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

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Savoir. Surprendre.

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

• 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 « silent killer »
- 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





Hypertension in the world & Canada

Mean systolic BP men 2015



Epidemiology of hypertension in Canada



Raj S. Padwal, MD, MSc,^{a,b} Asako Bienek, MHA,^c Finlay A. McAlister, MD,^a and Norm R.C. Campbell, MD;^d for the Outcomes Research Task Force of the Canadian Hypertension Education Program Canadian Journal of Cardiology 32 (2016) 687–694

Hypertension in the world & Canada

Hypertension prevalence, level of unawareness and uncontrolled rate

	HTN prevalence	Unaware	Not controlle		d
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%	
*be					

Anchala, R., et al., *Hypertension in India:*. Journal of Hypertension, 2014. **32**(6): 1170-1177.

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 $6 \cdot 2 - 7 \cdot 7$] of global DALYs)



Hypertension trends



Worldwide trends BP 1975-2015: Pooled analysis of 1479 population-based measurement studies – 19-1 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

<u>Data</u>

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 130 000 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 <u>geographically</u> and <u>demographically</u> 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
 - <u>93 regions</u>



Data

Data extraction

1	CCHS 2 32 221	2005 resp.		CCH 109 6	IS 2015 559 res	5 p.	CCHS Data			base Description			
									2005		2015		
Re	+ 			Been	• 40 × •				Sample	Population	Sample	Population	
Re	sp. 40 78 63	88		resp.	40 y. o 1 644	/er		CCHS sample size (12 years old & over)	132 221	27 126 164	109 659	30 590 780	
								Population 40 years old & over	78 638	15 069 236	71 644	17 948 254	
	_						-	Respondents 40 & over with HBP	23 394	3 765 353	22 362	4 903 358	
Resp. 40-64 y.o).	Resp. 65 y. over		Resp. 40-64 y.o.		Resp. 65 y. over		Population 40-64 years old	50 524	11 141 387	41 822	12 339 394	
50 524		28 114		50 524		28 114		Respondents 40-64 years old with HBP	10 624	2 032 686	8 934	2 417 204	
								Population 65 years old & over	28 114	3 927 849	29 822	5 608 860	
Resp. 40-64 v.o		Resp. 65 v. over		Resp. 40-64 v.o.		Resp. 65 v. over		Respondents 65 years & over with HBP	12 770	1 732 667	13 428	2 486 154	
with HBP		with HBP	with HBP		with HBP		Source: CCHS Statistics Canada, (2005, 2015)						
10024		.2110		0 004		10 720							

From CCHS weighted sample in 2015: 4 903 358 declared having diagnosed with hypertension

Descriptive statistics: <u>Age</u> and <u>gender</u> effects

People who declared HBP: Age effect							
40 years	old & over	40-64	years old	65 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	s old & over	40-64 y	ears old	65 years old & over		
	2005	2015	2005	2015	2005	2015	
Men	45.8%	49.1%	51.1%	54.5%	39.7%	43.8%	
	(<mark>23.6%</mark>)	(<mark>27.6%</mark>)	(<mark>18.7%</mark>)	(<mark>21.5%</mark>)	(<mark>39.4%</mark>)	(42.1%)	
Women	54.2%	50.9%	48.9%	45.5%	60.3%	56.2%	
	(<mark>26.2%</mark>)	(<mark>27.1%</mark>)	(17.8%)	(17.7%)	(47.9%)	(<mark>46.2%</mark>)	

(%) = Percentage within gender



Prevalence of high blood pressure in adults ≥20 years of age by age and sex

National Health and Nutrition Examination Survey: 2007–2012.



Mozaffarian D et al. Circulation. 2015;131:e29-e322 Copyright @ American Heart Association, Inc. All rights reserved.

Descriptive statistics: Risk factors & lifestyle

People of 65 years & over who declared having HBP						
	2005	2015				
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%				

Geography of hypertension (40-64 years old)





Geography of hypertension (65 years old & over)





Geography of hypertension (Evolution 2005-2015)





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





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



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





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



Population characteristics in hot spot/cold spot regions

Health Regions Sugroups Comparison (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!);
- <u>Age</u> & <u>gender</u> 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 <u>high HBP rates</u> shows <u>more diabetes</u> & <u>more obese people</u> even though 38.4% declared being in good, very good or excellent health;



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