

Pre-registration of research project  
Crime and Covid-19: Effect of changes in routine activities in  
Mexico City

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## Study Information

### 1. Title

Crime and Covid-19: Effect of changes in routine activities in Mexico City

### 2. Authorship

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### 3. Description

This study seeks to examine the effect of the covid-19-related changes in routine activities on crime patterns in an urban area. Using data from Mexico City, I will first identify a suitable proxy measure to estimate the amount of activity outside homes (such as public transit passenger numbers, mobility apps trip queries, or amount of air pollution) before and after the social distancing restrictions imposed due to the Covid-19 epidemic. Then, I will examine if temporal crime patterns are associated with those of the proxy measures of routine activities.

## **4. Hypotheses**

1. The incidence of crime in public places will decrease as the amount of air pollution decreases following a reduction of vehicular traffic due to the covid-19 lockdown.
2. The incidence of crime in public places will decrease as the amount of trip queries in urban mobility application decreases following a reduction of city trips due to the covid-19 lockdown.
3. The incidence of crime in public places will decrease as the amount of passengers in public transport decreases following a reduction of commuting due to the covid-19 lockdown.
4. The incidence of crime in private residences will increase as the amount of air pollution decreases following a reduction of vehicular traffic due to the covid-19 lockdown.
5. The incidence of crime in private residences will increase as the amount of trip queries in urban mobility application decreases following a reduction of city trips due to the covid-19 lockdown.
6. The incidence of crime in private residences will increase as the amount of passengers in public transport decreases following a reduction of commuting due to the covid-19 lockdown.

## **Design Plan**

### **5. Study Type**

- Observational Study - Data is collected from study subjects that are not randomly assigned to a treatment. This includes surveys, ‘natural experiments,’ and regression discontinuity designs.

### **6. Blinding**

- No blinding is involved in this study.

### **7. Is there any additional blinding in this study?**

Not applicable.

### **8. Study design**

Longitudinal study: city-wide time series analysis.

## **9. Randomization**

Not applicable.

## **Sampling Plan**

### **10. Existing data**

- Registration prior to creation of data: As of the date of submission of this research plan for preregistration, the data have not yet been collected, created, or realized.

### **11. Explanation of existing data**

Though the data that will be used is secondary, it has not been generated yet as it refers to measurements of social phenomena occurring at the time of writing and the future.

### **12. Data collection procedures**

Data will be collected from third-party open data repositories as it becomes available. Crime incidence, air pollution and public transport passenger data is reported by the Mexico City government on a regular basis. Data on trip queries in urban mobility apps will be collected from the app developer company.

### **13. Sample size**

I aim to obtain at least a year of pre-lockdown data, and at least three months of post-lockdown data. Observations will be aggregated to daily or weekly counts, depending on their quality.

As the analyses will be conducted city-wide, one spatial unit will be used for the main analysis. However, additional sub-city units (neighbourhoods, street segments) may be used in exploratory analyses.

### **14. Sample size rationale**

At the moment it is unknown how long the movement restrictions due to covid-19 lockdown restrictions will last. Thus, the estimate for the sample size was selected using the following rationale:

- Pre-lockdown period:
  - A year is the minimum period required to be able to capture seasonal trends for the post-lockdown counterfactual trend.
- Post-lockdown period:
  - A month could conceivably be enough to show an effect (using daily data), but if data are aggregated by week, it will not be sensitive enough to detect differences in crime trends. Longer would be better, but three months seems like a good compromise for a first assessment. In follow up studies, the period could be extended to capture whether crime patterns resume their original trajectory as (if) Mexico City resumes its usual activity patterns.

## 15. Stopping rule

Not applicable.

## Variables

### 16. Manipulated variables

Not applicable.

### 17. Measured variables

- Dependent variable (per day and/or week):
  - Counts of crimes of the following categories (the specific crime types used are to be determined depending on data availability).
- Independent variable (per day and/or week):
  - Air pollution:
    - \* 24h average of PM10 and PM2.5 suspended atmospheric particles.
    - \* 24h average of atmospheric sulphur dioxide levels.
  - Urban mobility queries:
    - \* Citymapper Mobility Index
  - Public transport passengers:
    - \* Daily number of passengers using bus rapid transit (Metrobus) system.
    - \* Daily number of passengers using metro system.

### 18. Indices

Not applicable.

## Analysis Plan

### 19. Statistical models

Interrupted time series regression is an appropriate approach to model the effects of covid-19 related restrictions on crime. This involves estimating whether the trend of crime incidents per unit time changes after a discrete time period (when a city-wide lockdown was imposed, for example).

However, so far the restrictions on city movements have not been consistently implemented, and there have been reports of many people flouting authorities' recommendations to stay at home. Thus, it is possible that a better alternative for causal inference may be to model crime incidence against a suitable proxy for routine activities. In this study, I propose using air pollution, trip queries in mobility apps, and passenger numbers in public transport in bivariate models with crime incidence as the dependent variable.

Given the longitudinal nature of the data, observations of the dependent variable are likely to be serially correlated, exhibit seasonality and an inherent trend. Thus, I will use ARIMA methods to control such temporal patterns.

To avoid contaminating the ARIMA components with the effect of the covid-19 restrictions, I will estimate the components using data for before the epidemic reached Mexico (up until February 2020, though this is subject to results of the exploratory analysis).

### 20. Transformations

Not applicable.

### 21. Inference criteria

I will use the standard  $p < 0.05$  criteria for determining if the coefficients of the independent variables are significantly different from zero as predicted in the null hypotheses.

### 22. Data exclusion

Not applicable.

### 23. Missing data

Not applicable.

## **24. Exploratory analysis**

Spatio-temporal data analysis will be used to explore how patterns of the dependent and independent variables changed during the observation period, with particular attention to changes in the extent and distribution during the pre- and post-lockdown periods.

## **Other**

## **25. Other**

Not applicable.

## **References**

Not applicable.