Social Determinants of Health

How COVID and Other Diseases Exploit Inequality

Canadian Society of Hospital Pharmacists
Alberta Branch

Faculty/Presenter Disclosure

- **Presenter:** Tony Nickonchuk

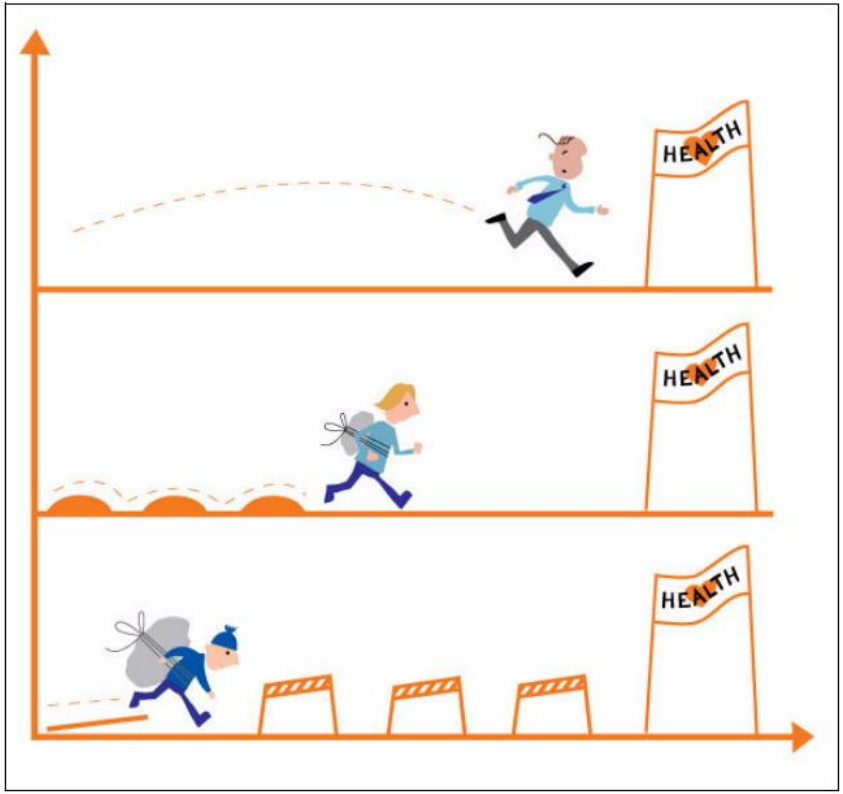
- **Relationships that may introduce potential bias and/or conflict of interest:**
  - **Grants/Research Support:** N/A
  - **Speakers Bureau/Honoraria:** Tony Nickonchuk has received speaking fees and expense support from the Alberta College of Family Physicians and a speaker fee from the Alberta Medical Association.
  - **Consulting Fees:** N/A
  - **Other:** N/A

What are social determinants of health?

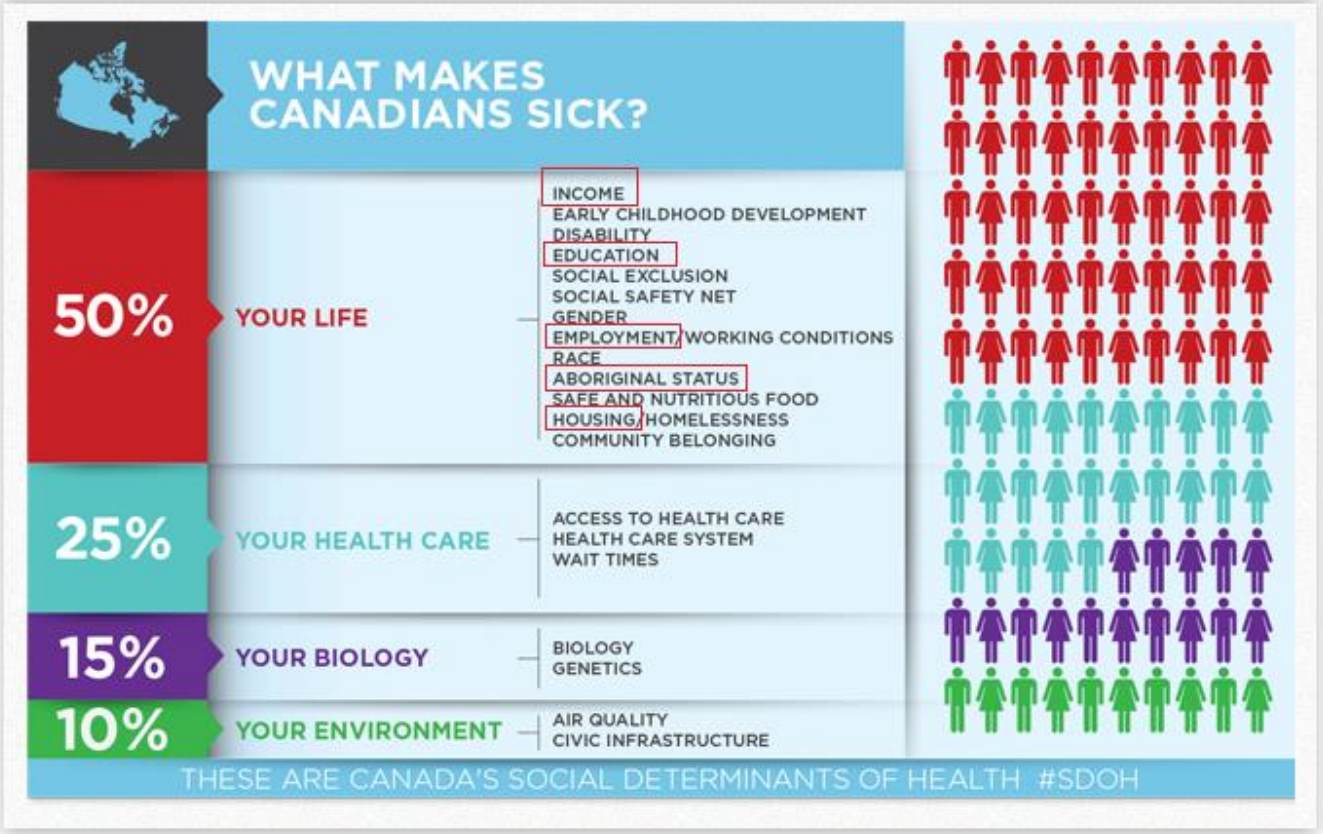
World Health Organization (WHO) defines social determinants of health (SDH) as:

> "The conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems."[1]

1. CMAJ Dec 6;188(17-18):E474-E483



2. Available at: https://goo.gl/dtJRPK Accessed: Sep 29 2017



3. Available at: https://goo.gl/y9ikQv Accessed: Sep 29 2017

A Word on Methodology

- In this area of study, randomized controlled trials are nonexistent
- Studies rely on lots of population-based cohort studies
- As such, causality is difficult to determine, although some try

Lung Cancer Analogy

- It was not until many lines of evidence converged in the 20th century that the link between cigarettes and lung cancer was firmly established
- Animal studies, cellular pathology, studies on individual carcinogenic substances, and robust population-based research
- Even with that, because of competing PR campaigns, in the 50s and 60s only 40% of the public believed smoking is a cause of lung cancer and only ⅓ of doctors (over 40% of doctors were regular smokers as well)

4. Tob Control. 2012;21:87-91.

The Evidence

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What Factors Are Associated with Outcomes?

- Many social determinants are linked to health outcomes
- Will focus on the four most frequently studied and measured:
  - Educational attainment
  - Income
  - Employment
  - Housing

Improving Prediction of Outcomes

- Prospective cohort study of CHD outcomes
- Predictions on Framingham alone were 3.7% and 3.9% for higher socioeconomic status (SES) and lower SES individuals, respectively
- Predictions that added SES to the model were 3.1% and 5.2%, respectively
- Actual observed outcomes in the cohort were 3.2% and 5.6%

6. Am Heart J. 2009 Jun;157(6):988-94.

SES as Determinant of Premature Mortality

- 2011, WHO released the 25x25 initiative, a plan to cut mortality from non-communicable diseases by 25% by 2025
- Looked at conventional risk factors:
  - Smoking
  - Diabetes
  - Physical inactivity
  - Alcohol
  - Hypertension
  - Obesity
- Did not look at SES

7. Lancet. 2017 Mar 25;389(10075):1229-1237

SES as Determinant of Premature Mortality

- Study looked at cohort of 1.7 million people in high-income countries, representing 26.6 million person-years
- Wanted to determine if SES had as much impact as other risk factors, and whether it should be focus of interventional efforts

7. Lancet. 2017 Mar 25;389(10075):1229-1237

SES as Determinant of Premature Mortality

Population Attributable Fraction (% reduction in premature mortality if impact of risk factor was eliminated)

Risk Factor	Men	Women
Smoking	29%	21%
Physical inactivity	26%	23%
SES	19%	15%
Hypertension	10%	8%
Diabetes	6%	7%
High alcohol intake	4%	3%
Obesity	-6% (NSS)	4%

7. Lancet. 2017 Mar 25;389(10075):1229-1237

Education as a Determinant

- Analysis of 3.5 million deaths in 16 European countries
- In total, 1,333 more deaths per 100,000 person-years for lowest education vs highest education
- Masks major regional differences:
  - Northern and western Europe difference was 811
  - Eastern Europe the difference was 2,204
  - In Mediterranean, differences due to education attenuated by very little inequality in death from CVD

8. NEJM. 2008;358:2468-81

Income as a Determinant

- Massive study that evaluated 1.4 BILLION deidentified tax records and matched them to Social Security Administration death records
- Time period 2001-2014
- Gap in life expectancy between poorest 1% and wealthiest 1%:
  - 14.6 years for men and 10.1 years for women
- Over the time period, life expectancy increases accrued unequally, with those in the top 5% gaining on average 2 more years of life expectancy than those in the bottom 5%

9. JAMA. 2016;315(16):1750-66.

Income as a Determinant

- Also differences in life expectancy among low income individuals between regions
- When comparing low income individuals across regions, life expectancy:
  - -ve correlation with poor health behaviours, especially smoking
  - +ve correlation with local area fraction of immigrants, fraction of college graduates, and government expenditures

9. JAMA. 2016;315(16):1750-66.

Confounding Factors?

- Poor health behaviours also associated with SES
- Evaluation of British Whitehall II and French GAZEL cohorts
- Both cohorts had strong socioeconomic gradients for mortality
- British cohort, poor health behaviours closely associated with SES; differences in mortality mostly eliminated when health behaviours controlled for
  - Except for CVD mortality
- French cohort, little difference in behaviours between SES groups so differences in mortality remained even after controlling

10. PLoS Med. 2011 Feb;8(2):e1000419

Oh Canada!!

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Census Cohort

- 2.7 million people followed for more than 10 years
- Lung cancer incidence:
  - If all same incidence as those with university degree, 127 fewer per 100,000
  - If all same incidence as highest income quintile, 133 fewer per 100,000
  - If all same incidence as managerial occupations, 208 fewer per 100,000
- Age-standardized mortality rates
  - Highest among those with least education, and vice versa
  - If all same rate as highest education group, 1,000 fewer deaths per 100,000 population

11. Health Rep. 2015 Jun;26(6):12-20.
12. Health Rep. 2012 Sep;23(3):23-31.

Inequality Comes With a Cost

- Study looked at 55,000 Ontarians and how likely they were to be a high-cost user (HCU) of healthcare resources 5 years later
- HCU=5% of population that accounts for ⅔ of expenses
- Odds ratios for becoming a HCU:
  - Low household income versus high: 1.30 (1.15, 1.48)
  - No post-secondary ed vs some: 1.27 (1.17, 1.38)
  - Food insecure vs food secure: 1.46 (1.24, 1.71)
  - Immigrant vs Canadian born: 0.87 (0.80, 0.95)

13. AJPM. 2015;49(2):161-71.

One Nation, Divisible

- Substantial inequality between non-First Nations and First Nations Canadians on social determinants and health outcomes
- In 2015, Canada ranked 10th on the UN human development index
- The same calculations for First Nations Canada only yield a rank of 71st, putting them in the same company as Venezuela, Cuba, Iran, Georgia, Turkey and Sri Lanka

14. Author's calculations using Statistics Canada data and UN HDI calculator; available at https://goo.gl/k3QVN5

Alberta First Nations Trends

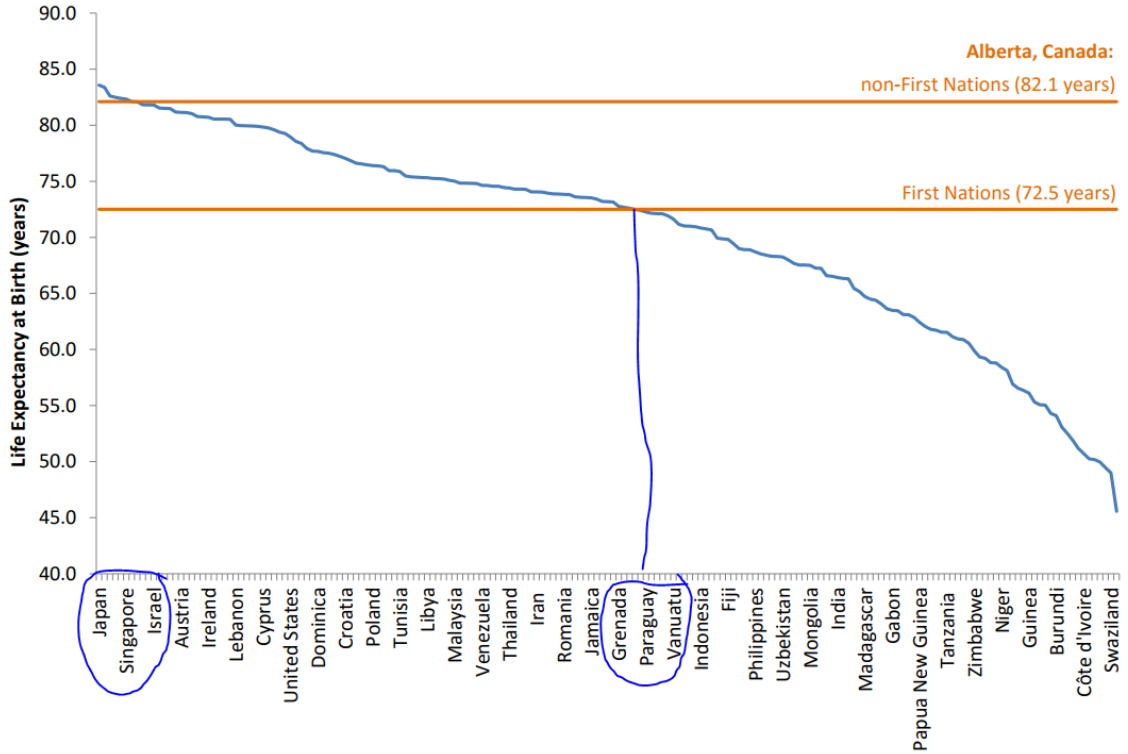
- Age-standardized mortality rate Alberta First Nations double that of non-First Nations, as are infant mortality rates, ED visit rates, opioid dispensing rates, rates of death due to unintentional injury, diabetes prevalence, chronic kidney dialysis prevalence,
- Infant mortality rates are double; more similar to Uruguay & China
- Age-standardized suicide rates are triple, as are lower leg amputations among diabetics
- Among women, rates of death due to assault are 7 times

15. Alberta First Nations Information Governance Centre. First Nations Health Trends-Alberta. Available at: https://goo.gl/Utofzx

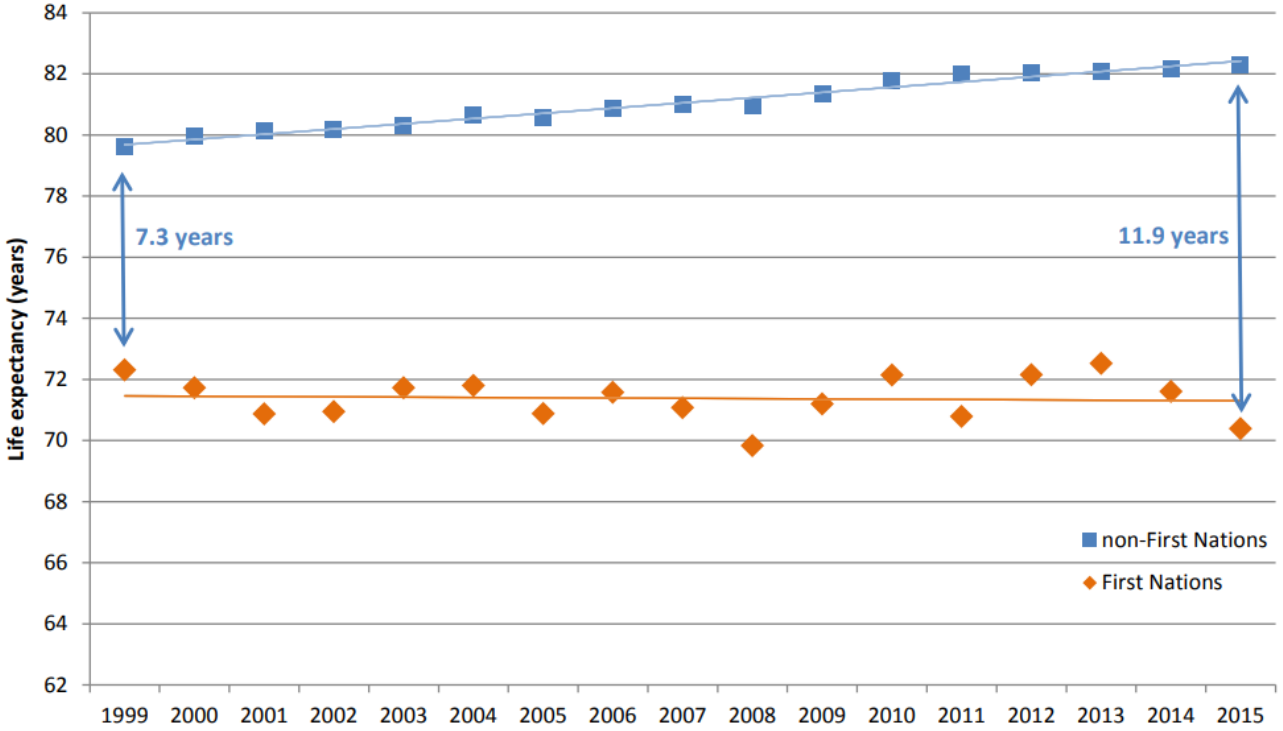
Loss of Life

- Life expectancy at birth for First Nations in Alberta is 10 years shorter than that of non-First Nations
- Gap has grown over time, not shrunk

15. Alberta First Nations Information Governance Centre. First Nations Health Trends-Alberta. Available at: https://goo.gl/Utofzx



15. Alberta First Nations Information Governance Centre. First Nations Health Trends-Alberta. Available at: https://goo.gl/Utofzx



15. Alberta First Nations Information Governance Centre. First Nations Health Trends-Alberta. Available at: https://goo.gl/Utofzx

A Closer Look at Income Inequality

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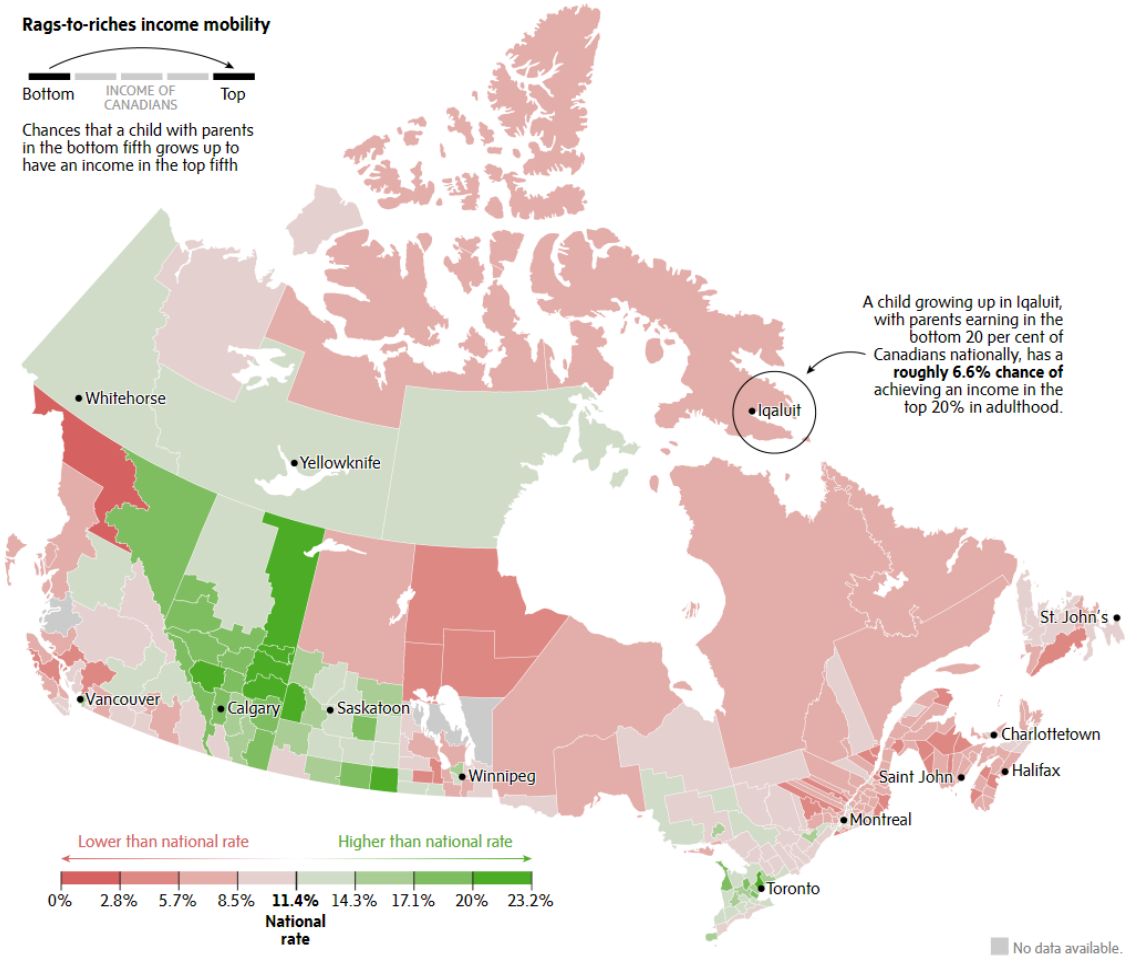
Not as Equal as We Think

- Economist Miles Corak
- Evaluation of millions of individual income tax datasets of individuals born between 1963 and 1970
- Looked at how where they’re born influenced their likelihood of having higher relative income than their parents, regardless of where they live later in life

16. A tale of two Canadas. Globe and Mail Available at: https://goo.gl/SAL9Zw



16. A tale of two Canadas. Globe and Mail Available at: https://goo.gl/SAL9Zw

Inequality in Canada

- From 1993 to 2011, income ratio between the highest income quintile and the lowest went from 4.82 to 5.44
- Income inequality aligns with other inequalities as well
  - 18% in lowest income group attend university, versus 40% in highest
  - This in turn impacts employment; lowest educated have 11.6% unemployment vs 4.7% for highest educated
  - Living in unacceptable housing with no access to alternatives: 50% lowest income, 0% highest
  - Food insecurity: 15% lowest income, 0.7% highest
  - Smoking: 29% lowest income, 15% highest

17. CIHI. Trends in Income-Related Health Inequalities in Canada.
Available at: https://goo.gl/fGzeb1

Addressing Inequality

Condition/Outcome	Change if No Inequality (#)	% of Total
COPD hospitalizations	-18,700	45%
Diabetes prevalence	-673,700	32%
Alcohol-related hospitalizations	-9,000	32%
Mental illness hospitalizations	-40,300	27%
MI hospitalizations	-11,000	15%
Infant mortality	-300	15%

17. CIHI. Trends in Income-Related Health Inequalities in Canada. Available at: https://goo.gl/fGzeb1

Moving to Opportunity

- Similar research as above done in US; strong relationship between where born and income mobility
- Experiment took 4600 low-income families living in public housing
- Group 1: housing vouchers but HAD to move to lower poverty neighborhood
- Group 2: housing vouchers but freedom of movement
- Group 3: Nothing

18. Moving to Opportunity. Available at: https://goo.gl/tNQs6X

Moving to Opportunity

- Children who moved before age 13:
  - More likely to be higher income as adults
  - More likely to attend college
  - Less likely to be single parent
- Effect weakened longer they stayed in original neighborhood; past age 13 it had a negative effect
- Cost of program implementation: ~$3800 per family
- Added tax revenue due to higher earnings: ~$22,400 per family

18. Moving to Opportunity. Available at: https://goo.gl/tNQs6X

Economics of Inequality

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Economics of Inequality

- Socioeconomic status differences account for roughly 35-40% of hospitalization rates in Canada
- Average lifetime health care costs 15% higher in lowest income group vs highest
  - 60% if consider any given year
- Over lifetime, lowest income group pays 5.8% of their income as taxes to fund health care; highest income group: 7.5%
- In absolute values, most funding comes from highest income group:
  - Top quintile makes 40% of the income and funds 47% of the system

19. CIHI. Hospitalization disparities. Available at: https://goo.gl/8x75ns
20. CIHI. Distributional effects. Available at: https://goo.gl/1oHyaE

Money Isn’t Always the Answer

- Law of diminishing returns
- In high income nations with generally high population health, only a weak relationship between public health spending and health outcomes
- More differences within Canada than between Canada and other nations

21. Department of Finance Working Paper. Available at: https://goo.gl/nTLktp

Spend It Wisely

- Total public expenditure in provinces does not seem to impact health outcomes
- Most positive impact comes from the following areas:
  - Medical care (not including hospitals)
  - Preventive care
  - Other social services (for those in need; elderly, disabled, temporary unemployment)
  - Post secondary education

22. J Epidemiol Community Health 2015;69:970-977

Bang for Your Buck

Intervention	Increase in $ Per Capita*	Total Spending Increase for Alberta** ($ millions)	Decrease in Mortality Per 100,000	Total Deaths Prevented**	$ Per Prevented Death ($1000s)
Preventive care	$26.76	$113	5	~210	$540
Post-secondary	$133.95	$567	16	~680	$835
Other social services	$128.80	$546	13	~550	$992
Medical care	$264.28	$1120	20	~850	$1320
Total expenses	$894.79	$3790	9	~380	$9975

22. J Epidemiol Community Health 2015;69:970-977; Presenter's calculations
*In 2016 CAD, converted using https://goo.gl/j71sH
**Based on 2016 Alberta census population, available here https://goo.gl/cw2Y2

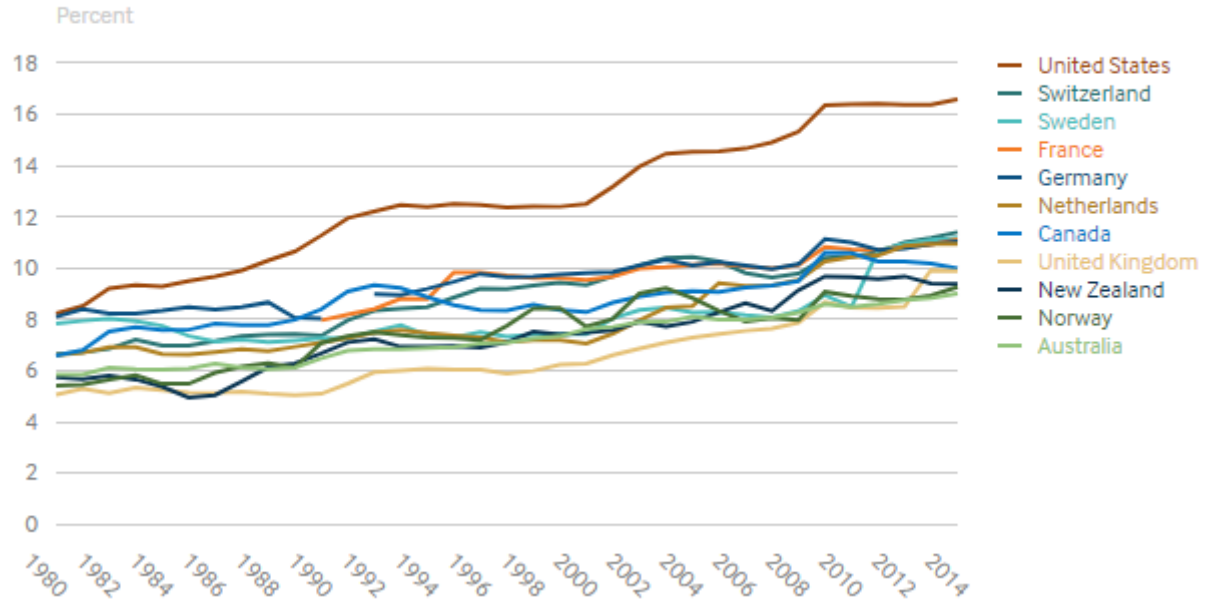
International Social Spending

- Among developed nations, public social expenditure is more closely correlated with health outcomes than health spending
- Most have grown social spending faster than health spending over time; US has gone in other direction
- They're a major outlier: 23rd in social spending, 1st in health spending; 27th in life expectancy
- Benefits of social spending take time to fully accrue
- Higher the inequality, the stronger the association between social spending and outcomes

23. RAND Europe. Health outcomes & social expenditures. Available at: https://goo.gl/2FQoeX

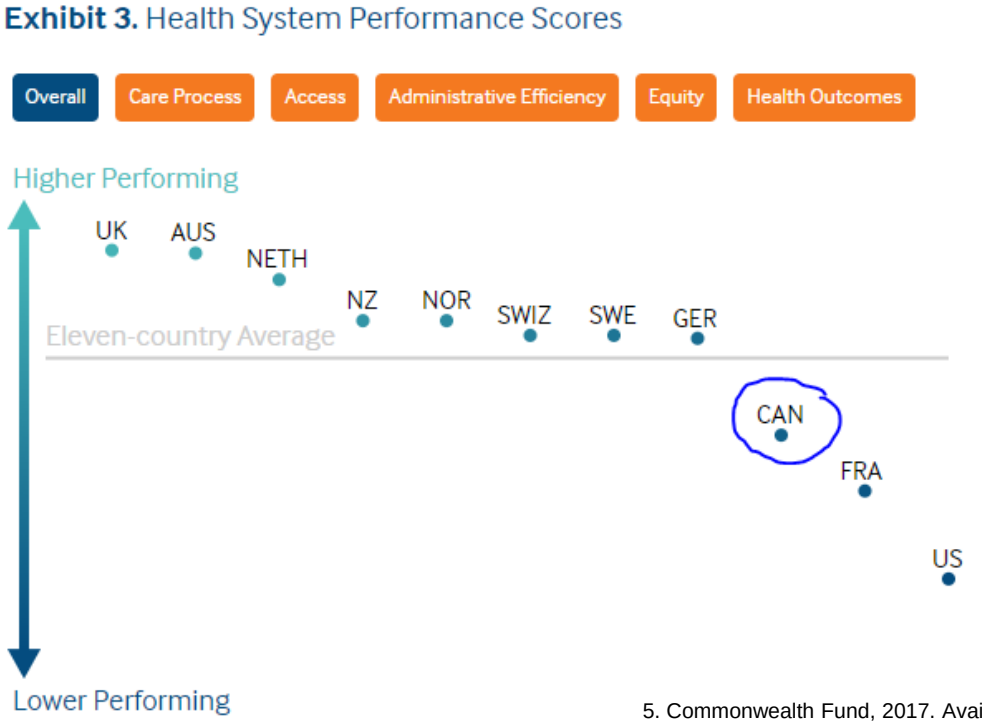
U.S.A.=Uniquely Substandard Attributes

Exhibit 1. Health Care Spending as a Percentage of GDP, 1980–2014



5. Commonwealth Fund, 2017. Available at: https://goo.gl/AoA2dU

U.S.A.=Uniquely Substandard Attributes



5. Commonwealth Fund, 2017. Available at: https://goo.gl/AoA2dU

A Look at Our World

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Analysis of Inequality

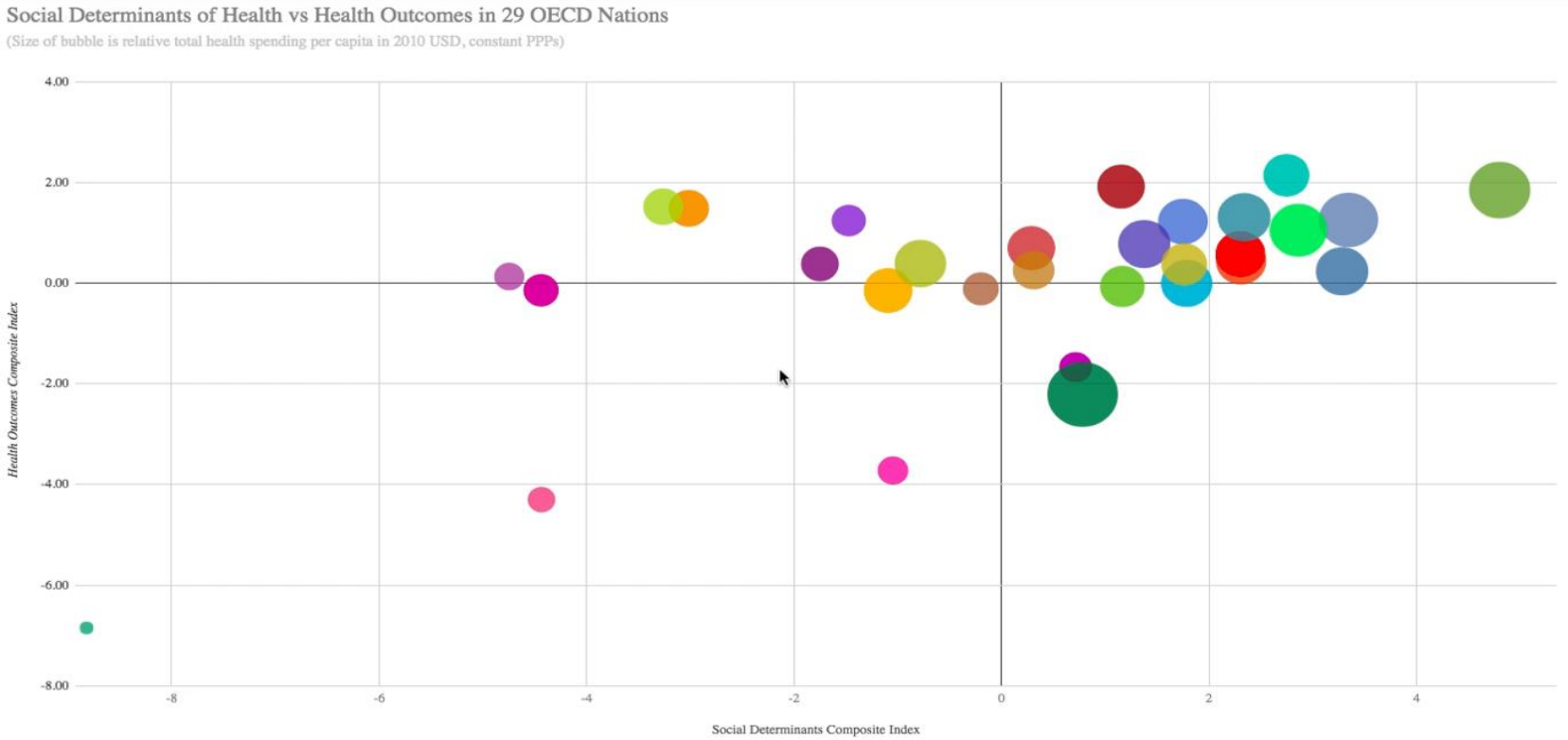
- For detailed methodology and all raw data, please contact me at nickonchuks@gmail.com
- Broadly:
  - Found determinants associated with health outcomes
  - Created composite determinants index
  - Also created outcomes index, a composition of potential years of life lost and life expectancy
- My rankings correlated 94% with those of the Conference Board of Canada

27. Conference Board of Canada. How Canada Performs. Available at https://goo.gl/DrS6PN

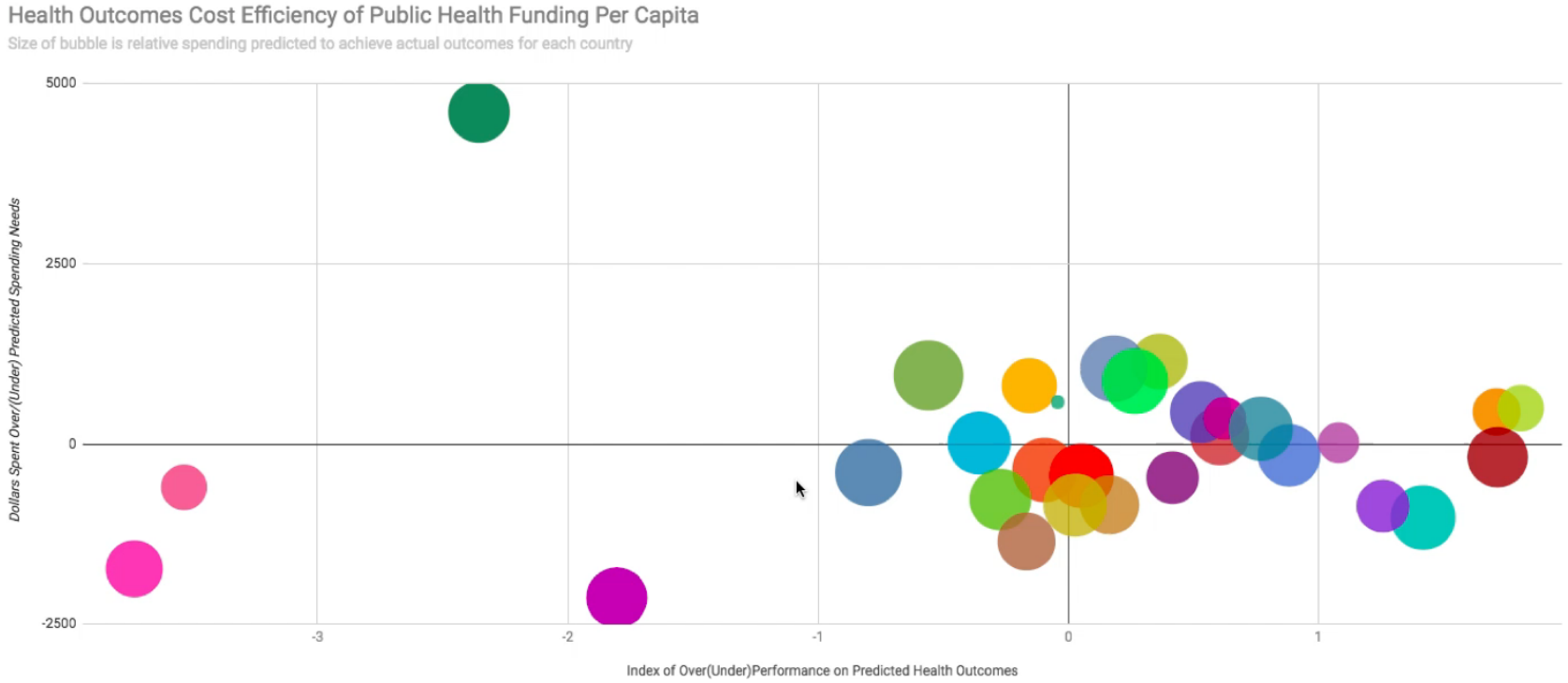
International Comparison

- Determinants in descending order of strength of association
  - Homicide rate
  - Household net adjusted disposable income
  - Educational attainment
  - Employment rate
  - Percentage of dwellings without basic facilities
- Outcomes
  - Potential years of life lost per 100,000 population
  - Life expectancy at birth
- Correlation=0.88; explains roughly 73% of differences
- Access data here: https://goo.gl/FJgYyo

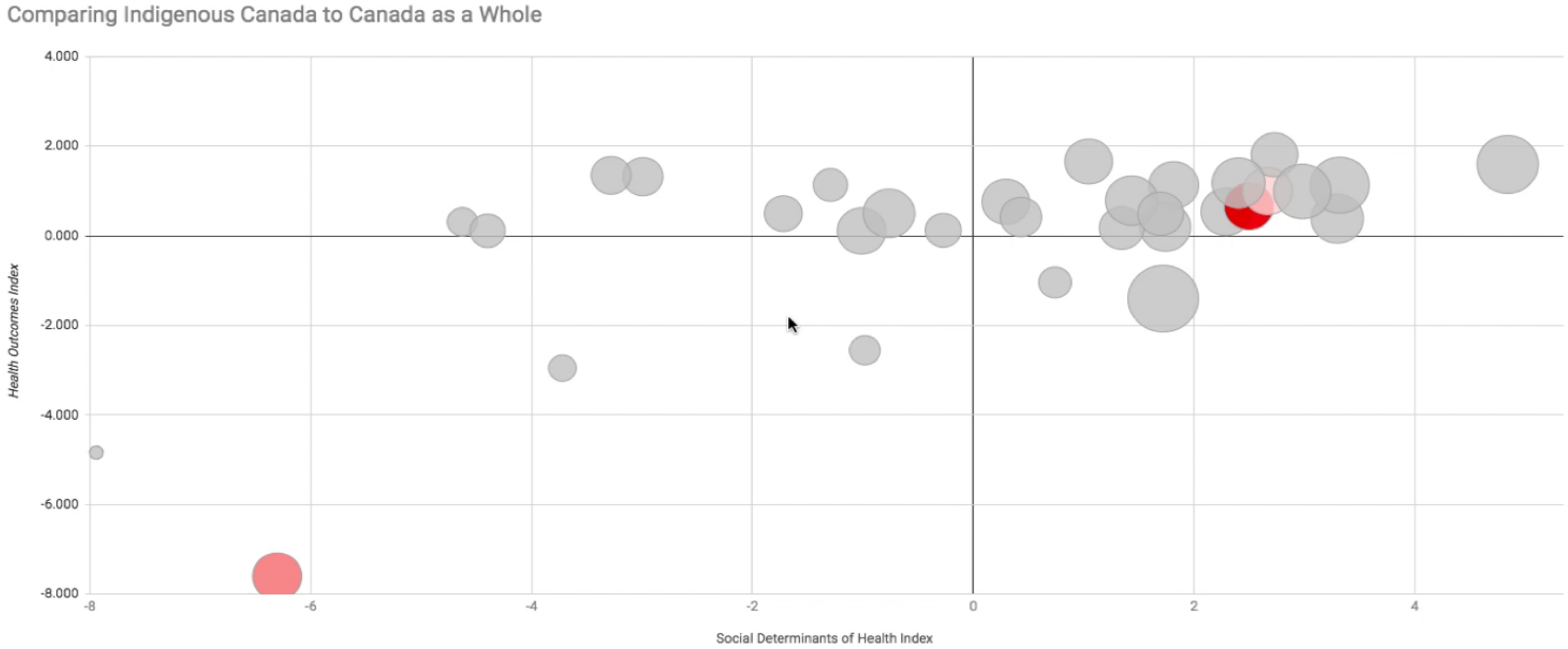
International Comparison



International Comparison

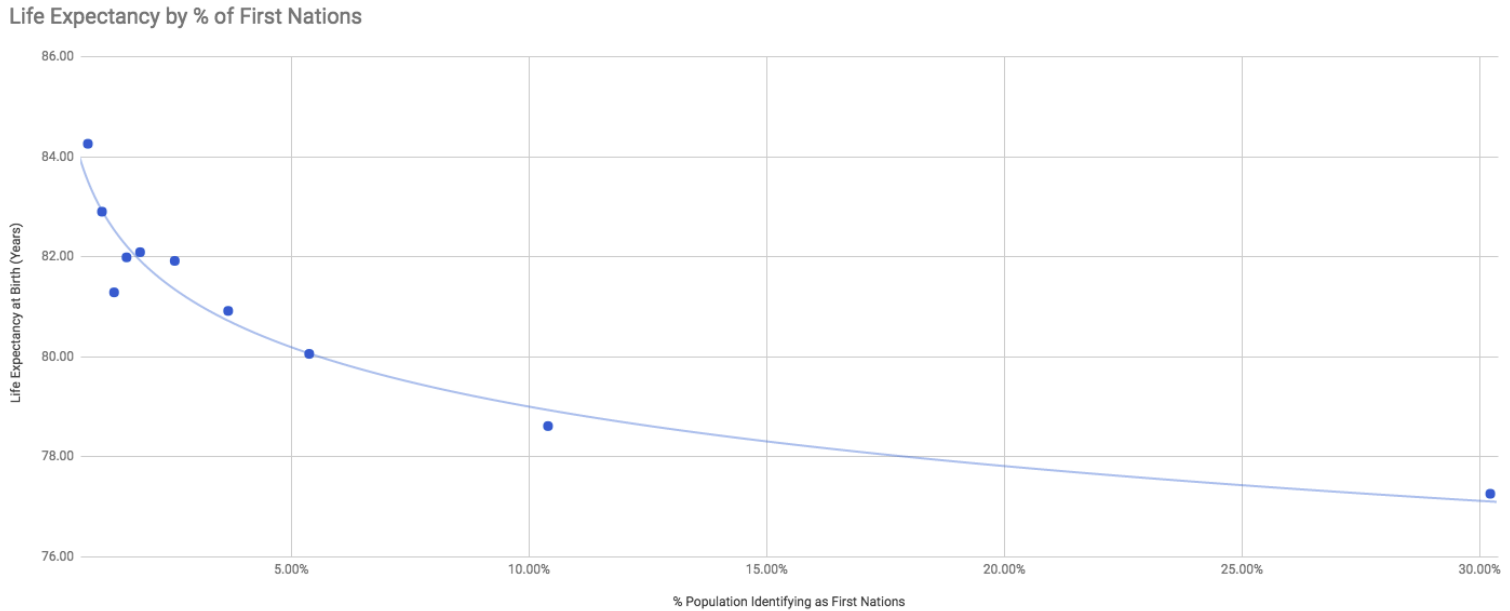


Indigenous Canada vs Non-Indigenous

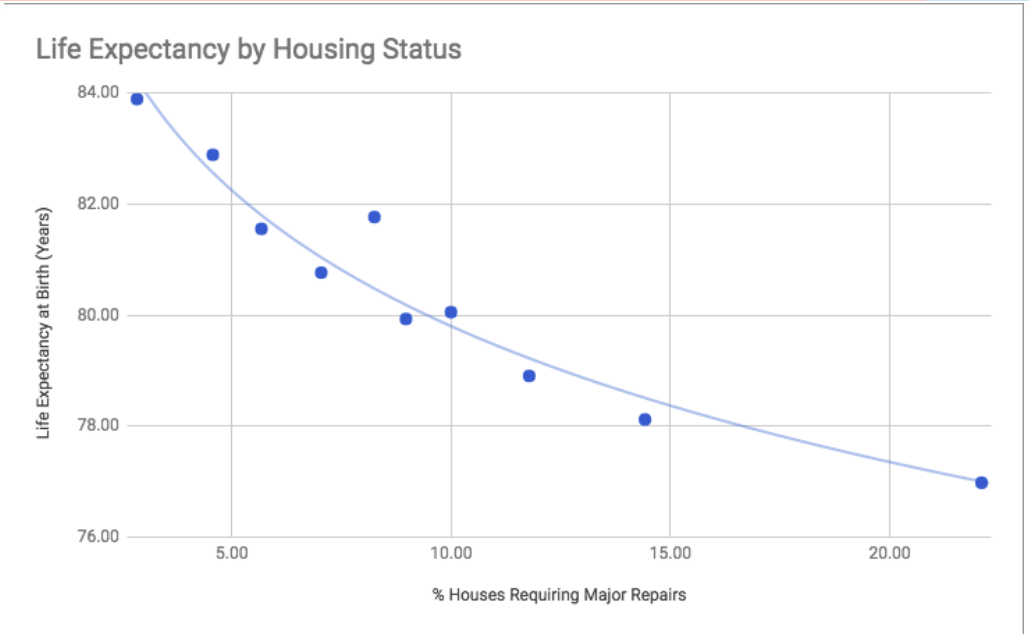


Alberta Inequality Study

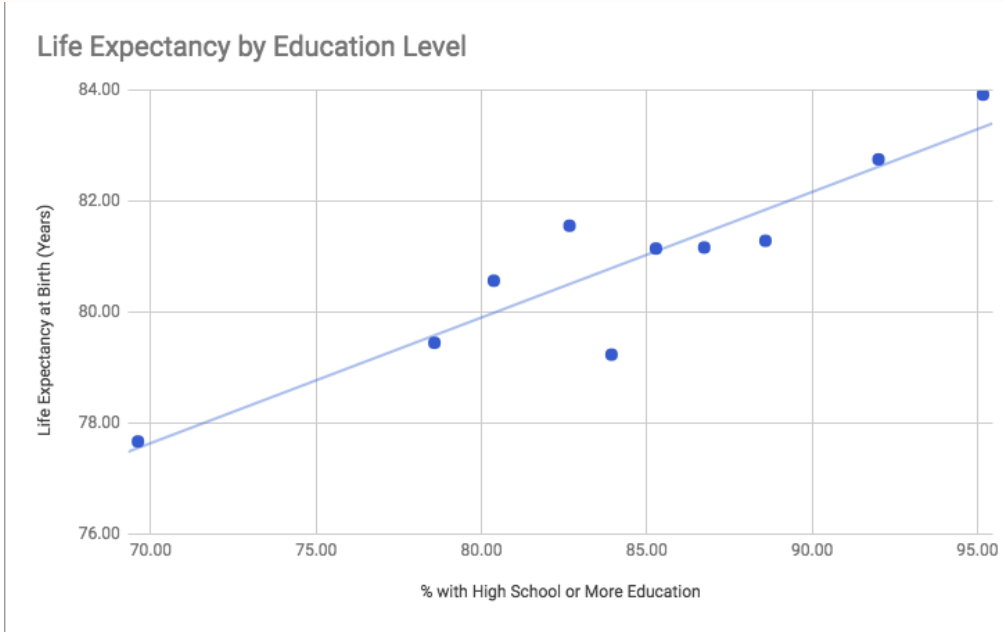
- 132 geographic regions within Alberta
- Determinants
  - % of population with high school or more education
  - % of houses needing major repairs
  - % of population identifying as First Nations
- Outcomes
  - Potential years of life lost per 100,000
  - Life expectancy
- Correlation=0.86; explains roughly 75% of differences
- Access data here: https://goo.gl/vPiAvW



- 10% of regions in Alberta with highest proportion of First Nations have life expectancy 6.5 years less than those with lowest proportion
- Every 1% increase in First Nations population lowers regional life expectancy by ~2 months
- If every decile had same life expectancy as highest decile, would add 10.95 million person-years

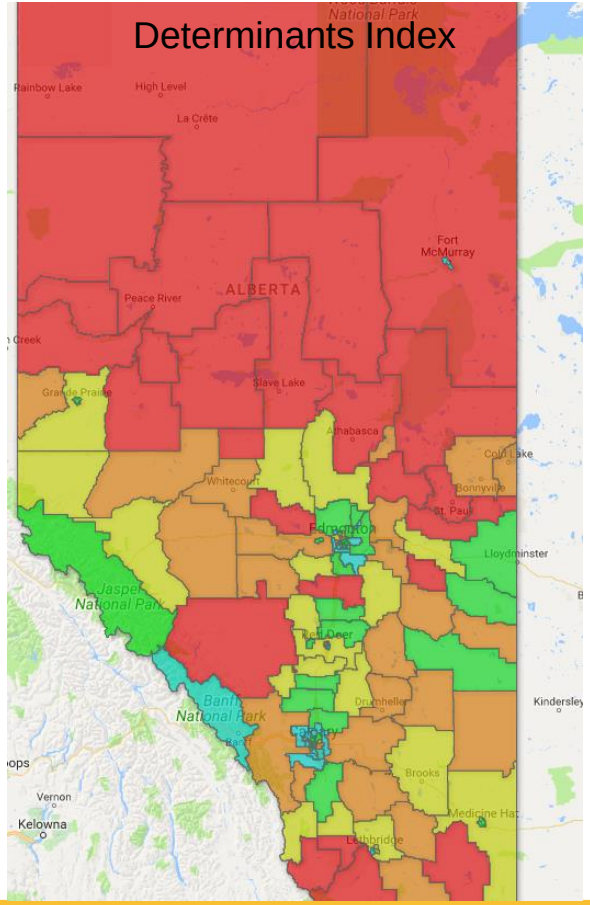


- 10% of regions in Alberta with highest proportion of housing needing major repairs have life expectancy 6.9 years less than those with lowest proportion
- Every 1% increase in % of housing needing major repairs lowers regional life expectancy by ~4 months
- If every decile had same life expectancy as highest decile, would add 9.4 million person-years

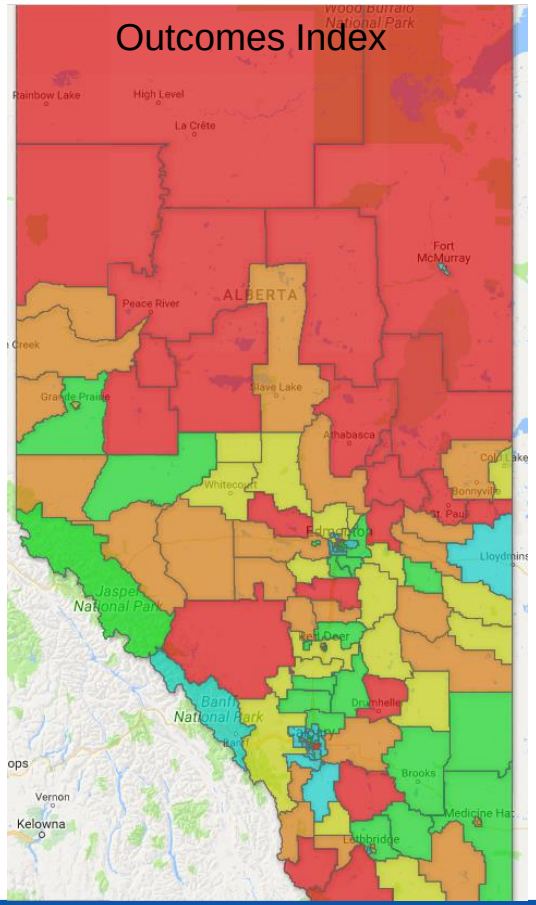


- 10% of regions in Alberta with highest proportion of those with high school or more education have life expectancy 6.3 years more than those with lowest proportion
- Every 1% increase in % of with high school or higher education increases regional life expectancy by ~2.5 months
- If every decile had same life expectancy as highest decile, would add 9.5 million person-years

Determinants Index



Outcomes Index



What Can You Do?

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COVID and Social Determinants of Health

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Racial Disparities

- African-Americans overrepresented among COVID patients
  - Georgia hospitalized COVID patients 80% black vs 30% of the general population
  - Louisiana 56% of COVID deaths were black vs 33% of population
  - Michigan 40% of deaths black vs 14% of population
  - Black death rate 3x that of white in Chicago, 2x in NYC

https://www.publichealthontario.ca/-/media/documents/ncov/covid-wwksf/2020/05/what-we-know-social-determinants-health.pdf?la=en

Racial Disparities

- UK visible minorities disproportionate mortality rates
  - 4x for black, 3-4x for Indian/Bangladeshi/Pakistani
- US and UK, COVID mortality strongly associated with neighborhood characteristics like minority population, poverty, crowding, and material deprivation
- One UK study found severe COVID-19 independently associated with:
  - Black, Asian, Middle-Eastern minority status
  - Male sex
  - Higher BMI
  - Area material deprivation
  - Household overcrowding

https://www.publichealthontario.ca/-/media/documents/ncov/covid-wwksf/2020/05/what-we-know-social-determinants-health.pdf?la=en
https://pubmed.ncbi.nlm.nih.gov/32556213/

Other Variables

- Analysis of 84 countries found that COVID mortality was positively associated with income inequality, even after controlling for population size, age, and wealth
- Analysis of 57 countries compared measures of ”cultural tightness” against COVID cases and deaths
  - Conclusion?
    - Compared with nations with high levels of cultural tightness, those with low levels are estimated to have had:
      - ~5x the number of cases
      - ~8.7x the number of deaths
      - Even after controlling for multiple variables
  - Authors conclude that “tightening social norms might confer an evolutionary advantage in times of collective threat”

https://pubmed.ncbi.nlm.nih.gov/32981770/
https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(20)30301-6/fulltext

Regional Disparity

- Analysis of county-level data showed significant increase in COVID mortality associated with various social determinants

1% Increase in Percentage in County	Percentage Increase in COVID Death Rate
Black residents	0.9%
Uninsured adults	1.9%
Households w/o internet	3.4%
Adults w/o high school diploma	3.5%
Incarceration rate	5.4%

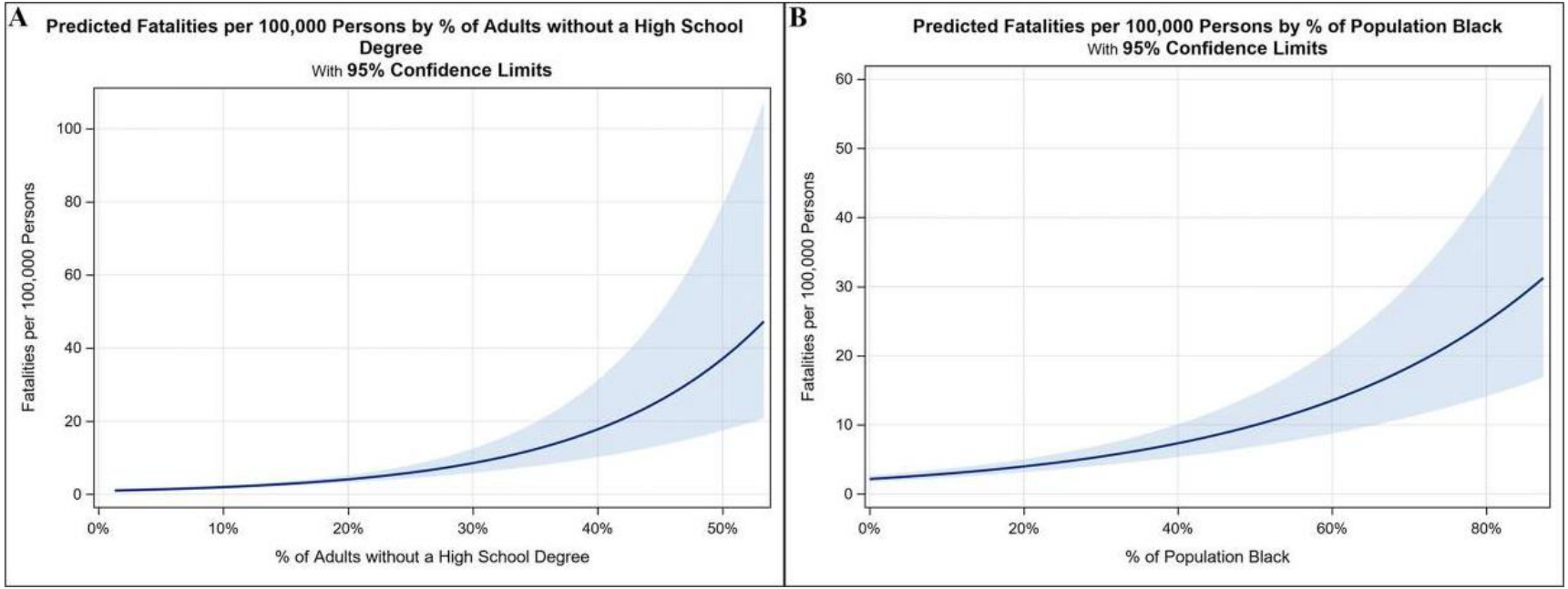
https://pubmed.ncbi.nlm.nih.gov/33403652/

Regional Disparity

- Another analysis of 1.1 million cases and ~62,000 deaths in 3127 US counties
  - Two socio-economic determinants of health with strongest association with cases and fatalities were:
    - Percentage of adults without high school degree
    - Proportion of black residents

https://pubmed.ncbi.nlm.nih.gov/33227595/

Regional Disparity

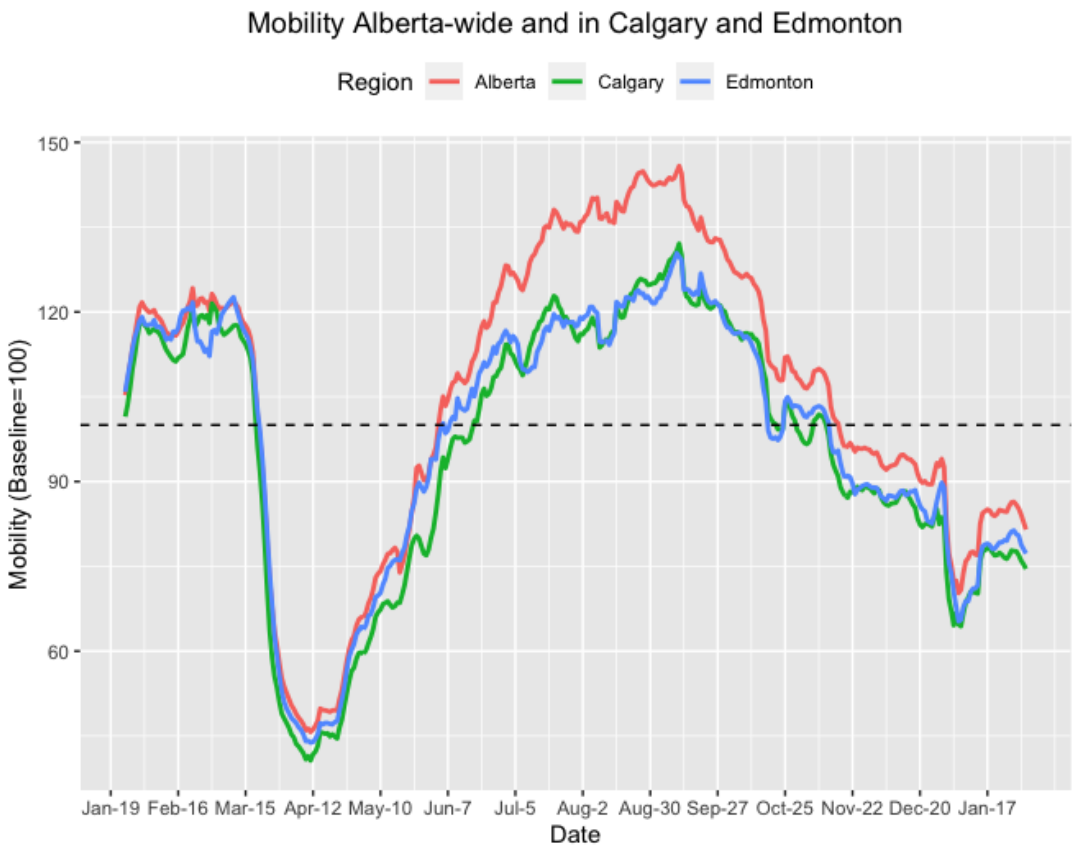


https://pubmed.ncbi.nlm.nih.gov/33227595/

Mobility Disparity

- Socioeconomic status is associated with ones ability to change mobility patterns
  - Low paid, low skill employment: can't stay home
  - Living in multi-family housing, unstable housing
- Studies of mobility using smartphone location data
  - Counties with higher social deprivation also generally larger, more densely populated, and had higher percentage of Black and Hispanic residents
  - After controlling for many variables, higher deprivation areas had significantly more cases and deaths and had significantly lower reduction in mobility

https://pubmed.ncbi.nlm.nih.gov/33413837/


Mobility Alberta-wide and in Calgary and Edmonton
Region
Alberta
Calgary
Edmonton
150
120
90
60
Mobility (Baseline=100)
Jan-19
Feb-16
Mar-15
Apr-12
May-10
Jun-7
Jul-5
Aug-2
Aug-30
Sep-27
Oct-25
Nov-22
Dec-20
Jan-17
Date

Mobility Disparity

- Fascinating study in Nature that used hourly location data of 98 million individuals to map mobility trends and their impacts on COVID
- Mobility reduction magnitude as important as timing
  - If mobility reduction in Chicago had been 25% of actual, COVID cases would have been 3.3X actual
  - If mobility reduction had been the same, but started one week later, cases would have been 1.5X actual
  - If no mobility reduction, 6.2X

https://www.nature.com/articles/s41586-020-2923-3

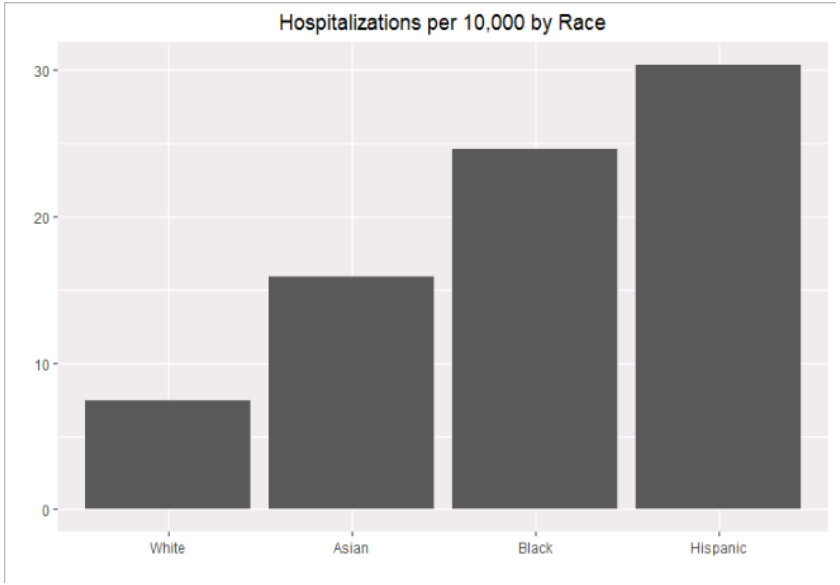
Mobility Disparity

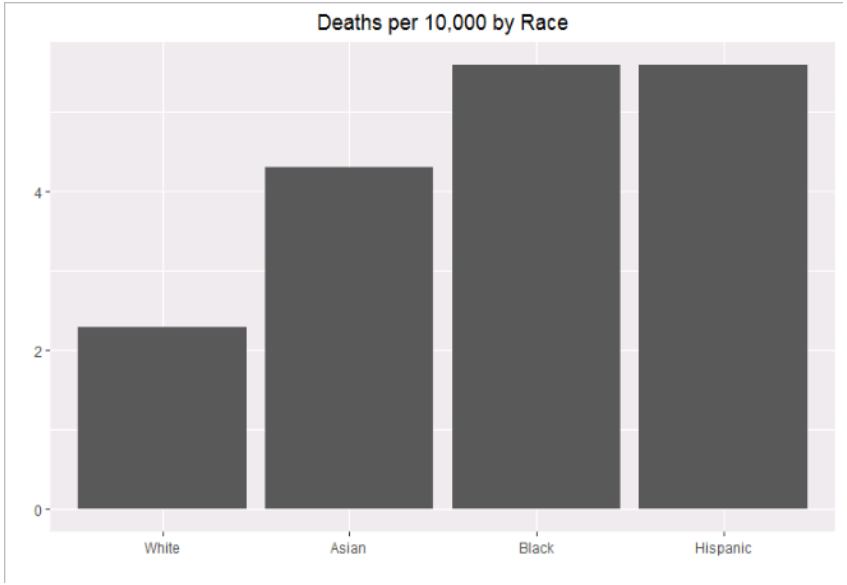
- Data confirms overdispersion of COVID case spread
  - 10% of points-of-interaction accounted for 85% of cases
- Significant socioeconomic disparity
  - Lower income census block groups (very finely detailed geographic areas with 600-3000 people) compared to higher income:
    - Smaller reductions in mobility
    - Visited points-of-interaction with higher transmission rates (generally smaller size and more crowded)

https://www.nature.com/articles/s41586-020-2923-3

Poorer Outcomes

- Large Kaiser Family Foundation analysis of 47.6 million individuals across the US





https://www.kff.org/coronavirus-covid-19/issue-brief/covid-19-racial-disparities-testing-infection-hospitalization-death-analysis-epic-patient-data/

Impact on Vaccination Efforts

- Even extends to vaccination efforts:
  - Due to racial differences in pharmacy concentration in the US and prevalence of “pharmacy deserts”, black communities are falling behind white communities in vaccination
  - Pharmacies are being used as part of the vaccination effort in the US
- Higher levels of vaccine hesitancy among Black and Hispanic populations compared to white

https://www.axios.com/communities-of-color-coronavirus-vaccines-disparities-be9477fa-67a8-4316-afa9-b6b40f6b5cb5.html
https://www.axios.com/vaccine-hesitancy-improving-disparities-ff23b84e-b3bc-4370-ab70-8c340d7b5427.html

Canada

- Large cross-sectional analysis of 14.7 million people
- Odds-ratio of testing positive for COVID:
  - Areas with highest household density: 2.08 (95% CI 1.95-2.21)
  - Lowest educational attainment: 1.52 (1.44-1.60)
  - Highest proportion of recent immigrants: 1.12 (1.07-1.16)

https://www.medrxiv.org/content/10.1101/2020.11.09.20223792v1.full.pdf

References

1. Andermann A. CLEAR Collaboration. Taking action on the social determinants of health in clinical practice: a framework for health professionals. Canadian Medical Association Journal. 2016 Dec 6;188(17-18):E474-E483.
2. National strategy to reduce social inequalities in health: Report No. 20 (2006-2007) to the Storting [Internet]. Norwegian Ministry of Health and Care Services; Feb 9, 2007. Available from: http://ec.europa.eu/health/ph_determinants/socio_economics/documents/norway_rd01_en.pdf
3. Social Determinants of Health. Peterborough Public Health; 2016 [cited 2017Sep29]. Available from: http://www.peterboroughpublichealth.ca/about-us/about-us-2/social-determinants-of-health/
4. Proctor RN The history of the discovery of the cigarette–lung cancer link: evidentiary traditions, corporate denial, global toll. Tobacco Control. 2012;21:87-91
5. Schneider EC, Sarnak DO, Squires D, Shah A, Doty MM. Mirror, Mirror 2017:International Comparison Reflects Flaws and Opportunities for Better U.S. Health Care. http://www.commonwealthfund.org/interactives/2017/july/mirror-mirror/. Accessed October 5, 2017.
6. Fiscella K, Tancredi D, Franks P. Adding socioeconomic status to Framingham scoring to reduce disparities in coronary risk assessment. Am Heart J. 2009 Jun;157(6):988-94.
7. Stringhini S, Carmeli C, Jokela M, et al. Socioeconomic status and the 25 × 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1·7 million men and women. Lancet. 2017 Mar 25;389(10075):1229-37.
8. Mackenbach JP, Stirbu I, Roskam AJR, et al. Socioeconomic inequalities in health in 22 European countries. N Engl J Med 2008;358:2468-81.
9. Chetty R, Stepner M, Abraham S. The association between income and life expectancy in the United States, 2001-2014. JAMA. 2016;315(16):1750-66.
10. Stringhini S, Dugravot A, Shipley M et al. Health behaviours, socioeconomic status, and mortality: further analyses of the British Whitehall II and the French GAZEL prospective cohorts. PLoS Med. 2011 Feb;8(2):e1000419.
11. Mitra D, Shaw A, Tjepkema M, Peters P. Social determinants of lung cancer incidence in Canada: A 13-year prospective study. Health Rep. 2015 Jun;26(6):12-20.
12. Tjepkema M, Wilkins R, Long A. Cause-specific mortality by education in Canada: a 16-year follow-up study. Health Rep. 2012 Sep;23(3):23-31.
13. Fitzpatrick T, Rosella LC, Calzavara A, et al. Looking Beyond Income and Education. Am J Prev Med. August 2015;49(2):161-71.
14. Author's calculations. Methodology available upon request.
15. Alberta First Nations Information Governance Centre. First Nations Health Trends-Alberta. "One-pagers". Available at: http://www.afnigc.ca/main/index.php?id=resources&content=FNHTA Accessed October 11, 2017.d

References

16. Cardoso T. A tale of two Canadas: Where you grow up affects your income in adulthood. The Globe and Mail. https://beta.theglobeandmail.com/news/national/a-tale-of-two-canadas-where-you-grow-up-affects-your-adult-income/article35444594/. Published June 26, 2017. Accessed October 11, 2017.
17. Canadian Institute for Health Information. Trends in income-related health inequalities in Canada. Available at: https://secure.cihi.ca/free_products/trends_in_income_related_inequalities_in_canada_2015_en.pdf Revised July 2016. Accessed October 12, 2017.
18. Chetty R, Hendren N, Katz LF. The effects of exposure to better neighborhoods on children: New evidence from the Moving to Opportunity experiment. The National Bureau of Economic Research. DOI: 10.3386/w21156. Published September 22, 2015. Accessed October 11, 2017.
19. Canadian Institute for Health Information. Hospitalization disparities by socio-economic status for males and females. Available at: https://secure.cihi.ca/free_products/disparities_in_hospitalization_by_sex2010_e.pdf Published October 2010. Accessed October 12, 2017.
20. Canadian Institute for Health Information. Analysis in Brief: Lifetime distributional effects of publicly financed health care in Canada. Available at: https://secure.cihi.ca/free_products/Lifetime_Distributional_Effects_AiB_EN.pdf Published May 2013. Accessed October 12, 2017.
21. Day K. Tousignant J. Government of Canada Department of Finance. Working Paper. Health Spending, Health Outcomes, and Per Capita Income in Canada: A Dynamic Analysis. Available at: https://www.fin.gc.ca/pub/pdfs/wp2005-07e.pdf Published June 2005. Accessed October 12, 2017.
22. Ng E. Muntaner C. Welfare generosity and population health among Canadian provinces: a time-series cross-sectional analysis, 1989-2009. J Epidemiol Community Health. 2015;69:970-977
23. Rubin J, Taylor J, Krapels J, et al. RAND Europe. Are better health outcomes related to social expenditure? A cross-national empirical analysis of social expenditure and population health measures. RAND Corporation. Available at: https://www.rand.org/content/dam/rand/pubs/research_reports/RR1200/RR1252/RAND_RR1252.pdf Published 2016. Accessed October 13, 2017.
24. Public Health Agency of Canada. Investing in Prevention - The Economic Perspective. Available at: https://www.canada.ca/en/public-health/services/health-promotion/population-health/investing-prevention-economic-perspective.html Published July 12, 2010. Accessed October 13, 2017.
25. Andermann A, CLEAR Collaboration. Taking action on the social determinants of health in clinical practice: a framework for health professionals. CMAJ. 2016 Dec 6;188(17-18):E474-E483.
26. Ferrer RL, Gonzalez Schlenker C, Lozano Romero R et al. Advanced primary care in San Antonio: Linking practice and community strategies to improve health. J Am Board Fam Med. May-June 2013;26(3):288-298.
27. Health - Provincial and Territorial Ranking - How Canada Performs. http://www.conferenceboard.ca/hcp/provincial/health.aspx. Published February 2015. Accessed October 13, 2017.