Neighbourhood characteristics and crime distribution on the Island of Montréal

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Statistics Canada | Statistique Canada

Ninth Crime Mapping Research Conference

Overview

- To present the geocoding of crime data from the Uniform Crime Reporting Survey (UCR2)
- To present research results of spatial data analysis in a Canadian city

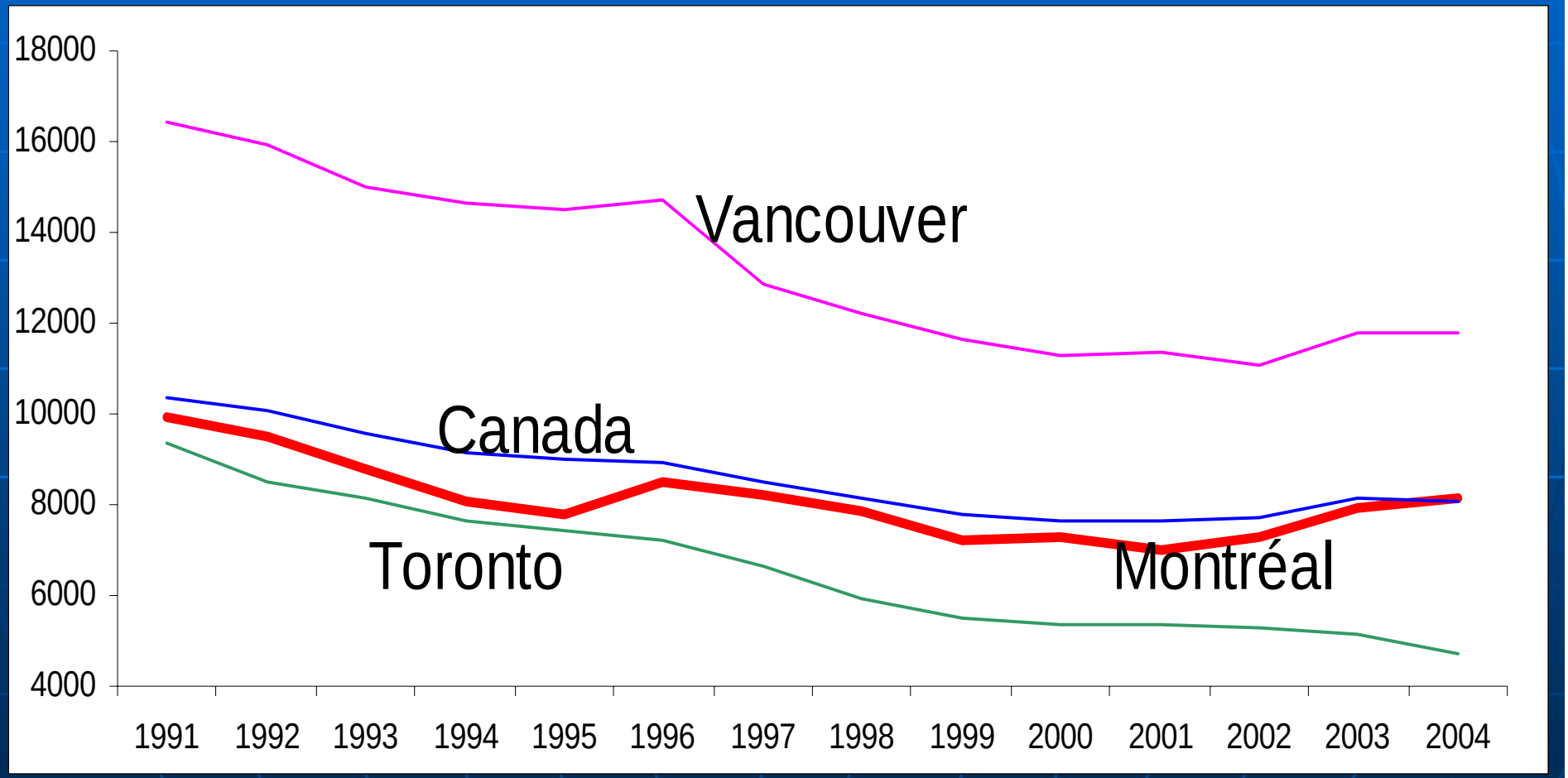
Geocoding and Spatial Data Analysis at Statistics Canada

- Importing the spatial component to the UCR2 database
- Importing other layers of data
  - (census, zoning, education, health)
- Modeling of geocoded data

Questions that can be Addressed with Geocoding

- How are different types of crime distributed across cities?
- What factors are associated with neighbourhood crime?
- How does neighbourhood crime compare across major cities?
- Which neighbourhoods have low crime despite other risk factors?
- What are the characteristics of charged persons' travel-to-offence patterns?

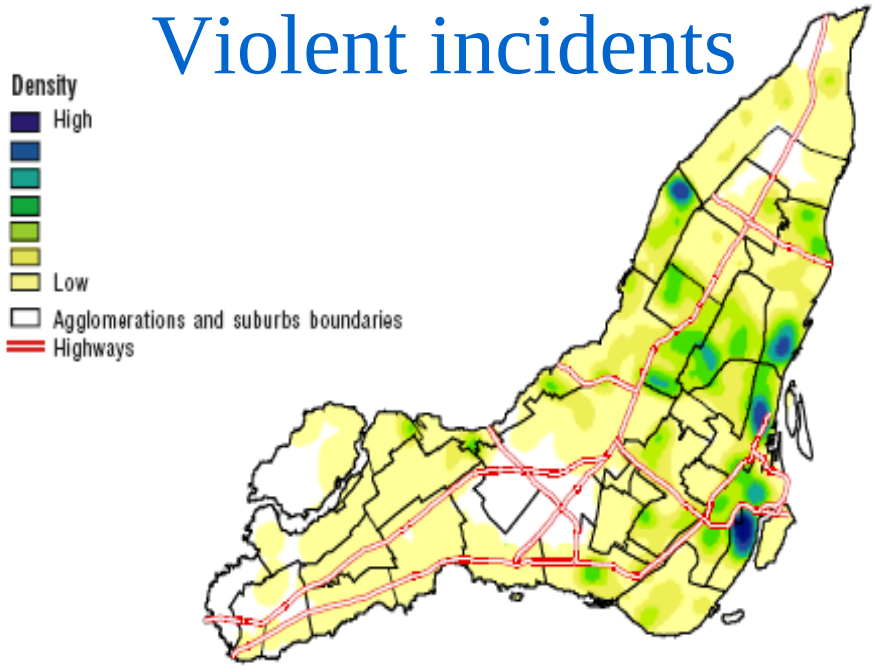
Crime rates in major metropolitan areas, Canada, 1991 to 2004



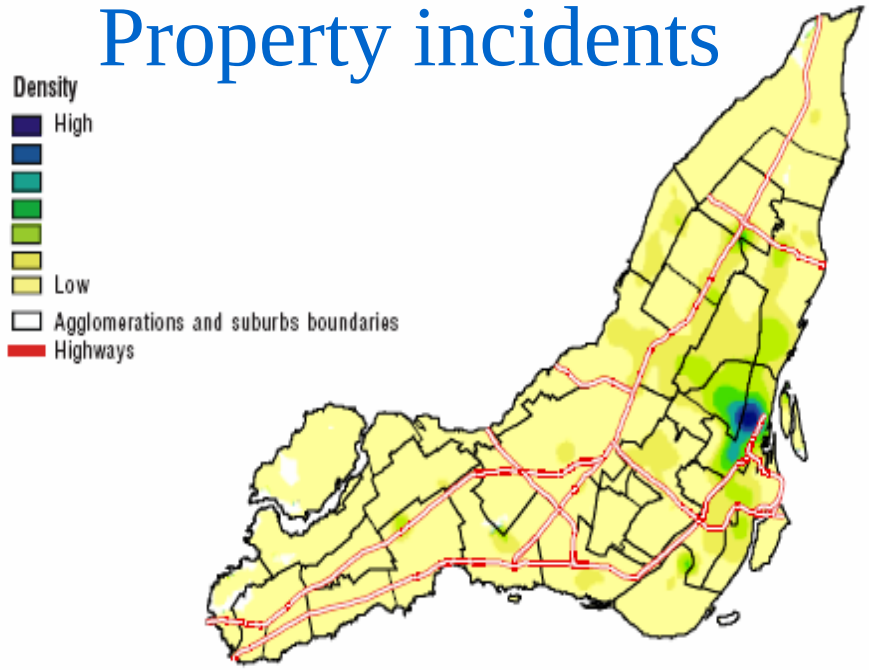
Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Kernel density distribution of crime incidents and population at risk, Montréal, 2001

Violent incidents



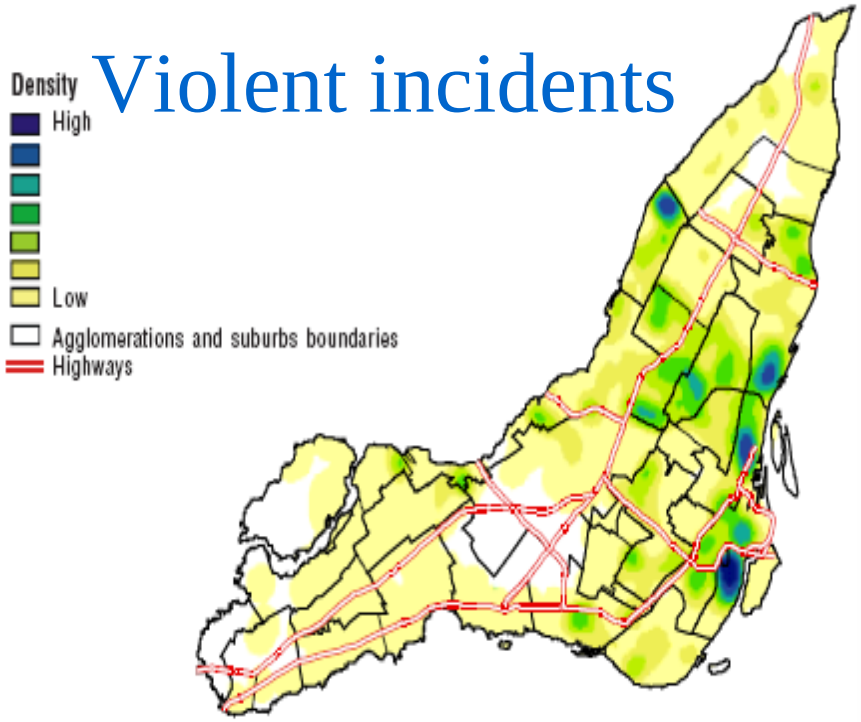
Property incidents



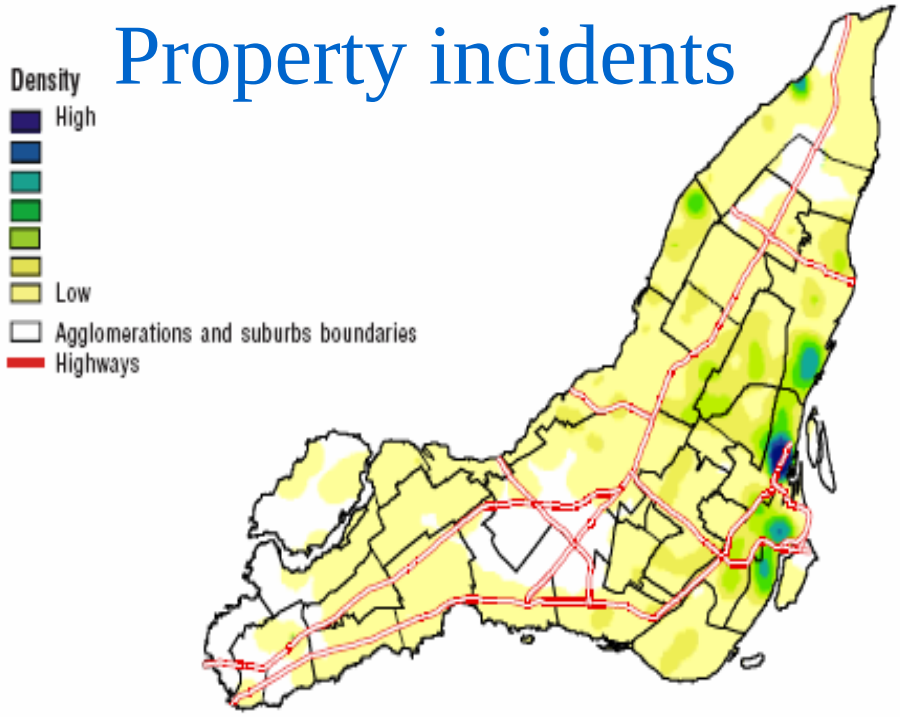
Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, geocoded database, 2001.

Kernel density distribution of place of residence of persons charged and the residential population, Montréal, 2001

Violent incidents



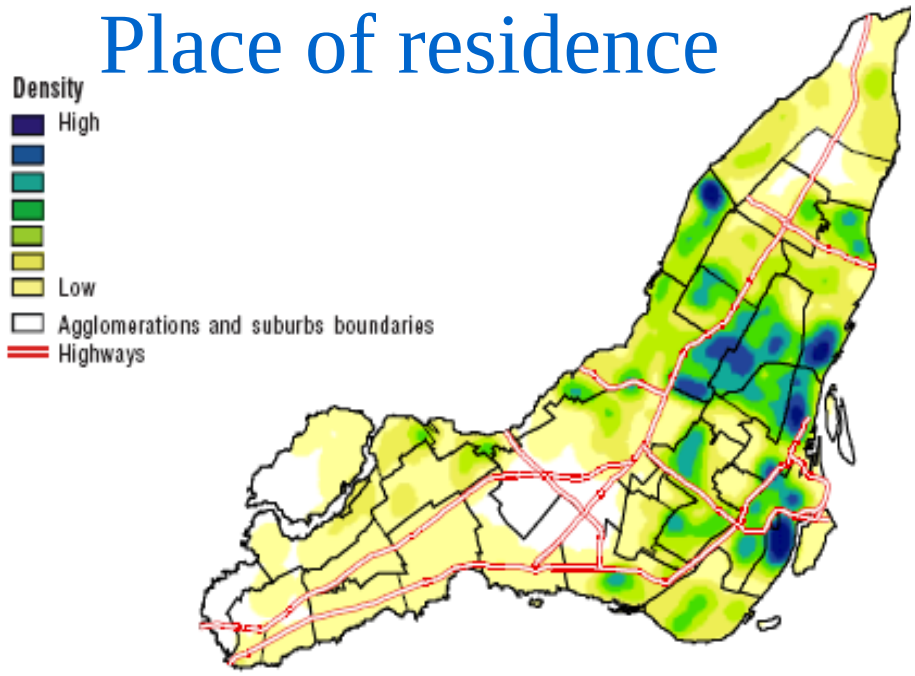
Property incidents



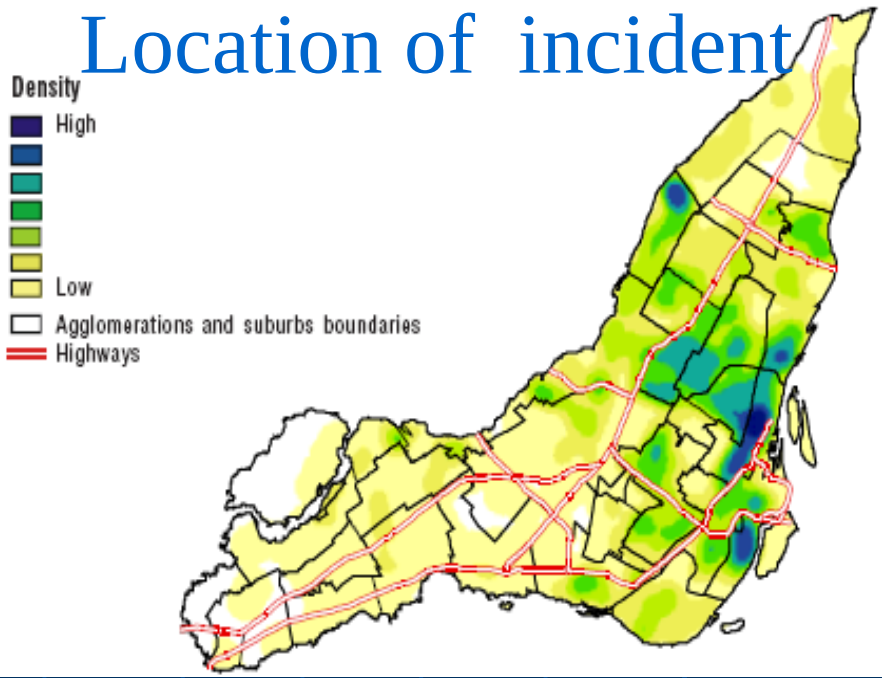
Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, geocoded database, 2001.

Kernel density distribution of place of residence of persons charged and location of violent incidents, Montréal, 2001

Place of residence



Location of incident



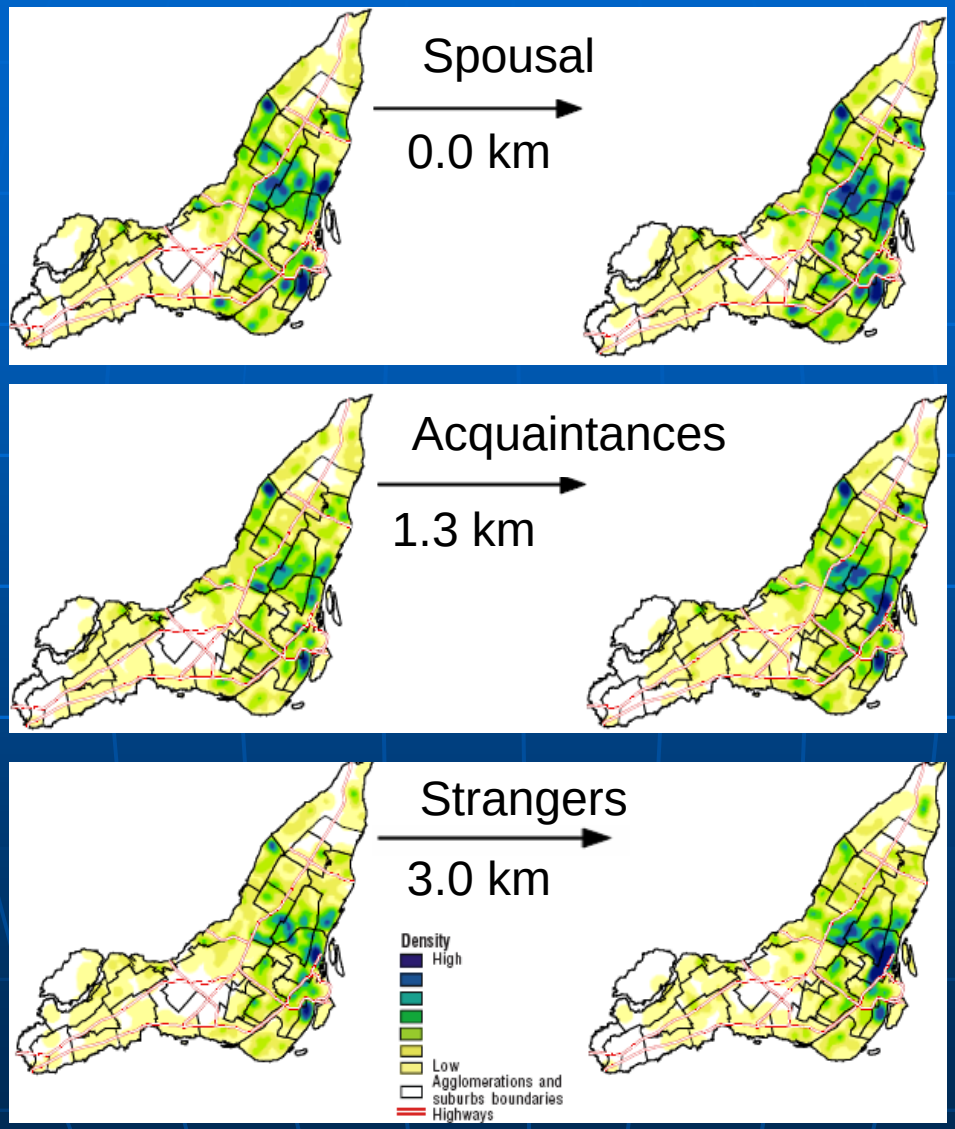
Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, geocoded database, 2001.

Median Distance Travelled, Violent Offences

- Assaults 0.35 Km
- Sexual assaults 1.29 km
- Robbery 3.11 km

Relationship

Place of residence of the accused

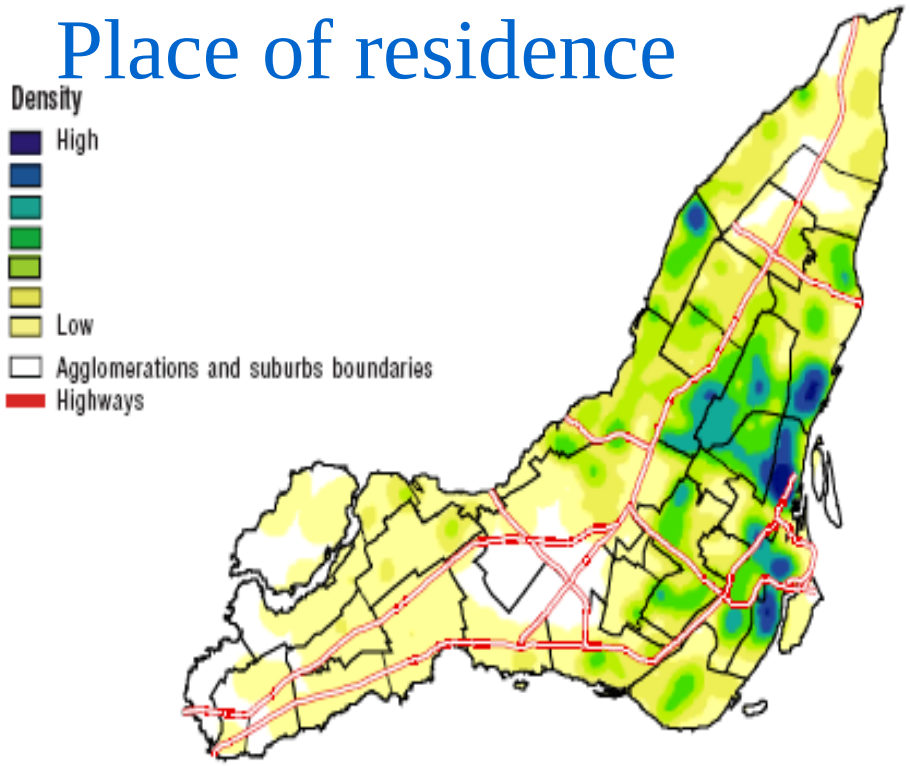


Location of offences

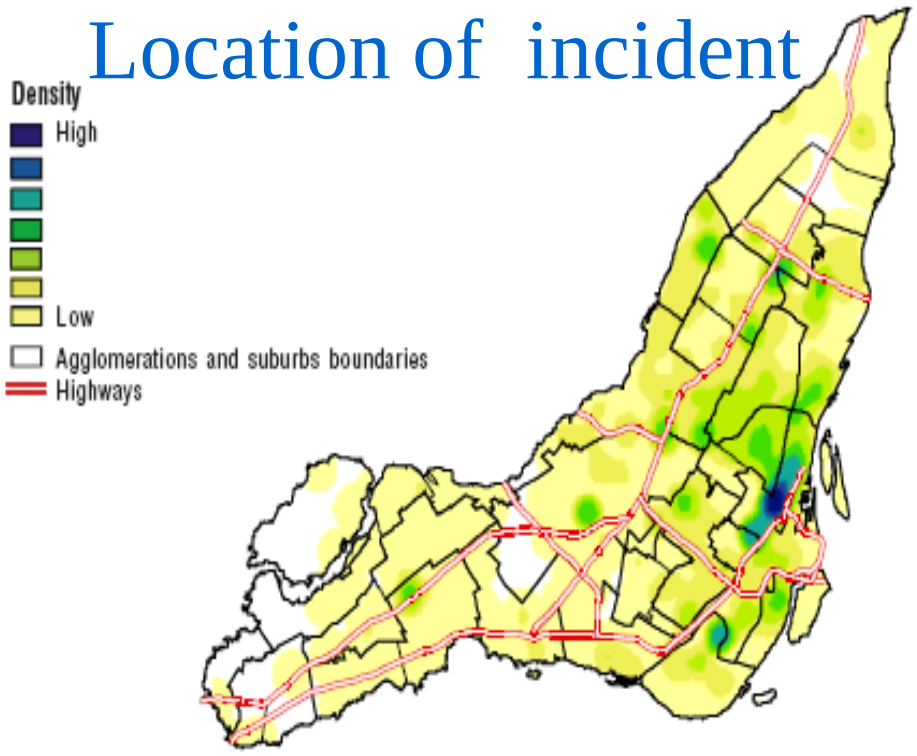
Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, geocoded database, 2001.

Kernel density distribution of place of residence of persons charged and location of property incidents, Montréal, 2001

Place of residence



Location of incident

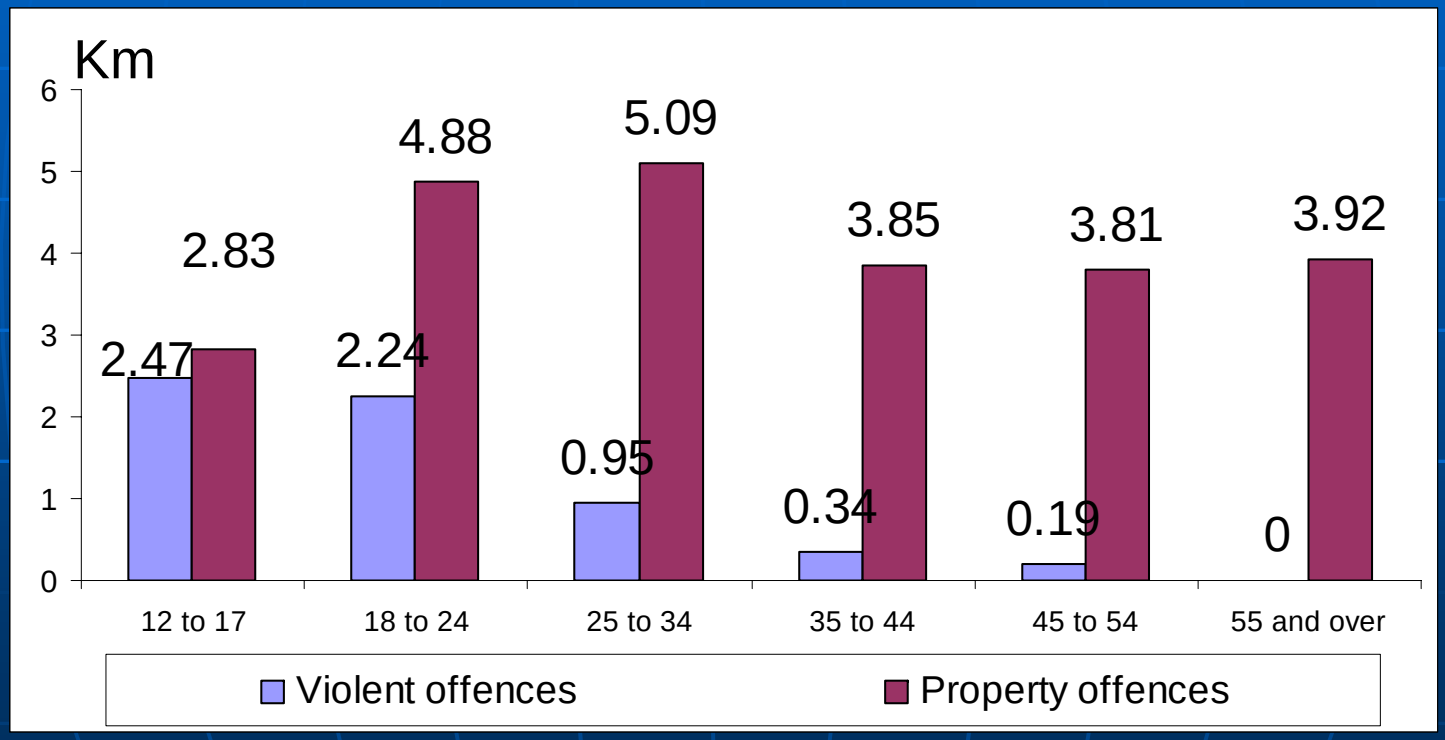


Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, geocoded database, 2001.

Median Distance Travelled, Property Offences

- B & E 3.30 km
- Shoplifting 4.1 km
- Theft 4.38 km
- Car theft 6.53 km

Median distance travelled, charged persons by age



Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, geocoded database, 2001.

Spatial Analysis

- Relate neighbourhood crime rates with the characteristics of the region
- Many reasons to suspect crime and other variables will be related between adjacent regions
- Need to consider the spatial nature of the data

Spatial Autocorrelation

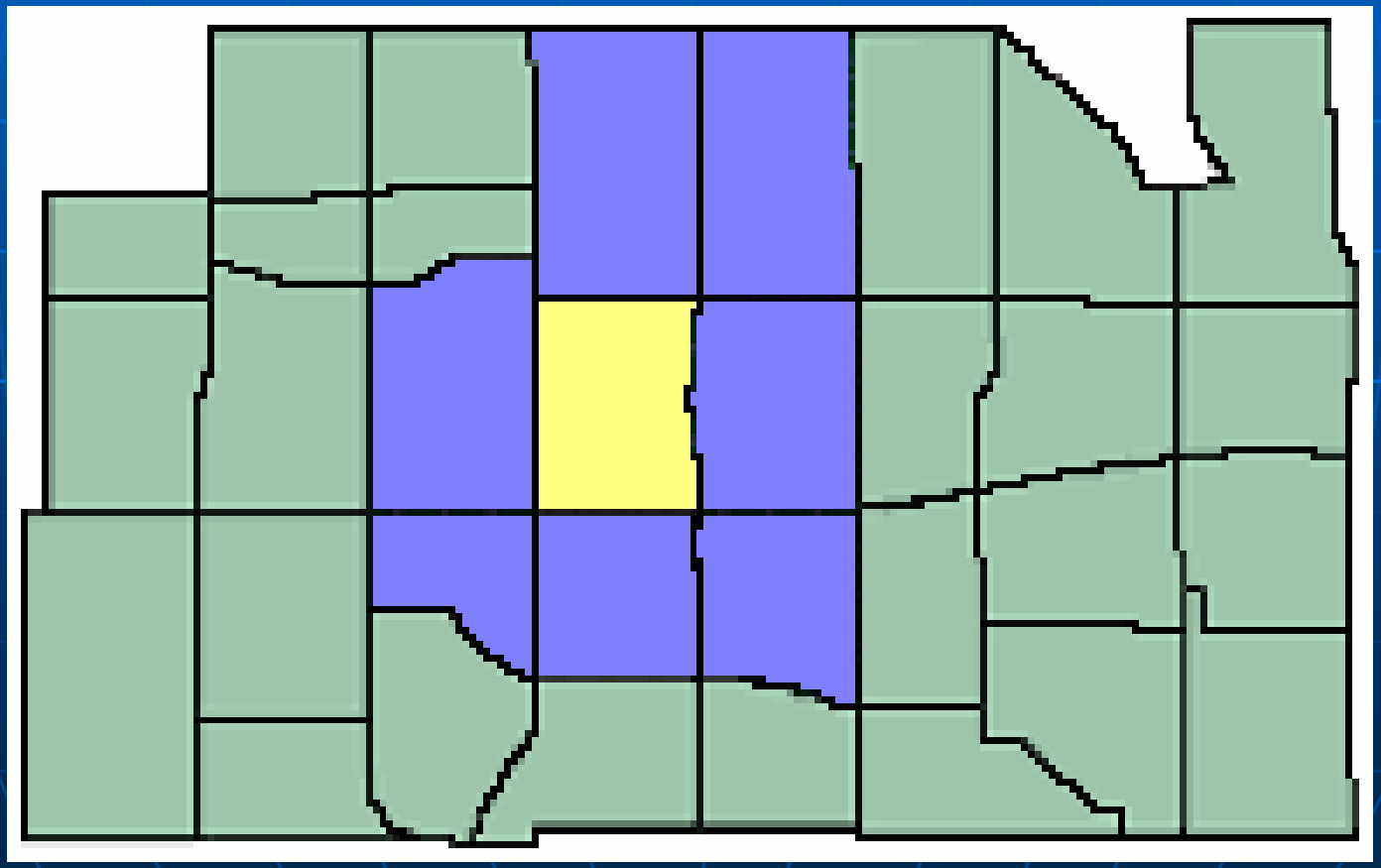
- Observations are not independent of those from nearby locations
- Possibility of spatial autocorrelation (SAC) in the error terms
- SAC may cause variables to *appear* more significant then they actually are

Spatial Models

- Spatial Lag Model
  - Add a term to the model that explains the variability caused by the spatial structure
  - Uses the average value from surrounding locations
- Spatial Error Model
  - Spatial dependence in model error terms
  - Error terms are related to average value from surrounding locations

Neighbourhoods

- Queen Contiguity Structure – includes all regions with common borders and vertices



Neighbourhood Characteristics

- Neighbourhood crime rate
- Demographic:
  - Males aged 15 to 24
  - Single, never married ✔
  - Lone-parent families
  - Recent movers
  - Recent immigrant
- Socio-Economic:
  - Low income ✔
  - Government transfers
  - Unemployment rate
  - Education ✔
  - Median household income
- Land-use and housing:
  - % Commercial, multifamily and single family ✔
  - Bar density ✔
  - Housing built before 1961
  - Household inaffordability

Violent Crime

- Spatial Error Model

Variable	Coeff	p-value	Signif.
Low Income	+ 0.20	<.0001	****
Bachelor's Degree	- 0.26	<.0001	****
Single	+ 0.20	<.0001	****
Commercial Area	+ 0.07	0.0008	***
Single Family Res.	+ 0.09	0.0005	***
Multiple Family Res.	+ 0.12	<.0001	****
Bar Density	+ 0.04	0.0577	*
Spatial Error	+ 0.32	<.0001	****

**** p < .0001, *** p < .001, ** p < 0.01, * p < .1

- Squared Correlation = 0.60

Property Crime

- Spatial Lag Model

Variable	Coeff	p-value	Signif.
Low Income	+ 0.11	<.0001	****
Visible Minority	- 0.05	0.0040	**
Single	+ 0.11	<.0001	****
Commercial Area	+ 0.12	<.0001	****
Bar Density	+ 0.05	0.0011	**
Spatial Lag	+ 0.43	<.0001	****

**** p < .0001, *** p < .001, ** p < 0.01, * p < .1

- Squared Correlation = 0.62

Conclusion

- Concentration of crime
- Local correlates of crimes
- Different interaction between factors

Data Accessibility

- “Neighbourhood Characteristics and the Distribution of Crime on the Island of Montréal” (aussi disponible en français)
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