 3000 4000 5000 6000 7000 8000 9000

case_rate by State

Higher mobility = Higher case rate

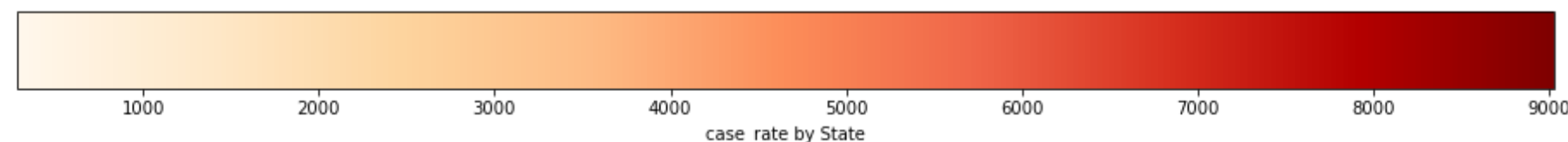
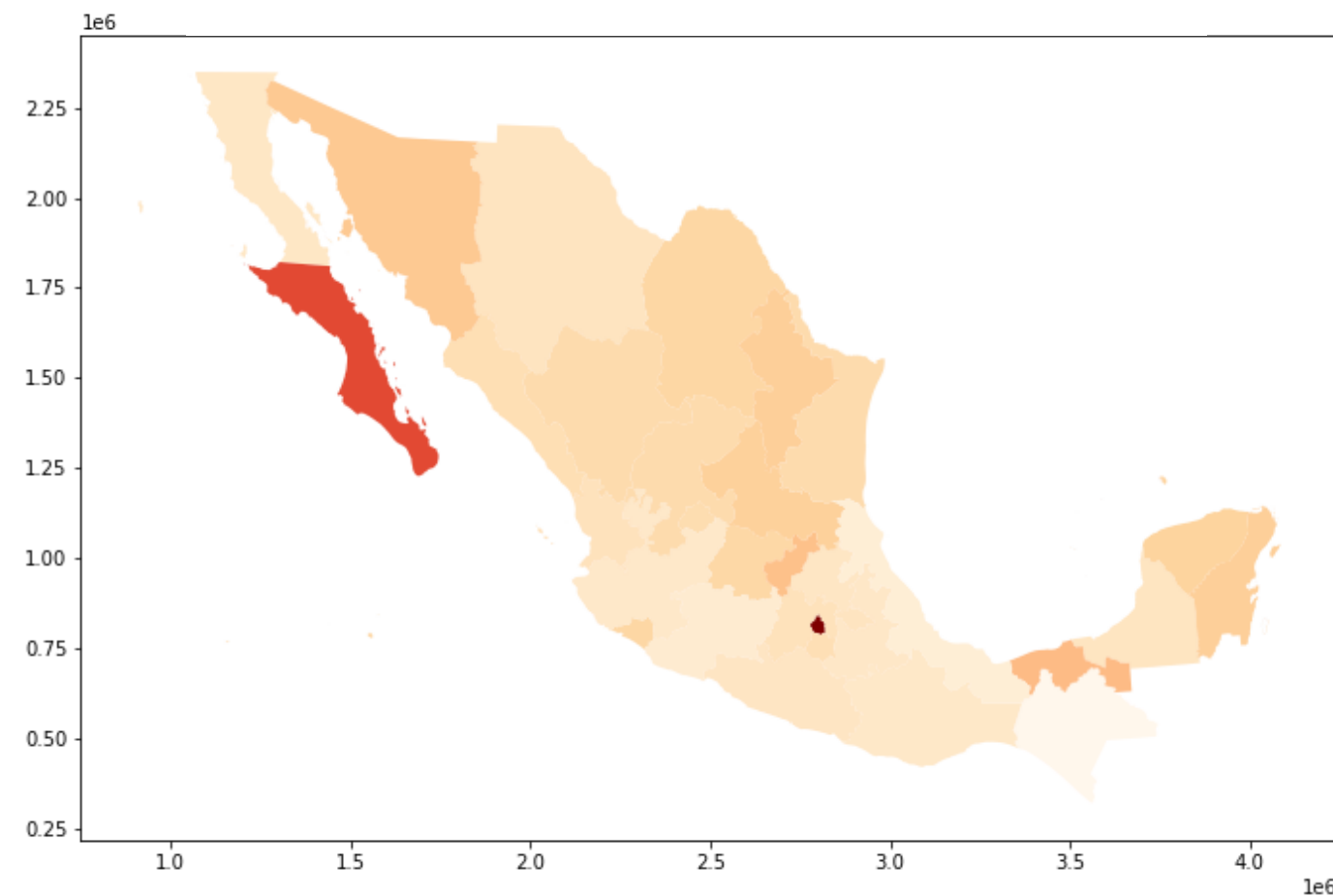
Data sources:

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

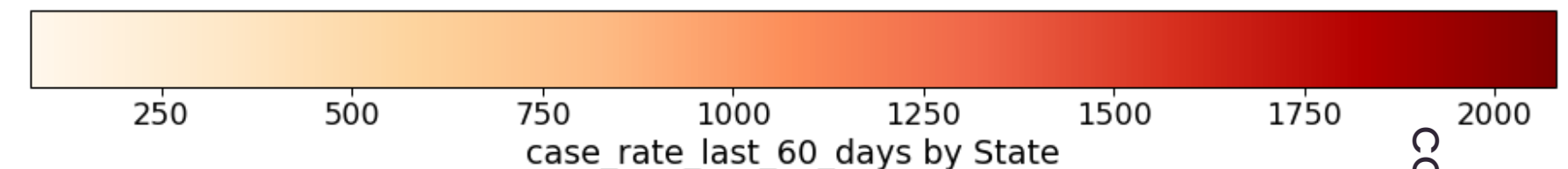
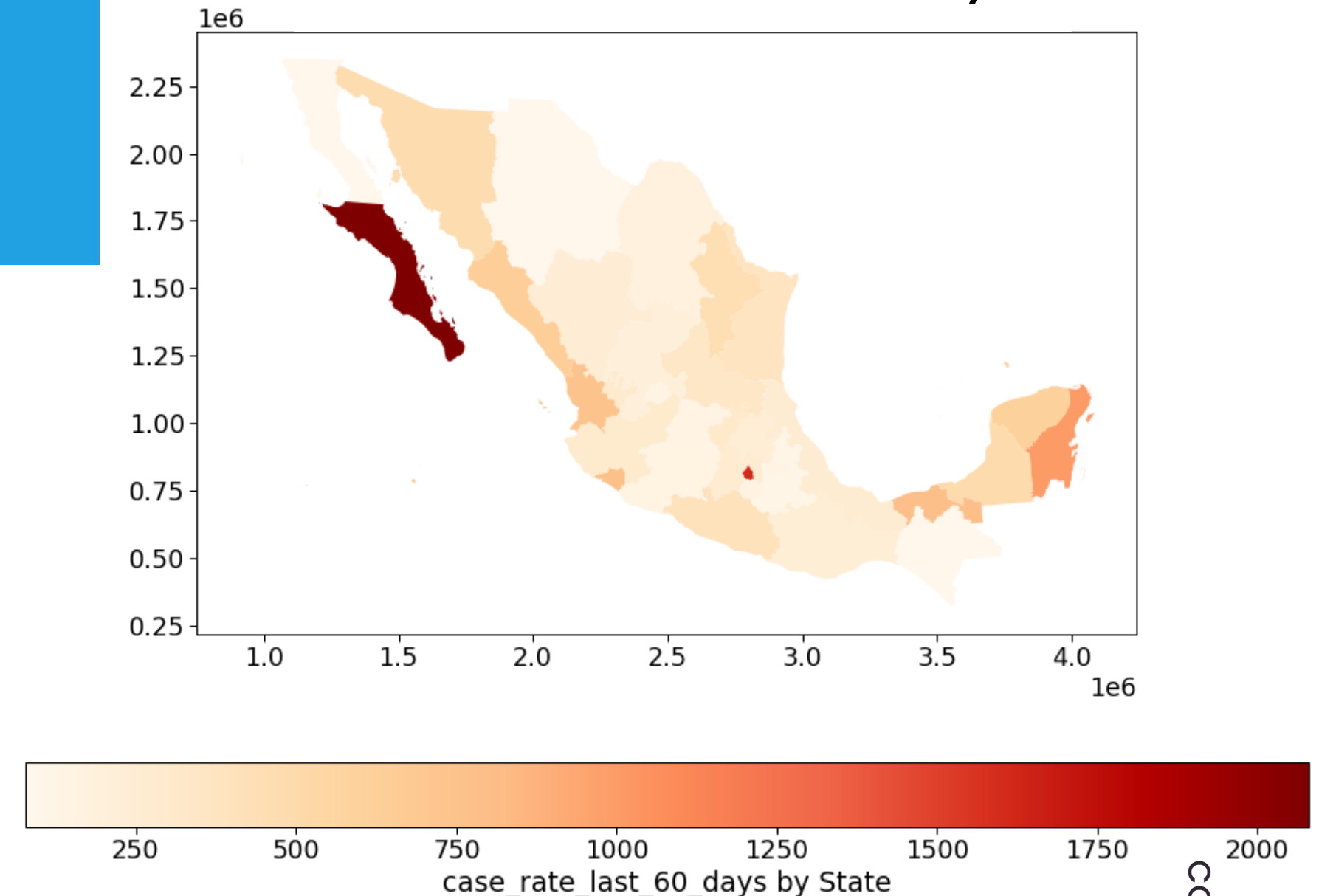
COVID-19 case rate in the states of Mexico

- 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

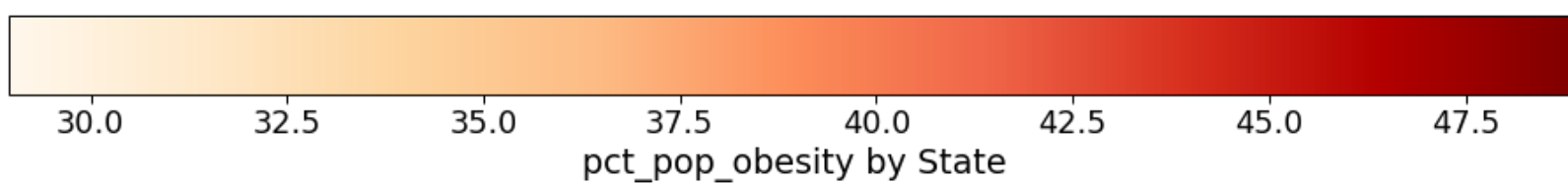
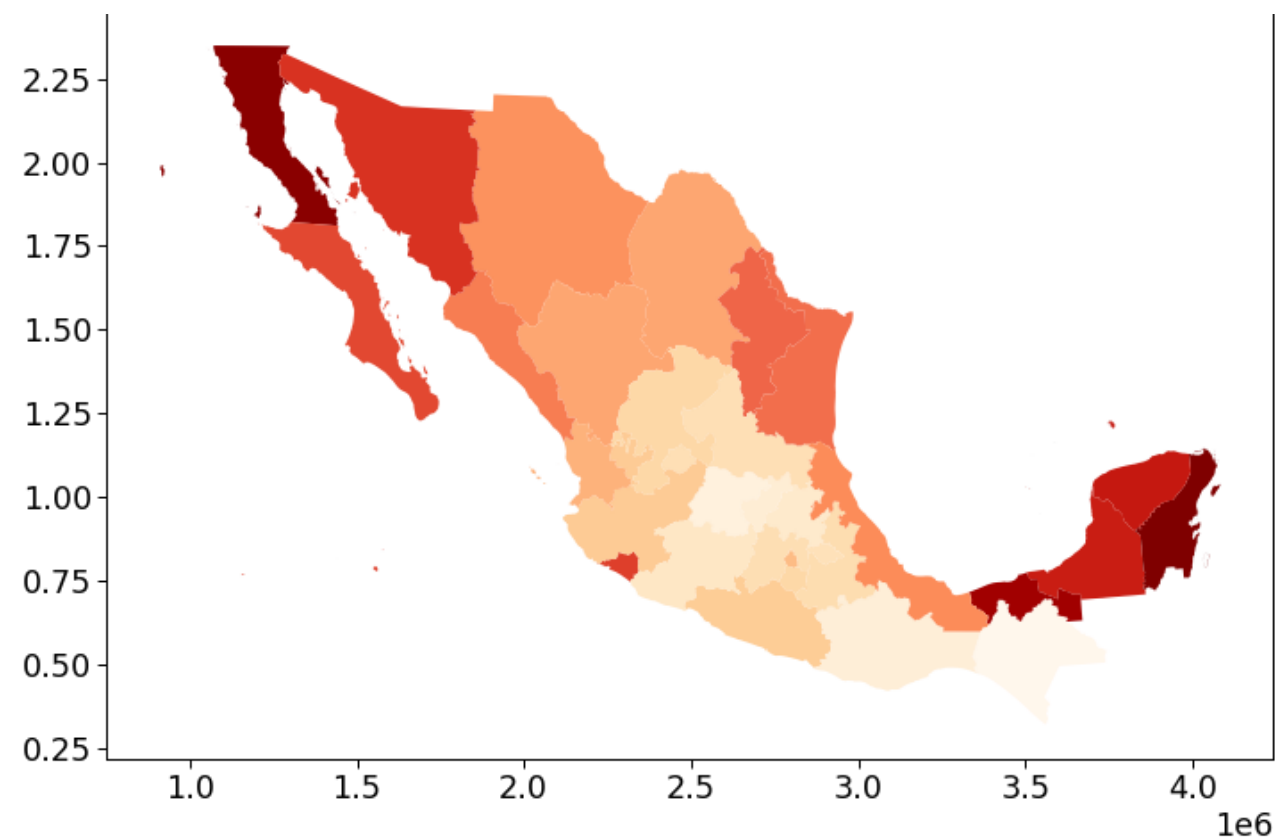


Data sources:

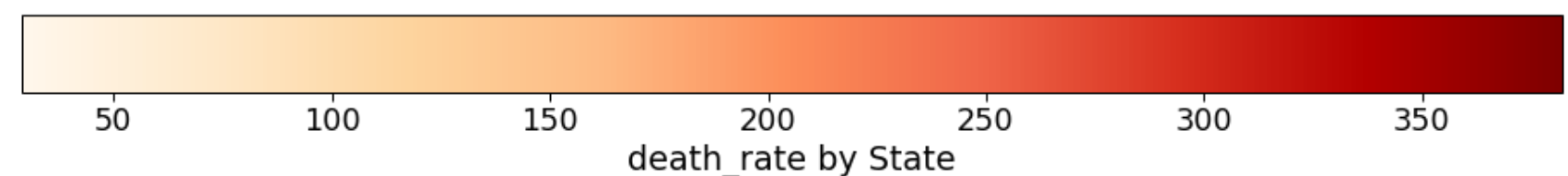
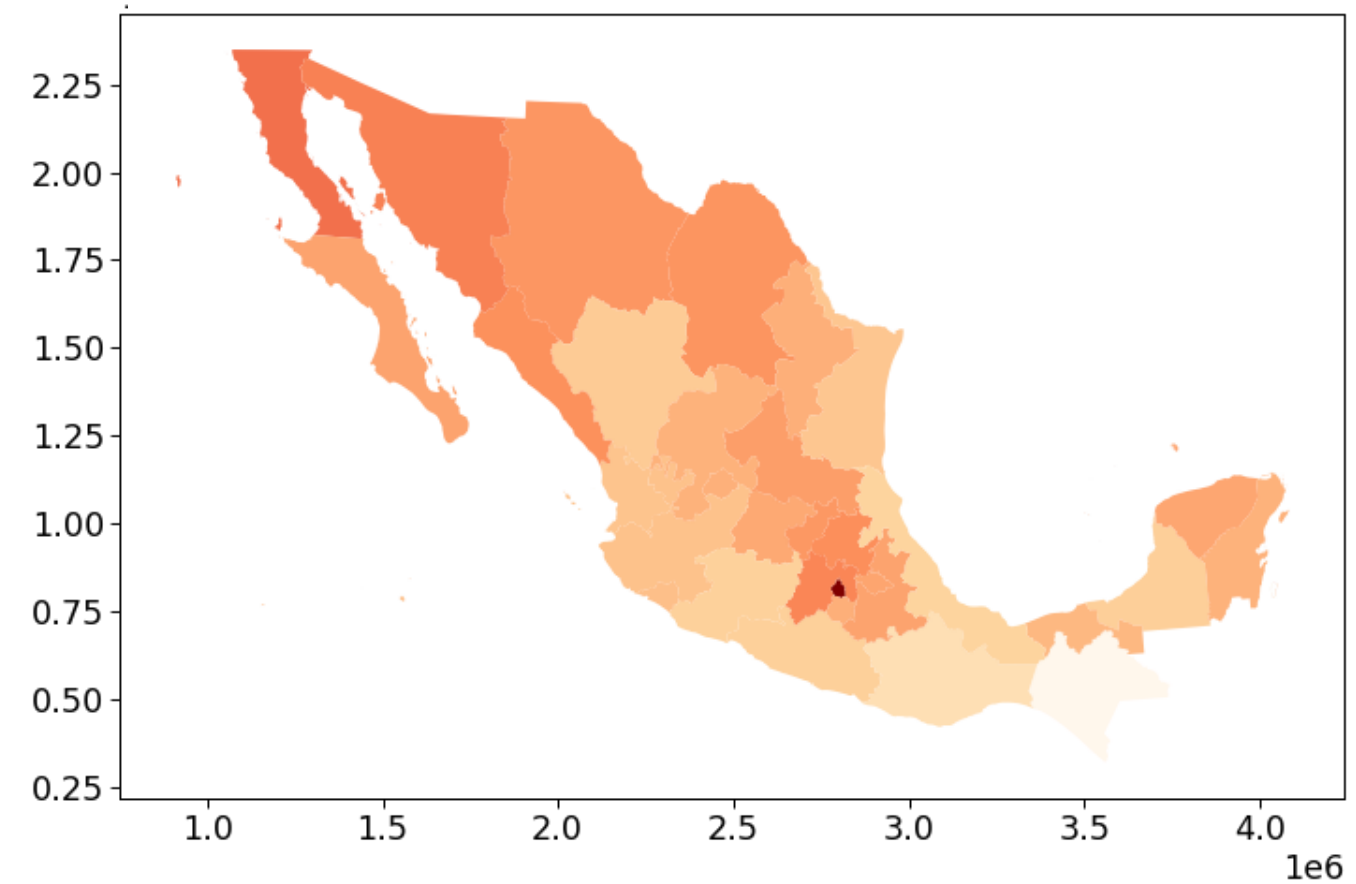
<https://datos.covid-19.conacyt.mx/#DownZCSV>

COVID-19 deaths and Obesity in the states of Mexico

Population percentage wit obesity



Death rate



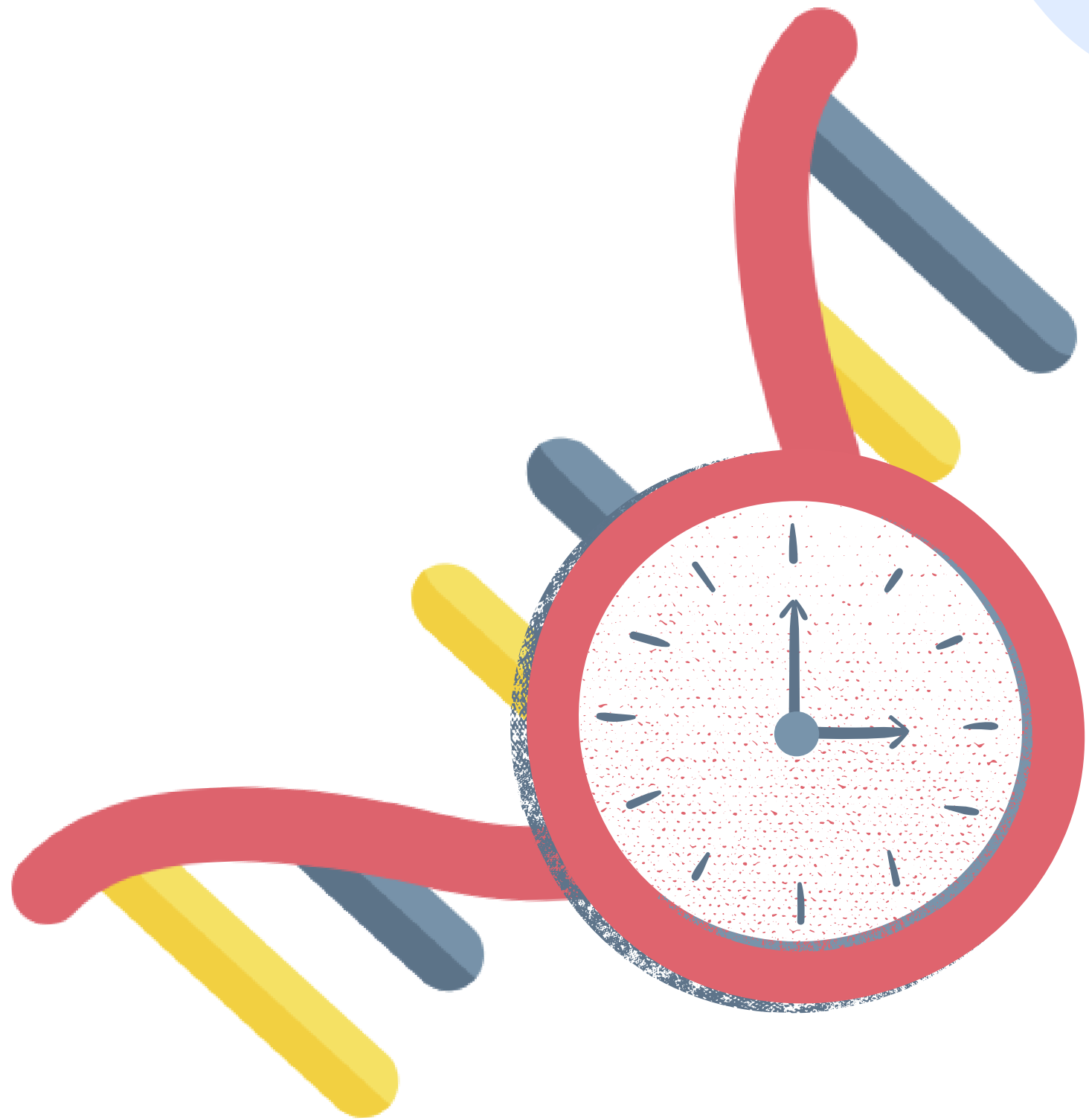
The obesity factor contributes to the number of deaths from COVID-19.

Data sources:

<https://www.inegi.org.mx/investigacion/pohd/2018/#Tabulados>

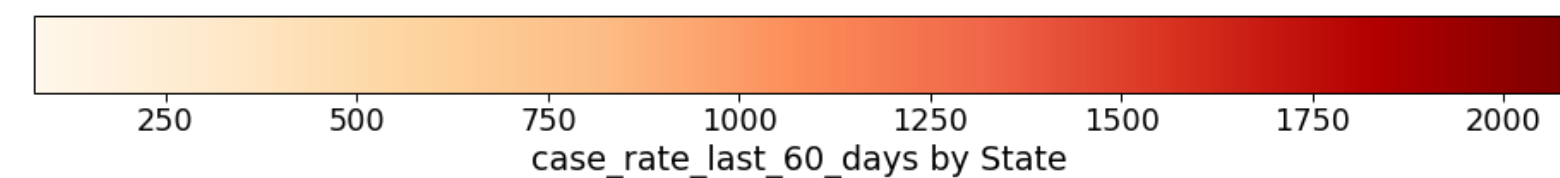
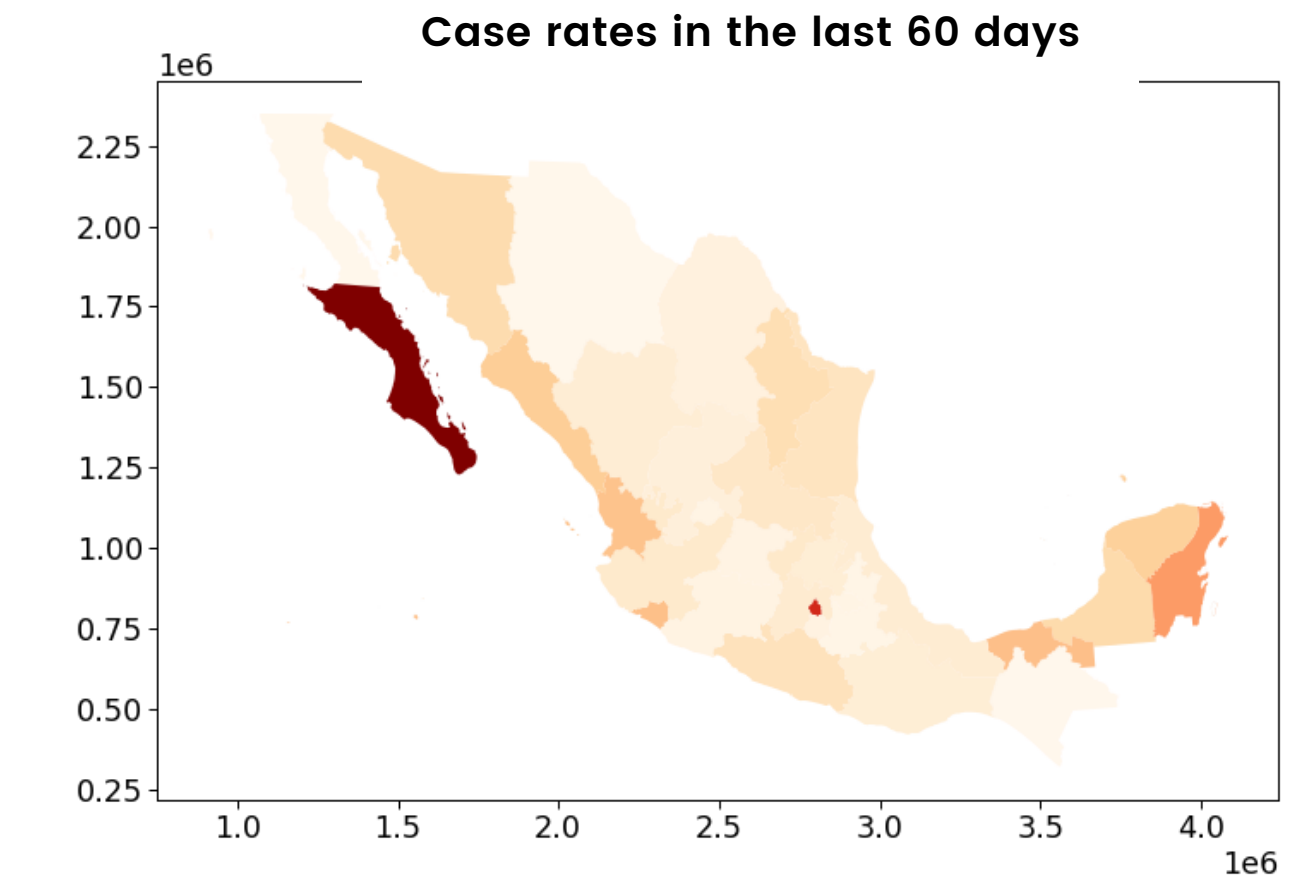
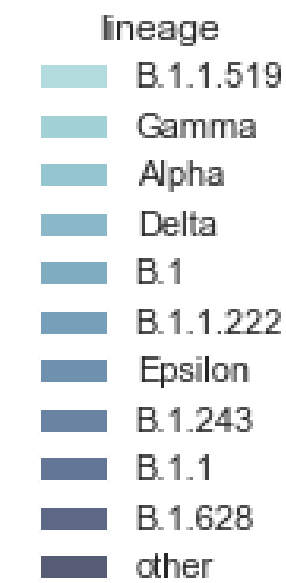
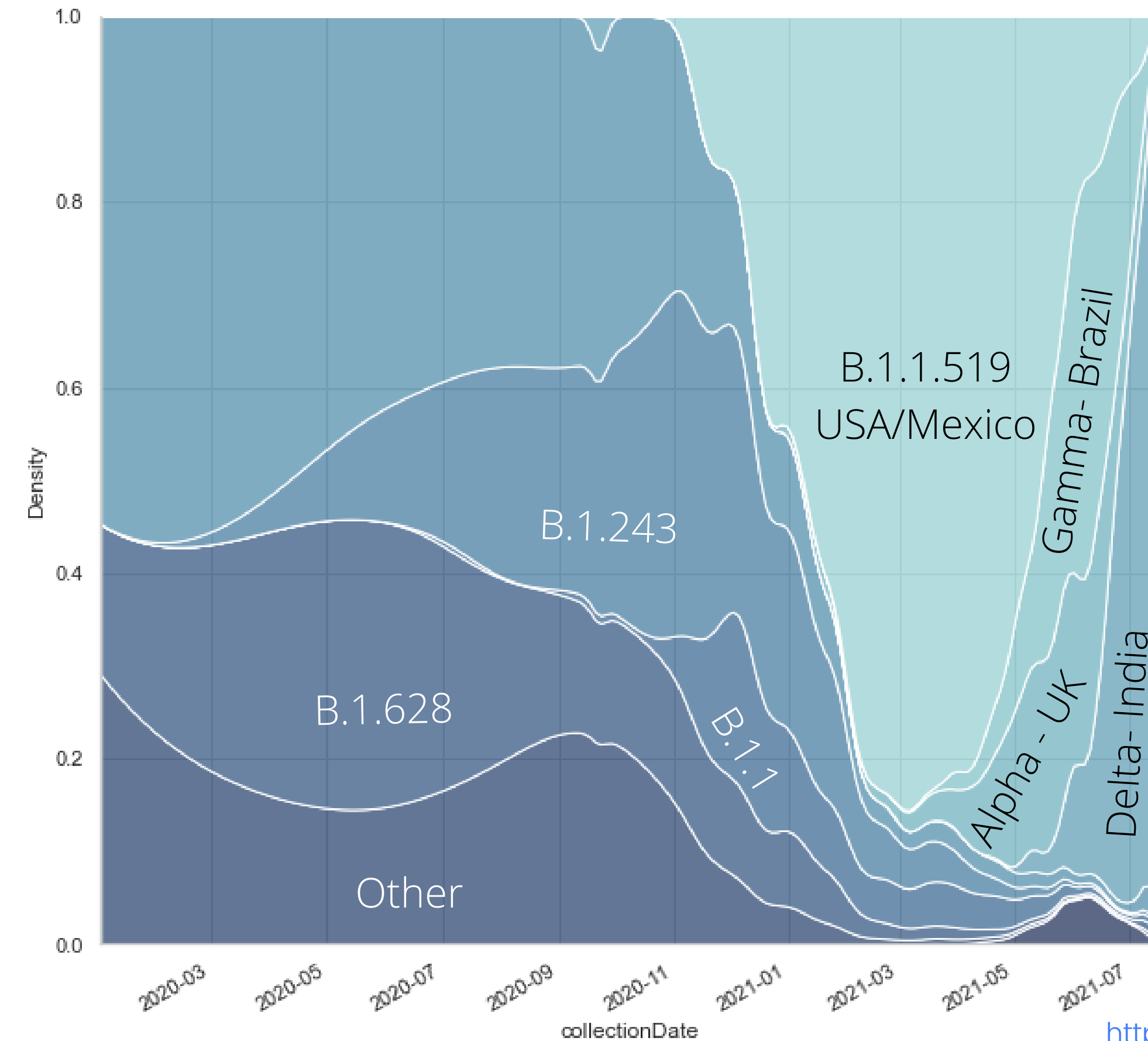
<https://datos.covid-19.conacyt.mx/#DownZCSV>

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:

COVID-19 | 2021

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

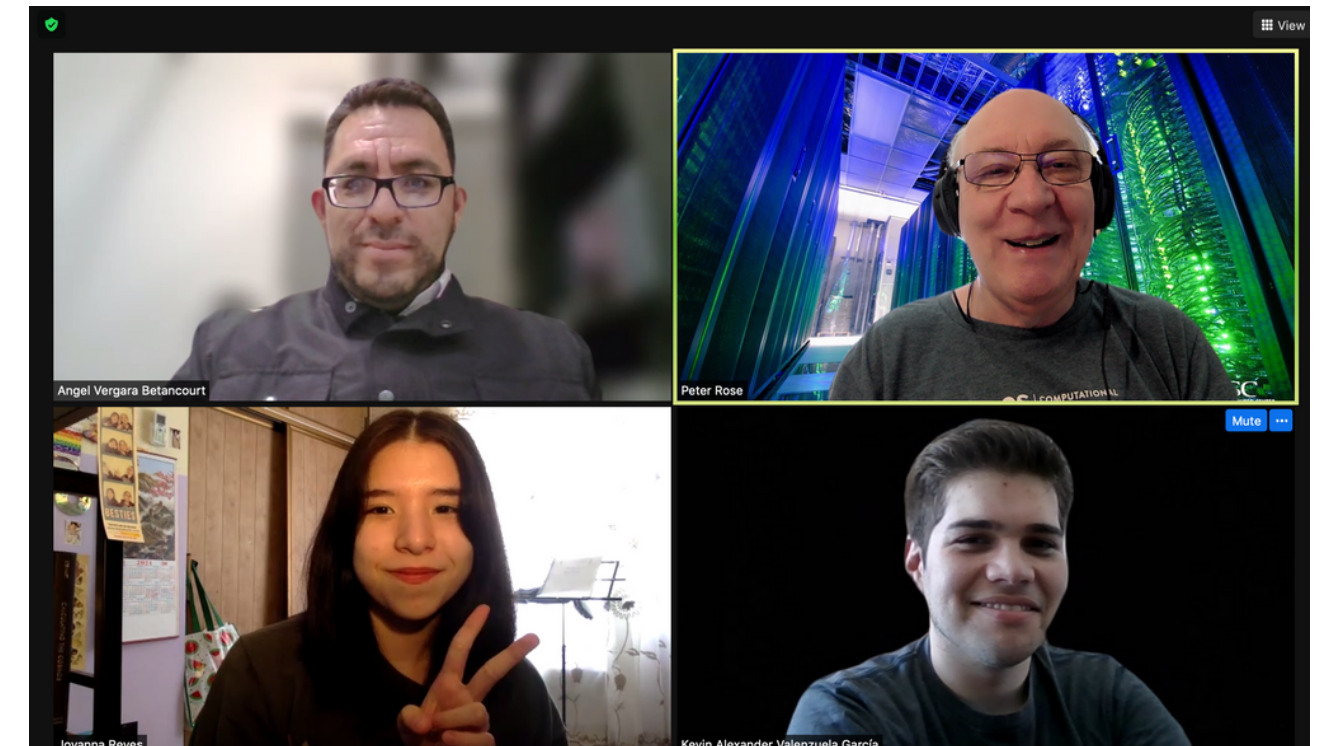
ACKNOWLEDGEMENTS



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DR. PETER ROSE



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**THANK
YOU!**