# Using ArcGis Pro to Track a Silent Killer： Hypertension in Canadian Population 

Denis Leroux（PhD）＊\＆Lyne Cloutier（PhD）＊＊<br>＊Department of Environmental Sciences，＊＊Department of Nursing<br>University of Quebec at Trois－Rivières，Canada



## Presentation outline

- Introduction

Definition, global trends, world distribution \& hypertension in Canada

- Objectives of the study

Geography of hypertension in Canada, temporal evolution of hypertension (2005-2015)
Descriptive statistics \& Geostatistics
Occasion to switch to ArcGis Pro!
Data
Canadian Community Health Survey database 2005-2015 (CCHS)
Canadian Health Regions
Data extraction and weighting, data challenges (geographical unit changes, missing data)
Methods \& Analysis
Subgroups extraction, maps production
Temporal \& geographical evolution between 2005 \& 2015
Geographical patterns (Getis-Ord)
Results \& Conclusion
Maps, statistics \& Geostatistics

## Introduction

## -What is hypertension?

- High blood pressure (HBP or hypertension) is when blood pressure, the force of blood pushing against the blood vessels walls, is consistently too high.
Hypertension is a «
"
- Hypertension effects on the body:

Brain
Cerebral vascular disease (Stroke, dementia)
Eyes
Retinopathy
Heart
Myocardial infarction, coronaropathy, angina, heart failure Kidneys

Nephropathy, End stage renal disease
Peripheral vascular disease


## Introduction

## - Hypertension in the world \& Canada

Mean systolic BP men 2015


Epidemiology of hypertension in Canada


## Introduction

## - Hypertension in the world \& Canada

Hypertension prevalence, level of unawareness and uncontrolled rate

|  | HTN prevalence | Unaware | Not controlled |
| :---: | :---: | :---: | :---: |
| Canada | $22,6 \%$ | $15,7 \%$ | $31.9 \%$ |
| China | $44,7 \%$ | $55,3 \%$ | $92,8 \%$ |
| England | $30 \%$ | $35 \%$ | $72 \%$ |
| India | $29,8 \%$ | $58 \%$ | $79,8 \%$ |
| USA* | $29 \%$ | $20 \%$ | $51,7 \%$ |
| *before the 2017 guidelines |  |  |  |

Anchala, R., et al., Hypertension in India:. Journal of Hypertension, 2014. 32(6): 11701177.

Lu, J., et al., Hypertension in China: Lancet, 2017. 390(10112): p. 2549-2558.

In 2010, the main leading risk factors for global disease burden was high blood pressure (7.0\% [95\% uncertainty interval 6.2-7.7] of global DALYs)


## Introduction

- Hypertension trends


Worldwide trends BP 1975-2015:
Pooled analysis of 1479 population-based measurement studies - $19 \cdot 1$ million participants


Lancet. 2017 Jan 7;389(10064):37-55.

## Objectives of the study

- General insight:

Extract from CCHS databases (2005 \& 2015), respondents who declared being diagnosed with HBP \& create subgroups based on age and survey year
Generate descriptive statistics based on subgroups (globally)
Look at risk factors for these subgroups

- Geographical insight:

Map hypertension rate across the country in 2005 \& 2015 at health region scale
Map hypertension rate evolution from 2005 to 2015 at health region scale
Identify health regions with significantly high or low hypertension rate using geostatistics

Compare populations in these regions to pinpoint differences in risk factors

## Data

- Health data collection in Canada
- Canadian Health Measure Survey

5000 Canadians sample
Precise and reliable measures but... no geography!

## Canadian Community Health Survey

Big sample: about 130000 respondents each 2 years


Covers Canadian from 12 years old and over
Questionnaire survey (all aspect of health), but based on self declaration
Data collection is continuous but based on a 2 years cycle (new database each 2 years)
Each respondent is located in his/her own health region (enable mapping of data)
Each respondent is geographically and demographically weighted according to his/her characteristics (age structure and geographical distribution of population)

## Data

## - Geography of the CCHS

All respondents located in their respective health region
2005
117 regions across the country
2015
103 regions across the country

## - Health regions fusion

14 regions were merged to match 2015

## - Missing data

Northern health regions
Not enough population (refusal) to collect reliable data for hypertension

- Final number of geographical units


93 regions

## Data

## - Data extraction



From CCHS weighted sample in 2015: 4903358 declared having diagnosed with hypertension

## Analysis \& Results

- Descriptive statistics: Age and gender effects

| People who declared HBP: Age effect |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 40 years old \& over | 40-64 years old |  | $\mathbf{6 5}$ years old \& over |  |  |
| 2005 | 2015 | 2005 | 2015 | 2005 | 2015 |
| $24.9 \%$ | $27.3 \%$ | $18.2 \%$ | $19.5 \%$ | $44.1 \%$ | $44.3 \%$ |


| People who declared HBP: Gender effect |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 40 years old \& over |  | 40-64 years old |  | 65 years old \& over |  |
|  | 2005 | 2015 | 2005 | 2015 | 2005 | 2015 |
| Men | $\begin{aligned} & 45.8 \% \\ & (23.6 \%) \end{aligned}$ | $\begin{aligned} & 49.1 \% \\ & (27.6 \%) \end{aligned}$ | $\begin{gathered} 51.1 \% \\ (18.7 \%) \end{gathered}$ | $\begin{aligned} & 54.5 \% \\ & (21.5 \%) \end{aligned}$ | $\begin{gathered} \hline 39.7 \% \\ (39.4 \%) \end{gathered}$ | $\begin{gathered} 43.8 \% \\ (42.1 \%) \end{gathered}$ |
| Women | $\begin{gathered} 54.2 \% \\ (26.2 \%) \end{gathered}$ | $\begin{aligned} & 50.9 \% \\ & (27.1 \%) \end{aligned}$ | $\begin{gathered} 48.9 \% \\ (17.8 \%) \\ \hline \end{gathered}$ | $\begin{gathered} 45.5 \% \\ (17.7 \%) \end{gathered}$ | $\begin{aligned} & 60.3 \% \\ & (47.9 \%) \end{aligned}$ | $\begin{aligned} & 56.2 \% \\ & (46.2 \%) \\ & \hline \end{aligned}$ |


$(\%)=$ Percentage within gender

## Analysis \& Results

## - Descriptive statistics: Risk factors \& lifestyle

| People of 65 years \& over who declared having HBP |  |  |
| :--- | :---: | :---: |
|  | $\mathbf{2 0 0 5}$ | $\mathbf{2 0 1 5}$ |
| Who declared being in good, very good or excellent health condition | $67.0 \%$ | $72.9 \%$ |
| With hypertension \& diabetes | $19.4 \%$ | $25.4 \%$ |
| Who smoke daily or occasionally | $9.0 \%$ | $8.8 \%$ |
| With overweight | $40.8 \%$ | $35.7 \%$ |
| Obese people | $20.4 \%$ | $23.0 \%$ |
| With family doctor/general practitioner | $97.2 \%$ | $91.3 \%$ |
| Who consulted a family doctor/general practitioner during last 12 months | $91.7 \%$ | $82.8 \%$ |
| With post-secondary diploma | $39.3 \%$ | $46.6 \%$ |
| Proportion of immigrants | $26.0 \%$ | $28.9 \%$ |

## Analysis \& Results

- Geography of hypertension (40-64 years old)



## Analysis \& Results

- Geography of hypertension (65 years old \& over)



## Analysis \& Results

- Geography of hypertension (Evolution 2005-2015)



## Analysis \& Results

- Geography of hypertension: Hot spot/Cold spot Analysis (2005)



## Analysis \& Results

. Geography of hypertension: Hot spot/Cold spot Analysis (2015)


## Analysis \& Results

## - Geography of hypertension: Hot spot/Cold spot Analysis (40-64 years old)



## Analysis \& Results

## - Geography of hypertension: Hot spot/Cold spot Analysis (65 years old \& over)



## Analysis \& Results

## - Population characteristics in hot spot/cold spot regions

| Health Regions Sugroups Comparison <br> (Health regions with significantly lower or higher blood pressure rates) (95\% - 99\% level) |  |  |
| :---: | :---: | :---: |
| People's characteristics ( 65 years \& over) | Population living in health regions with low HBP rate (\%) | Population living in health regions with high HBP rate (\%) |
| Who declared HBP | 38.4\% | 52.7\% |
| Who declared HBP \& diabetes | 8.9\% | 12.5\% |
| Who declared HBP \& smoke daily or occas. | 3.4\% | 5.0\% |
| Who declared HBP \& overweight | 13.1\% | 17.5\% |
| Who declared HBP \& obese | 9.2\% | 15.6\% |
| Who declared being in good, very good or excellent health condition | 28.2\% | 38.4\% |
| Household income less than $40,000 \$$ | 16.7\% | 22.2\% |
| Household income more than $80,000 \$$ | 7.0\% | 11.1\% |
| With no secondary diploma | 9.2\% | 19.6\% |
| Immigrant population (born outside Canada) | 7.8\% | 7.7\% |



## Conclusion

- Hypertension is still a major problem in Canadian population, especially for people aged 65 years and older with $44 \%$ of them declaring HBP and women 46.2\%;
- Canadians over 65 years old with HBP do not seem to consider hypertension as a major health problem since $72.9 \%$ considered themselves in good, very good or excellent health in 2015 (silent killer!);
- Age \& gender are significant factors when studying hypertension in Canada;

From 2005 to 2015, Canadians 65 years and older with HBP where more prone to obesity \& diabetes;

## Conclusion

- Increase in hypertension rate in health regions is spread all over Canada, even tough some regions showed a decrease in HBP rate;
- Getis-ord analysis located a cold spot region in western Canada while a hot spot was located in Ontario (central Canada);
- Cluster of health regions with high HBP rates shows more diabetes \& more obese people even though $38.4 \%$ declared being in good, very good or excellent health;



## denis.leroux@uqtr.ca

