Which Income Measure Should We Use in Area-level Health Inequalities Research?

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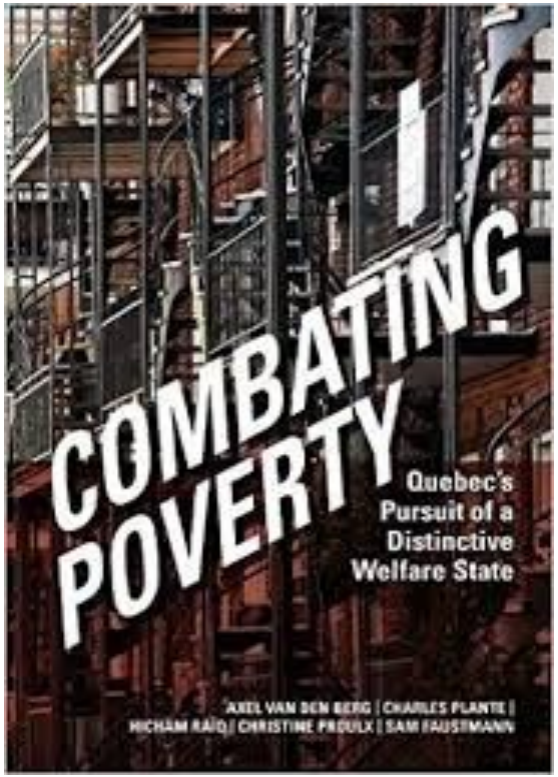
Overview

- Review how we measure income-related health inequalities
- Review how we usually measure income
- Review problems with the usual way of doing things and consider alternatives
- Propose improvements

A bit about myself

- I am the lead researcher with the UPHN
- UPHN is advancing the city-level study of health inequalities which is in turn leading us to need to think carefully about how income is measured
- But my background is in economic sociology, particularly, poverty studies

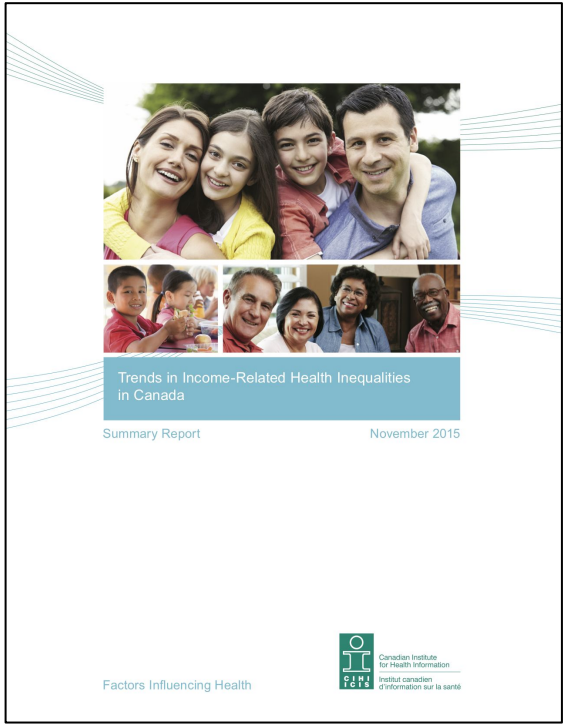


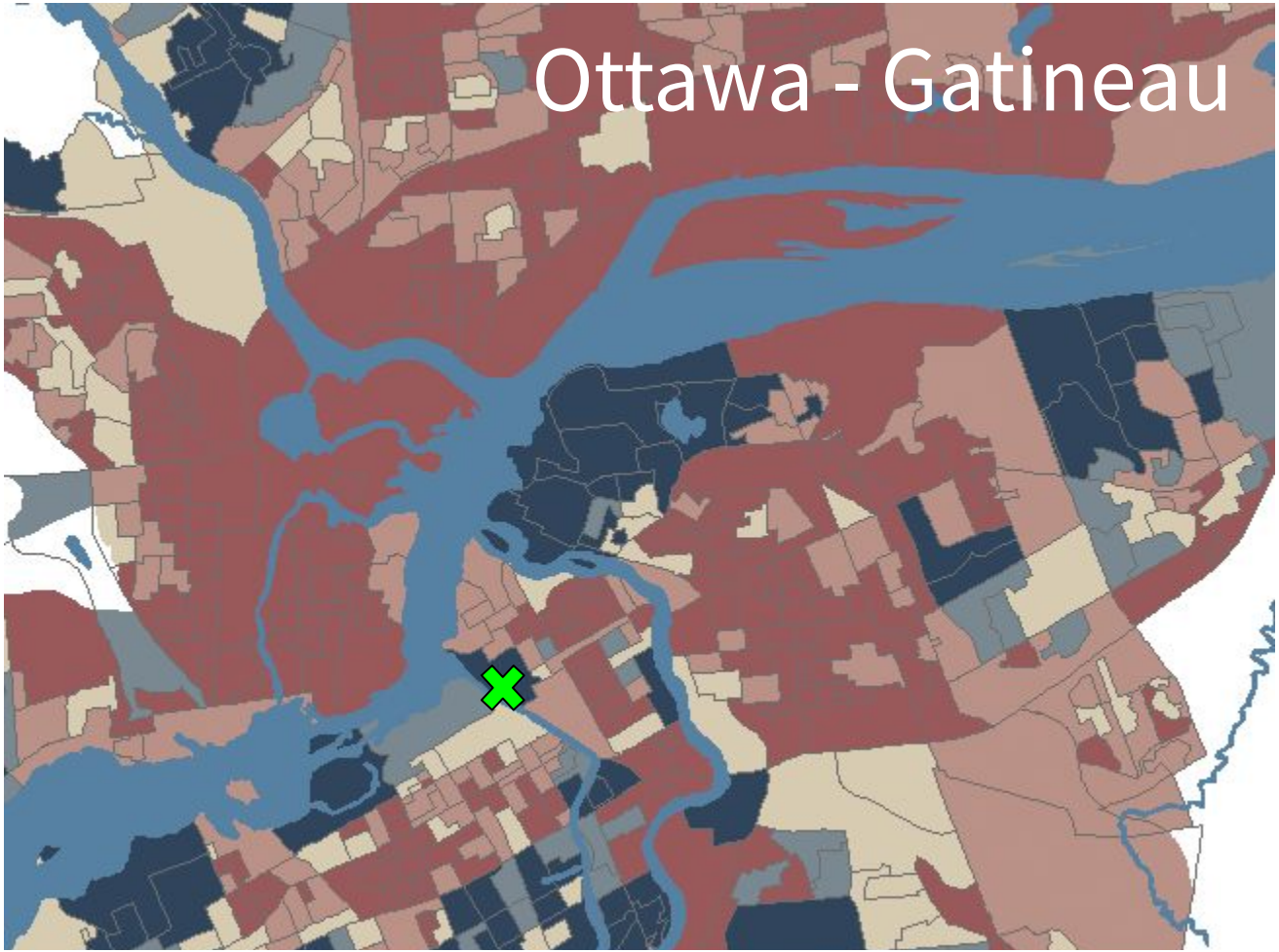
Measuring health inequalities

- Once we have selected our population, the calculation of health inequalities proceeds in three steps:
    - Information on a health outcome is gathered.
    - Rates are calculated for different groups of people based on their characteristics called “stratifiers”
    - Differences between these rates are compared using measures of inequality

“Income-related” health inequalities

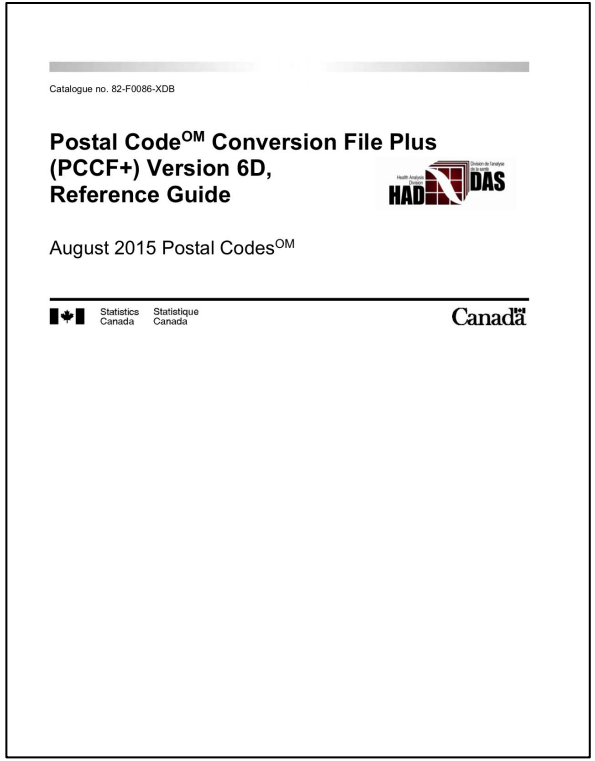
- In “income-related” health inequalities research, the stratifier is income
- In Canada, this has ordinarily been operationalized using the income quintiles that are included in the PCCF+
- This is an area-level income measure—people are sorted into groups based on which DA/neighbourhood they live in
- Some studies consider individual income but that is not my focus today




Ottawa - Gatineau

Why the PCCF+?

- A lot of administrative data has no socio-economic information in it but it does have postal codes
- The PCCF+ is a program that maps postal code data to Statistics Canada's suite of Census Geographies
- Neighbourhood in this data is defined as "Dissemination Area" (DA):
    - "Small area composed of one or more neighbouring dissemination blocks, with a population of 400 to 700 persons." (Link)



Catalogue no. 82-F0086-XDB

Postal Code^{OM} Conversion File Plus (PCCF+) Version 6D, Reference Guide

August 2015 Postal Codes^{OM}

Statistics Canada Statistique Canada

Canada

“PCCF+ income” in the past

- In the past, the PCCF+ has provided four area-level income variables:
  - QAIPPE: Quintiles, CMA/CA, Before-tax
  - QNIPPE: Quintiles, National, Before-tax
  - DAIPPE: Deciles, CMA/CA, Before-tax
  - DNIPPE: Deciles, National, Before-tax
- As best as I can tell, this was worked out in the late-1990s and we have done it this way ever since

“PCCF+ income” today

- In the latest version of the PCCF+, new after-tax versions of the above four variables are also included (New names: e.g. QAIPPE = QABTIPPE)

```
data geo_sesref ;
    infile sesref ;
    input
        @  1  PR         $2.                 /* Province                                  */
        @  3  CD         $2.                 /* Census Division                           */
        @  5  DA         $4.                 /* Dissemination Area                        */
        @  1  DA16uid    $8.                 /* Dissemination Area Unique Identifier (2016) */
        @ 10  AREA       $3.                 /* CMACA OR 'R'+PR IF NOT IN CMACA           */
        @ 13  IMPFLG     $1.                 /* IMPUTATION FLG: *=IPPE & AVHHINC IMPUTED  */
        @ 14  BTIPPE      8.                 /* BEFORE TAX IPPE VALUE                     */
        @ 23  ATIPPE      8.                 /* AFTER TAX IPPE VALUE                      */
        @ 32  QABTIPPE   $1.                 /* AREA-BASED BT QUINTILE: 1=POOREST         */
        @ 34  QNBTIPPE   $1.                 /* NATIONAL   BT QUINTILE: 1=POOREST         */
        @ 36  DABTIPPE   $2.                 /* AREA-BASED BT DECILE:   1=POOREST         */
        @ 39  DNBTIPPE   $2.                 /* NATIONAL   BT DECILE:   1=POOREST         */
        @ 42  QAATIPPE   $1.                 /* AREA-BASED AT QUINTILE: 1=POOREST         */
        @ 44  QNATIPPE   $1.                 /* NATIONAL   AT QUINTILE: 1=POOREST         */
        @ 46  DAATIPPE   $2.                 /* AREA-BASED AT DECILE:   1=POOREST         */
        @ 49  DNATIPPE   $2. ;               /* NATIONAL   AT DECILE:   1=POOREST         */
run ;
```

Different bases

- The PCCF+ provides quintiles calculated for the country as a whole and within CMA
- The reasons for using the latter are:
    - Costs of living are highly variable from city to city in Canada, particularly housing
    - It also ensures that we end up with the full distribution in every city

PCCF+ measures income oddly

- Quintiles sort an income distribution into five groups
- PCCF+ neighbourhood income is equal to:

$$\text{DA Median Household Income} \times \frac{\text{DA Population}}{\text{DA Household Adjusted Population}}$$

- Household Adjusted Population is calculated using LICO equivalents scale weights
- Quintiles are weighted by population size

How do we measure income in poverty studies?

- Of course, health research is not the only field that uses income to stratify outcomes and explore inequities
- Poverty is often operationalized in Canada as low-income—a threshold is drawn and research explores how people below this line fair
- Critically, the field does not measure income in the same way as the PCCF+

What are we trying to measure?

- The field of poverty measurement is a vast one
- Key thing: poverty measures try to capture people's capacity to participate in society (think Amartya Sen's "capabilities")
- How do we scale income reflect people's capability?
- The Low-Income Measure (LIM) is the leading measure used in poverty studies globally
    - 50% of median household adjusted after-tax income

Discrepancies

1. Before-tax vs after-tax income
2. LICO household adjustment vs. LIM household adjustment
3. National or CMA quintiles vs. national or provincial quintiles
4. Imputed median vs. actual median

What happens to health inequalities if we measure income the same way?

- I calculated city-level health inequalities for the largest cities in every province using PCCF+ income quintiles and quintiles I created myself using Census of Population files that can be accessed in the RDC
- I created national and CMA quintiles using before and after-tax income, the LIM household adjuster, and medians that were directly calculated
- I calculated rate differences for self-rated less than very good health in pooled years of the CCHS, 2001-2005, 2006-2010, 2011-2015

UPHN cities

+ Surrey
+ Mississauga
+ Laval
+ Longueuil
+ Sherbrooke
+ Fredericton

National level rates are largely similar

Table 1. Rate differences in self-reported less than very good health calculated in urban Canada using different quintile constructions, 2011-2015

Sorce	Base	Before-tax	After-tax
PCCF+	Canada	15.3%	
	CMA	15.4%	
Census	Canada	15.1%	14.7%
	CMA	14.7%	14.4%

But things change dramatically when we compare cities

- Sticking with PCCF+ income but switching between bases results in very different ranking of health inequalities calculated city-level health inequalities for the largest cities in every provi

Table 2. City rate difference rankings for self-reported less than very good health, PCCF+ CMA and national quintiles, before-tax, 2011-2015

	CMA	National	Difference
Saint John	1	1	0
Ottawa - Gatineau	2	8	-6
Sherbrooke	3	3	0
Québec	4	2	2
Victoria	5	6	-1
Regina	6	7	-1
Calgary	7	4	3
Hamilton	8	11	-3
Toronto	9	13	-4
Canada	10	12	-2
Vancouver	11	14	-3
St. John's	12	10	2
London	13	9	4
Saskatoon	14	15	-1
Halifax	15	17	-2
Winnipeg	16	16	0
Montréal	17	18	-1
Moncton	18	5	13
Edmonton	19	19	0

- Similarly, keeping quintile base and income the same, changing how we calculate medians affects rankings

Table 3. City rate difference rankings for self-reported less than very good health, PCCF+ CMA quintiles compared to census derived, before-tax, 2011-2015

	PCCF+	Census	Difference
Saint John	1	6	-5
Ottawa - Gatineau	2	5	-3
Sherbrooke	3	7	-4
Québec	4	1	3
Victoria	5	16	-11
Regina	6	19	-13
Calgary	7	2	5
Hamilton	8	9	-1
Toronto	9	15	-6
Canada	10	11	-1
Vancouver	11	13	-2
St. John's	12	12	0
London	13	3	10
Saskatoon	14	8	6
Halifax	15	10	5
Winnipeg	16	14	2
Montréal	17	18	-1
Moncton	18	4	14
Edmonton	19	17	2

- Selecting between before- and after-tax is also a non-trivial choice

Table 4. City rate difference rankings for self-reported less than very good health, census derived CMA quintiles, before and after-tax, 2011-2015

	Before-tax	After-tax	Difference
Québec	1	2	-1
Calgary	2	4	-2
London	3	8	-5
Moncton	4	6	-2
Ottawa - Gatineau	5	9	-4
Saint John	6	1	5
Sherbrooke	7	3	4
Saskatoon	8	12	-4
Hamilton	9	11	-2
Halifax	10	17	-7
Canada	11	13	-2
St. John's	12	7	5
Vancouver	13	16	-3
Winnipeg	14	15	-1
Toronto	15	14	1
Victoria	16	5	11
Edmonton	17	19	-2
Montréal	18	18	0
Regina	19	10	9

Table 5. City rate difference rankings for self-reported less than very good health, PCCF+ and census derived CMA quintiles, past and present

	PCCF+			Census			
	2011-2015	2001-2015	Difference	2011-2015	2001-2015	Difference	DD
Saint John	1	16	-15	5	18	-13	-2
Ottawa - Gatineau	2	11	-9	4	9	-5	-4
Sherbrooke	3	8	-5	6	7	-1	-4
Québec	4	15	-11	1	11	-10	-1
Victoria	5	9	-4	15	5	10	-14
Regina	6	1	5	18	1	17	-12
Calgary	7	2	5	2	2	0	5
Hamilton	8	3	5	8	4	4	1
Toronto	9	18	-9	14	17	-3	-6
Canada	10	12	-2	10	12	-2	0
Vancouver	11	5	6	12	3	9	-3
St. John's	12	17	-5	11	15	-4	-1
London	13	10	3	3	13	-10	13
Saskatoon	14	7	7	7	10	-3	10
Halifax	15	6	9	9	8	1	8
Winnipeg	16	14	2	13	14	-1	3
Montréal	17	13	4	17	16	1	3
Edmonton	18	4	14	16	6	10	4

- Discrepancies between methodological choices are magnified over time

We need to make our methodological choices carefully

Income for comparative city-level analysis

- I think health researchers should operationalize income in the same way as social scientists
- Use median household adjusted after-tax income—ideally, these medians should be measured directly
- The base should probably be at the city (or at least provincial) level
- If you are limited to using PCCF+ variables and not doing historical work, you should use QAATIPPE

Health informing social science

- At this time, health is the only field that ordinarily uses relative income concepts based at the city-level
- However, we have seen some reports in poverty studies that have begun to consider this option
- The regionality of health authorities has led the field of health to ask these questions first

We have the data—we just need to use it

- QAATIPPE is a problematic variable and we also do not have it going back in time
- In the past, it would have been very difficult to backcast QAATIPPE but we actually have all the data we now need
- Detailed taxfiler data is available to researchers vis Statcan's RDC program going back to the 1990s—we can estimate year-over-year income quintiles

My next steps

- This is my first presentation on this topic and I plan to work on it more in the future
- I would like to take on developing a historic area-level income quintile measure in the medium-term
- More work is needed to explore impact on additional health indicators
- Work will be needed to validate new approach within individual cities

Thank you.

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