# The Relationship Between Social Factors and Crime Rates in Toronto: An Analysis

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16 April, 2022

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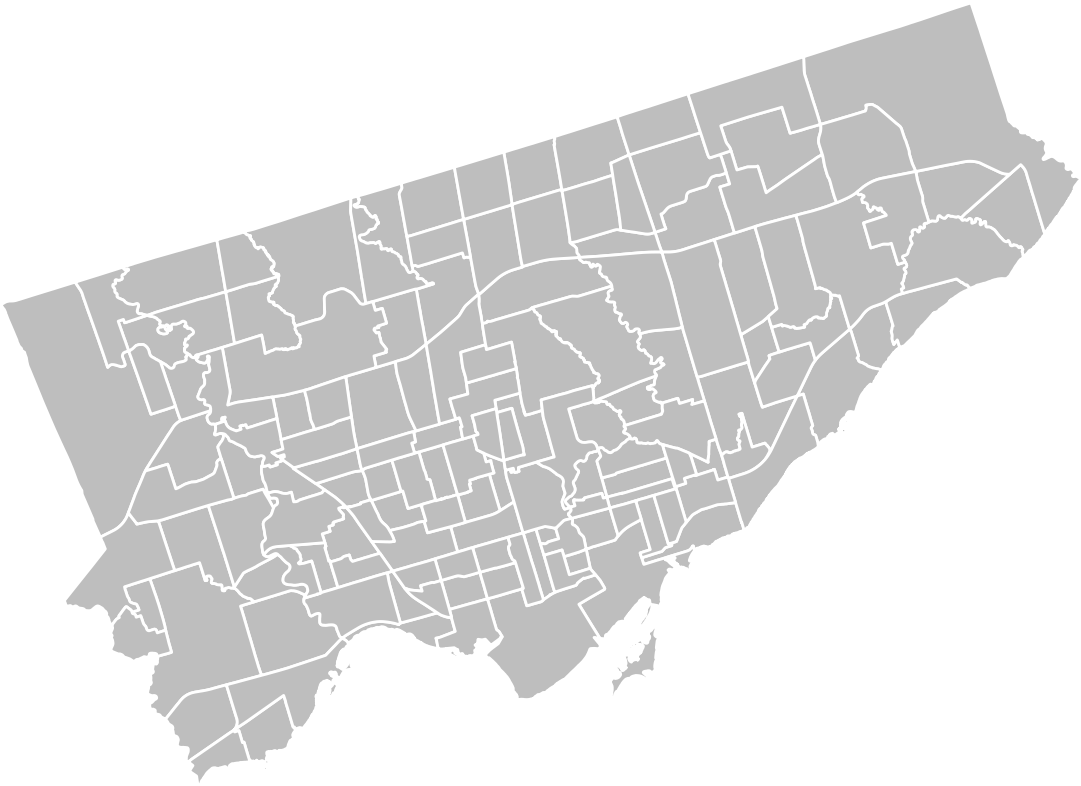
```
rm(list = ls())
```

## Introduction

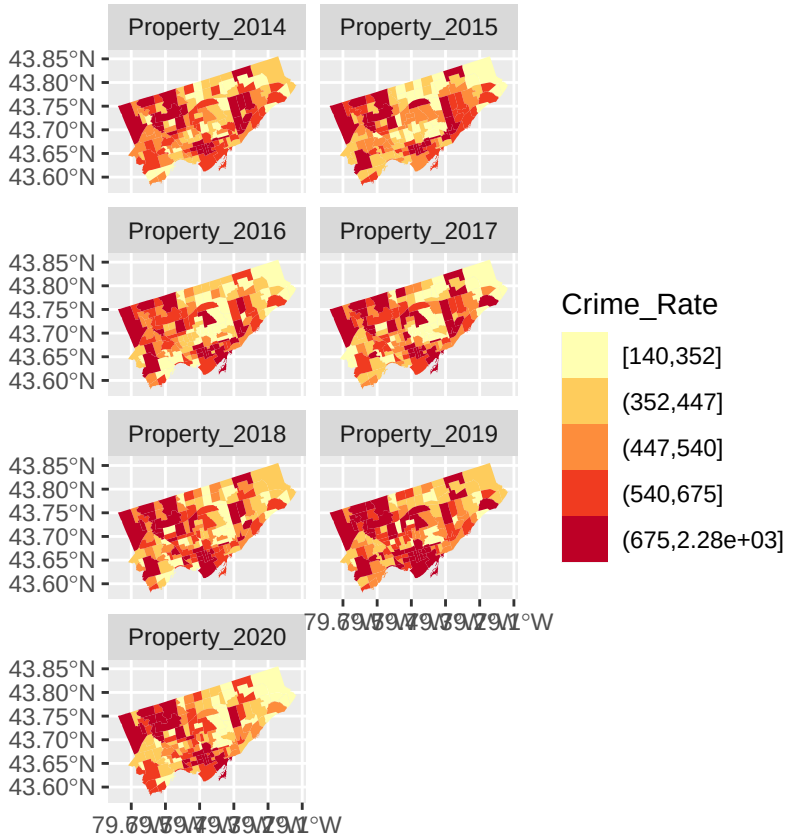
```
ggplot() +
  geom_sf(data = data,
          color = "white",
          fill = "gray") +
  theme_void()+
  theme(panel.grid.major = element_line(colour = 'transparent'))
```



#auto theft, break and enter, robbery, theft over

```
data <- mutate(data,
Property_2014 = (AutoTheft_Rate2014 + BreakAndEnter_Rate2014 + Robbery_Rate2014+ TheftOver_Rate2014),
Property_2015 = (AutoTheft_Rate2015 + BreakAndEnter_Rate2015 + RobberyRate_2015+ TheftOver_Rate2015),
Property_2016 = (AutoTheft_Rate2016 + BreakAndEnter_Rate2016 + Robbery_Rate2016+ TheftOver_Rate2016),
Property_2017 = (AutoTheft_Rate2017 + BreakAndEnter_Rate2017 + Robbery_Rate2017+ TheftOver_Rate2017),
Property_2018 = (AutoTheft_Rate2018 + BreakAndEnter_Rate2018 + Robbery_Rate2018+ TheftOver_Rate2018),
Property_2019 = (AutoTheft_Rate2019 + BreakAndEnter_Rate2019 + Robbery_Rate2019+ TheftOver_Rate2019),
Property_2020 = (AutoTheft_Rate2020 + BreakAndEnter_Rate2020 + Robbery_Rate2020+ TheftOver_Rate2020),
MeanProperty = (Property_2014+ Property_2015+ Property_2016+Property_2017+Property_2018+Property_2019+P
data1 <- data
data1 <- pivot_longer(data, cols=Property_2014:Property_2020, names_to = "Year", values_to = "Crime_Rat
```

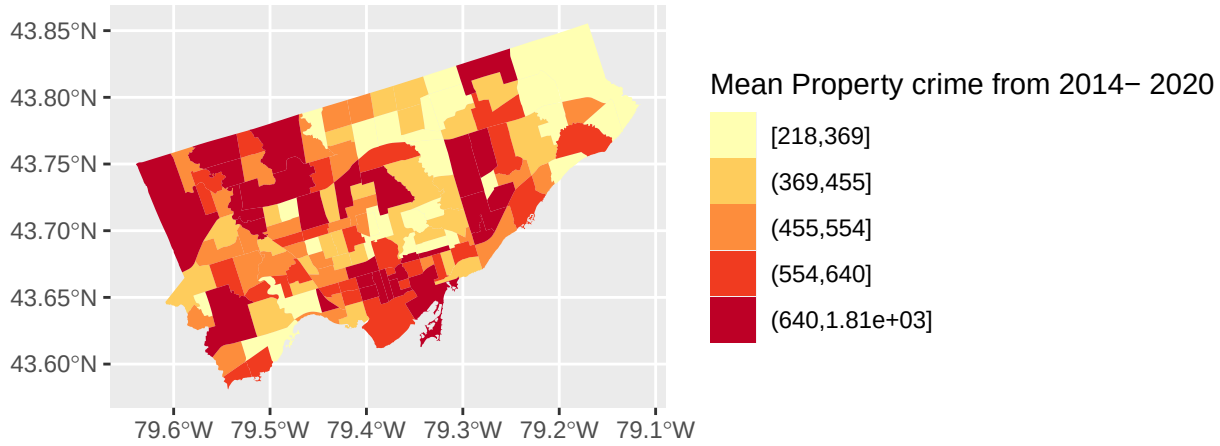
```
ggplot(data1) +
  geom_sf(aes(fill = cut_number((Crime_Rate), 5)),
          color = NA,
          size = 0.1) +
  scale_fill_brewer(palette = "YlOrRd") +
  coord_sf() +
  labs(fill = "Crime_Rate") +
  facet_wrap (~ Year, ncol =2)
```




```
ggplot(data) +
  geom_sf(aes(fill = cut_number((data$MeanProperty), 5)),
          color = NA,
          size = 0.1) +
```

```
  scale_fill_brewer(palette = "YlOrRd") +
  coord_sf() +
  labs(fill = "Mean Property crime from 2014- 2020")
```

```
## Warning: Use of ‘data$MeanProperty‘ is discouraged. Use ‘MeanProperty‘ instead.
```




```
data.nb <- poly2nb(pl = data)
data.w <- data  %>%
  as("Spatial") %>%
  poly2nb() %>%
  nb2listw()
```

```
data <- data %>%
  mutate(sma = lag.listw(data.w, MeanProperty))
```

```
Property_s1 <- sample(data$MeanProperty)
Property_s1.sma <- lag.listw(data.w, Property_s1)

Property_s2 <- sample(data$MeanProperty)
Property_s2.sma <- lag.listw(data.w, Property_s2)

Property_s3 <- sample(data$MeanProperty)
Property_s3.sma <- lag.listw(data.w, Property_s3)

Property_s4 <- sample(data$MeanProperty)
```

```
Property_s4.sma <- lag.listw(data.w, Property_s4)

Property_s5 <- sample(data$MeanProperty)
Property_s5.sma <- lag.listw(data.w, Property_s5)

Property_s6 <- sample(data$MeanProperty)
Property_s6.sma <- lag.listw(data.w, Property_s6)
```


Figure 1: Maps showing the empirical distribution of mean annual opioid pills per person and five simulated landscapes

```
mp <- moran.plot(data$MeanProperty, data.w)
```

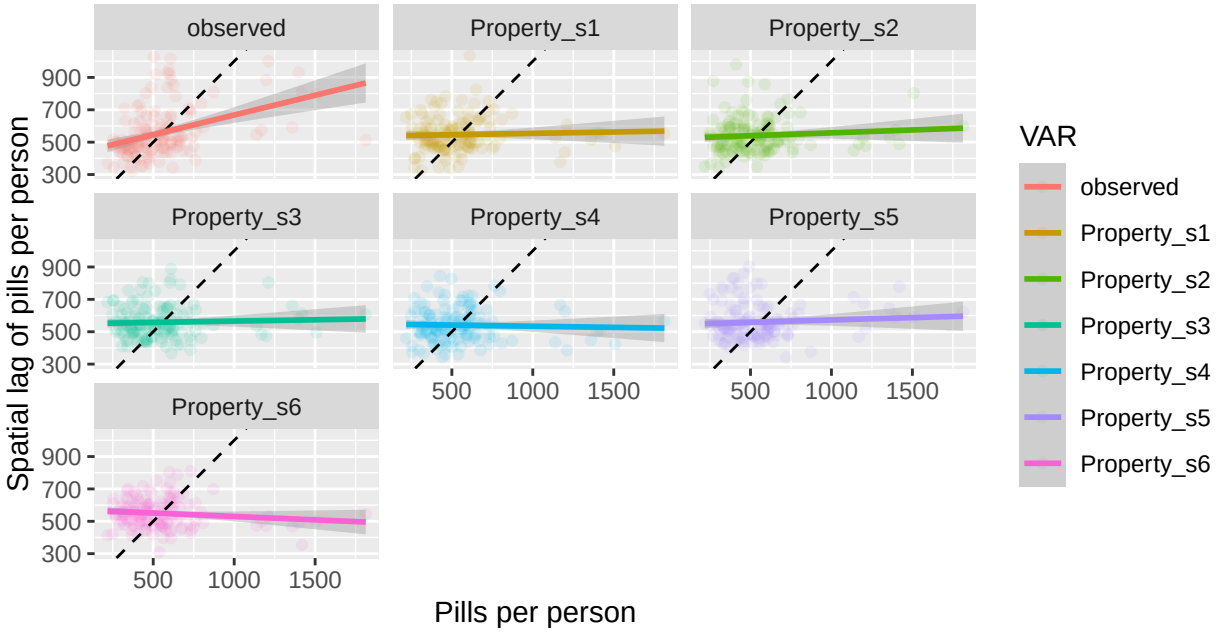
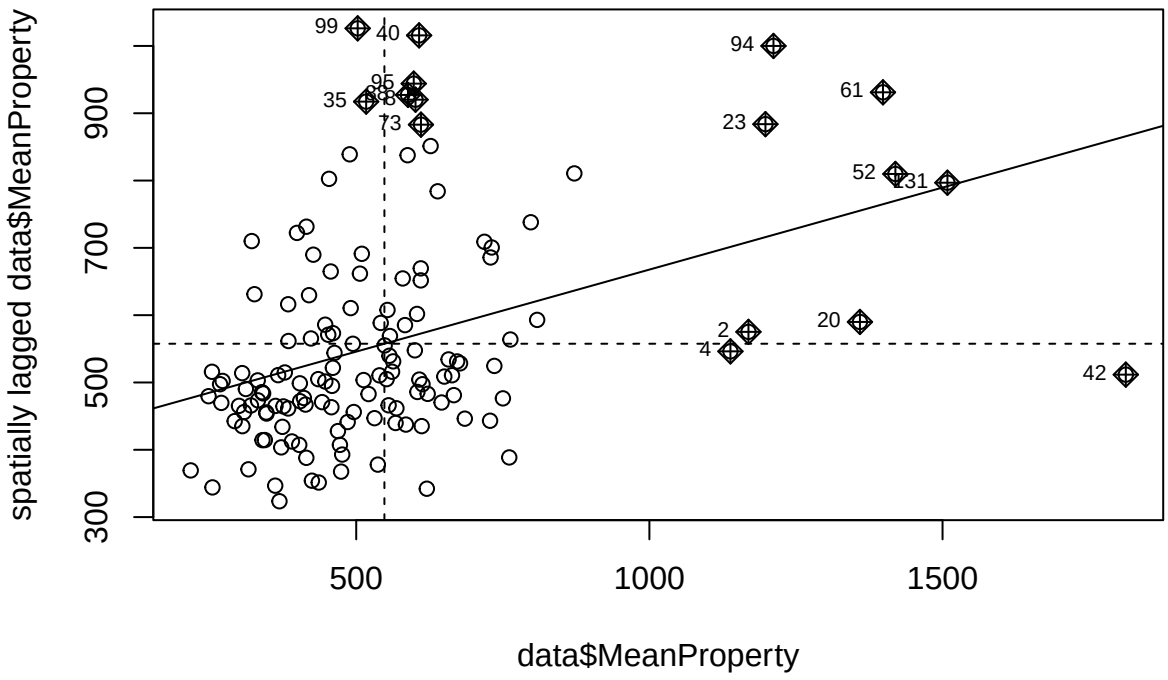



Figure 2: Moran's scatterplots of empirical and simulated spatial moving averages of mean annual opioid pills per person




```
moran.test(data$MeanProperty,data.w)
```

```
##
##  Moran I test under randomisation
##
## data:  data$MeanProperty
## weights: data.w
##
## Moran I statistic standard deviate = 5.2639, p-value = 7.052e-08
## alternative hypothesis: greater
## sample estimates:
## Moran I statistic       Expectation          Variance
##       0.243772652      -0.007194245       0.002273099
```

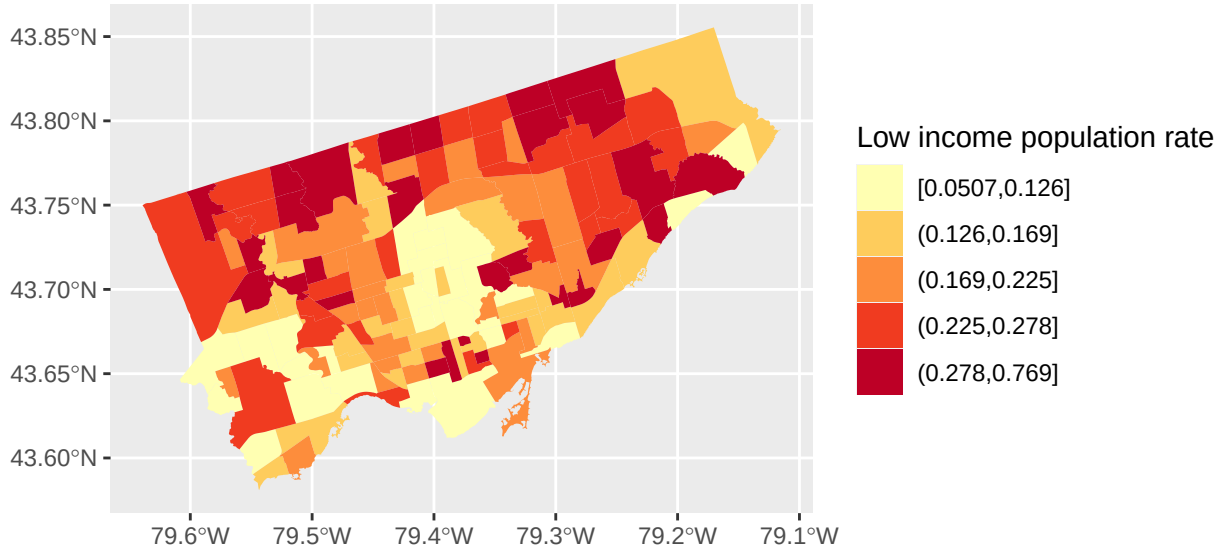
```
library(readxl)
wellbeing_toronto <- read_excel("wellbeing_toronto.xlsx")

data3 <- merge(data,wellbeing_toronto,by="Hood_ID")

data3 <- mutate(data3,
                low_income_rate = data3$`Low Income Population`/data3$`Total Population`,
                college_rate = data3$`With College Certificate/Diploma`/data3$`Total Population`,
                umemployment_rate = data3$Unemployed/data3$ `Total Population`)
```

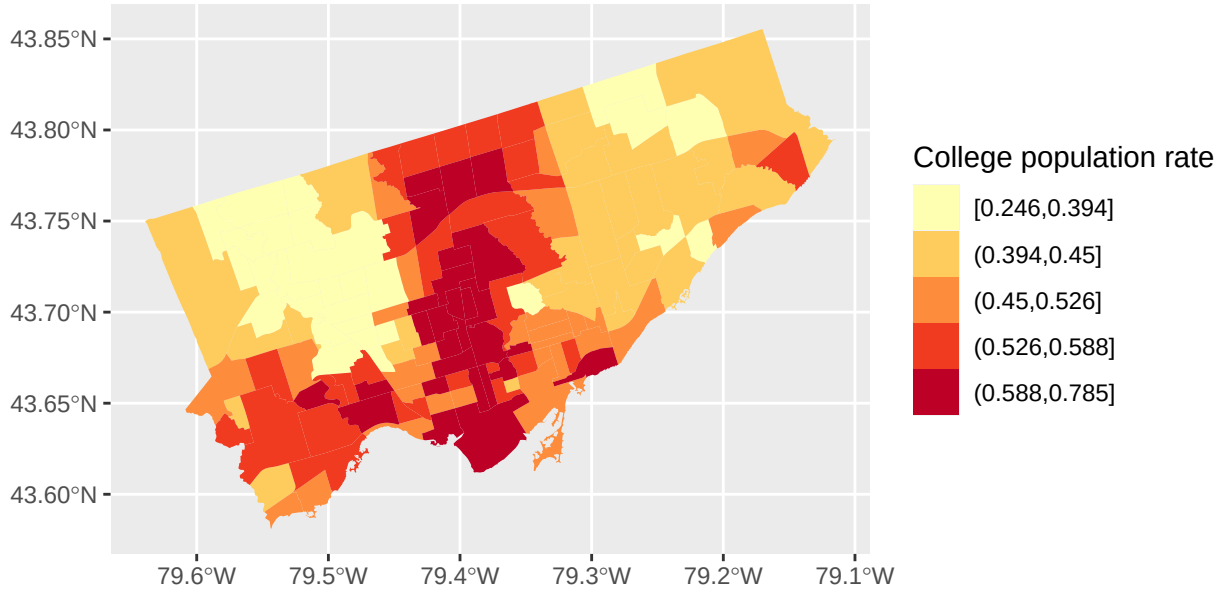
```
ggplot(data3) +
  geom_sf(aes(fill = cut_number((data3$low_income_rate), 5)),
          color = NA,
          size = 0.1) +
  scale_fill_brewer(palette = "YlOrRd") +
  coord_sf() +
  labs(fill = "Low income population rate")
```

```
## Warning: Use of ‘data3$low_income_rate‘ is discouraged. Use ‘low_income_rate‘
## instead.
```



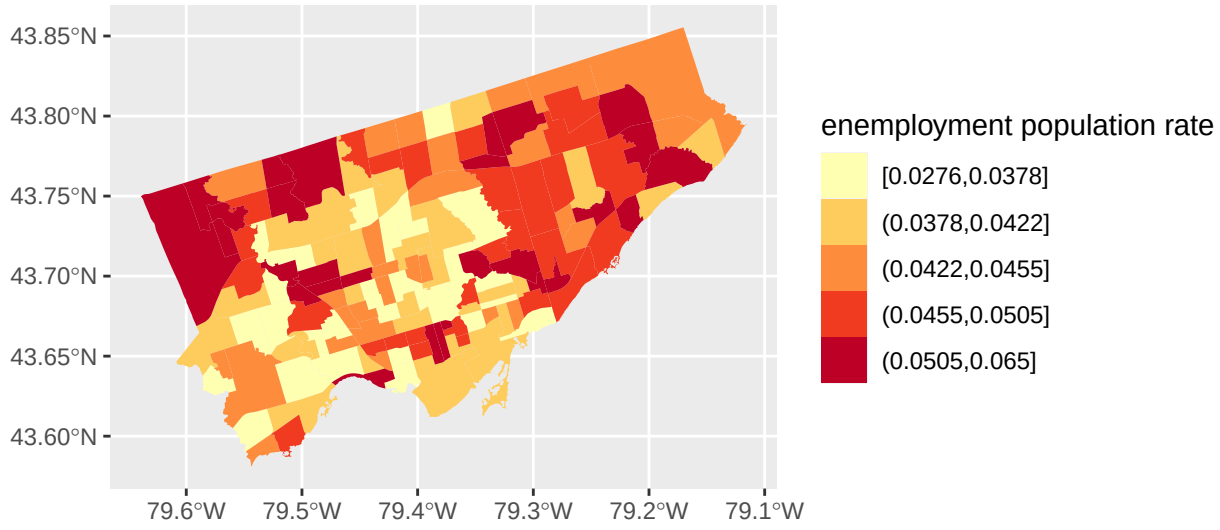

```
ggplot(data3) +
  geom_sf(aes(fill = cut_number((data3$college_rate), 5)),
          color = NA,
          size = 0.1) +
  scale_fill_brewer(palette = "YlOrRd") +
  coord_sf() +
  labs(fill = "College population rate")
```

```
## Warning: Use of ‘data3$college_rate‘ is discouraged. Use ‘college_rate‘ instead.
```




```
ggplot(data3) +
  geom_sf(aes(fill = cut_number((data3$umemployment_rate), 5)),
          color = NA,
          size = 0.1) +
  scale_fill_brewer(palette = "YlOrRd") +
  coord_sf() +
  labs(fill = "enemployment population rate")
```

```
## Warning: Use of ‘data3$umemployment_rate‘ is discouraged. Use
## ‘umemployment_rate‘ instead.
```


43.85°N
43.80°N
43.75°N
43.70°N
43.65°N
43.60°N
79.6°W
79.5°W
79.4°W
79.3°W
79.2°W
79.1°W
enemployment population rate
[0.0276,0.0378]
(0.0378,0.0422]
(0.0422,0.0455]
(0.0455,0.0505]
(0.0505,0.065]