

Social Determinants of Health

How a warm meal and dry home beat 90% of medications
(Well....not quite 90%, but who's counting?)



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 a speaker fee and expense support from the Alberta College of Family Physicians.
 - **Consulting Fees:** N/A
 - **Other:** N/A



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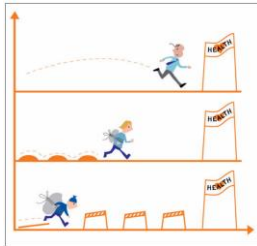
What are social determinants of health?

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 Doc 6:186(17-18):E474-E483





2. Available at: <https://goo.gl/URjRNK> Accessed: Sep 29 2017

PRACTICAL EVIDENCE
FOR INFORMED PRACTICE CONFERENCE



3. Available at: <https://goo.gl/yfMkQv> Accessed: Sep 29 2017

PRACTICAL EVIDENCE
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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

PRACTICAL EVIDENCE
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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 1/3 of doctors (over 40% of doctors were regular smokers as well)

4. Tab General. 2012;21:87-91.

PRACTICAL EVIDENCE
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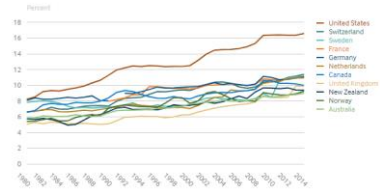




Please Ignore the Elephant

U.S.A.=Uniquely Substandard Attributes

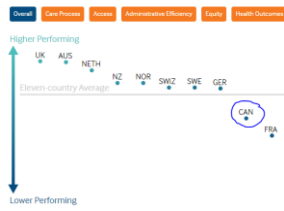
Exhibit 1. Health Care Spending as a Percentage of GDP, 1980–2014



© Commonwealth Fund, 2017. Available at: <https://goo.gl/A0A2JU>

U.S.A.=Uniquely Substandard Attributes

Exhibit 3. Health System Performance Scores



© Commonwealth Fund, 2017. Available at: <https://goo.gl/A0A2JU>

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Exhibit 3. Health System Performance Scores



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The Evidence



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):1750-60.



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!!



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 Res. 2015 Jun;26(6):12-20.

12. Health Res. 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 ⅓ 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/3QVtN6>



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/4tdfzx>

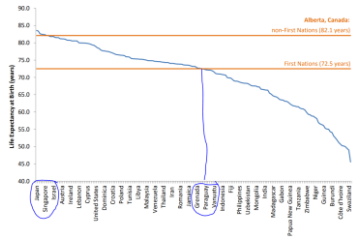


Loss of Life

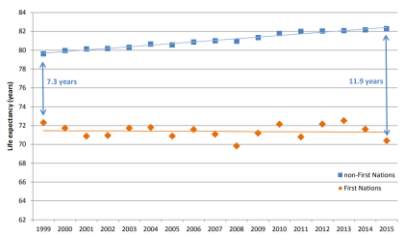
- Life expectancy at birth for First Nations in Alberta is 10 years shorter than that of non-First Nations
- Gap has grown over time, not shrunk

15. Alberta First Nations Information Governance Centre. First Nations Health Trends-Alberta. Available at <https://goo.gl/4tdfzx>





15. Alberta First Nations Information Governance Centre. First Nations Health Trends Alberta. Available at: <https://igo.gov.ab.ca/>



15. Alberta First Nations Information Governance Centre. First Nations Health Trends Alberta. Available at: <https://igo.gov.ab.ca/>



A Closer Look at Income Inequality

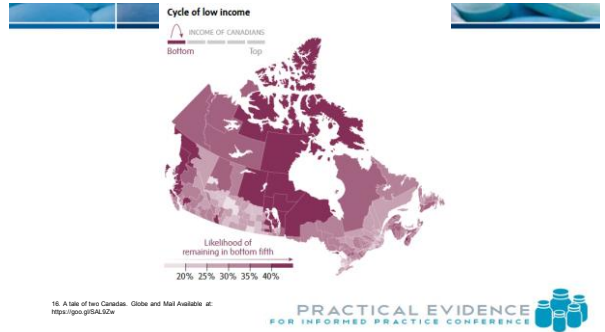
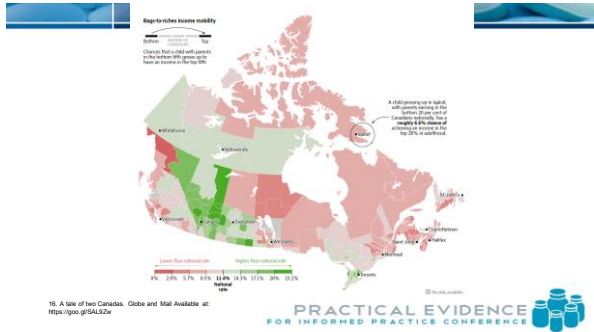
Not as Equal as We Think

- 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://go.globeandmail.com/>





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. CHA. Trends in Income-Related Health Inequalities in Canada. Available at: <https://go.globe.ca/2w>



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. CHA. Trends in Income-Related Health Inequalities in Canada. Available at: <https://go.globe.ca/2w>



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/9N2d6X>



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/9N2d6X>



Economics of Inequality



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. CH: Hospitalization disparities. Available at <https://goo.gl/9N2d6X>

20. CH: Distributional effects. Available at <https://goo.gl/9N2d6X>



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://go.gn1L4p>



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://www.oanda.com/>

**Based on 2016 Alberta census population, available here <https://go.gn1w2Y2>



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
- Major outlier is the US: 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://go.gn1ZDwX>



Relative Cost

- Most preventive health interventions are not cost-saving, just cost-effective (ie. <\$50,000 per quality-adjusted life year (QALY))
 - Including vaccination, CRC screening
- Very few are cost-saving
 - Clinical smoking-cessation counseling
 - HIV behavioural risk reduction interventions
 - Needle exchange programs
 - Obesity interventions for children
 - Mandatory seatbelts

24. Investing in Prevention. Public Health Agency of Canada. Available at: <http://goj.ca/19686>



What Can You Do?



Taking Action

- "Taking action on the social determinants of health"-CMAJ, 2016 Dec 6.
- Social diagnoses important, may avoid inappropriate investigations
- Even when women presented with bruises and broken bones, only 14% asked about violence by care provider
- More tools to work social inquiry into patient encounter
 - Eg. "Do you ever have difficulty making ends meet at the end of the month?"
 - 98% sensitive at identifying those below poverty line; 64% specific

26. CMAJ. 2016 Dec 6;188(17-18):E474-E483



It Takes a Village

- Once "social diagnosis" made, "social prescribing" involves connecting patients with pertinent community resources
- Cluster RCT of 8 community health centres in Boston
- Systematically screened for locally relevant social needs during well child visits and gave physicians one-pager of local resources
 - Increased provider referrals
 - Increased family enrolment in support services
 - Increased maternal employment
 - Increased access to child care
 - Decreased homelessness at one year

25. CMAJ. 2016 Dec 6;188(17-18):E474-E483



Clinical-Community Partnerships

- San Antonio community oriented primary care model
- Aimed at enhancing well-being of community, not just patients
- Hired outreach workers who interacted with patients in their communities, connected them with social supports, and fed that info back into the clinic as well
- In ZIP codes studied:
 - 24% decrease in hospitalizations
 - 12% decrease in ER visits
 - Annual savings of \$250,000

20. J Am Board Fam Med May-June 2013; 6(3):288-98.



Other Ways to Make a Difference

- Hiring dedicated support service navigators
- Building partnerships with public health organizations
- Using your voice to speak about health impacts of social challenges
- Download the CLEAR Toolkit from the CLEAR Collaboration
 - <https://www.mcgill.ca/clear/home-page>

25. CMAJ. 2016 Dec 6;188(17-18):E474-E483



A Look at Our World



Analysis of Inequality

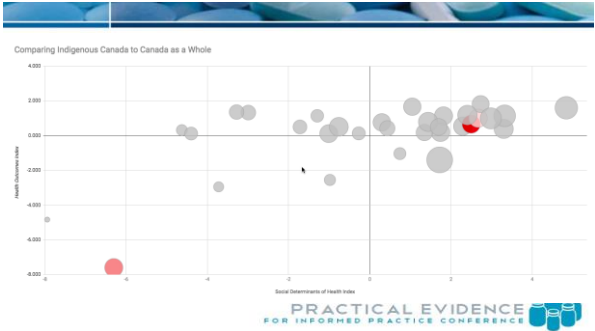
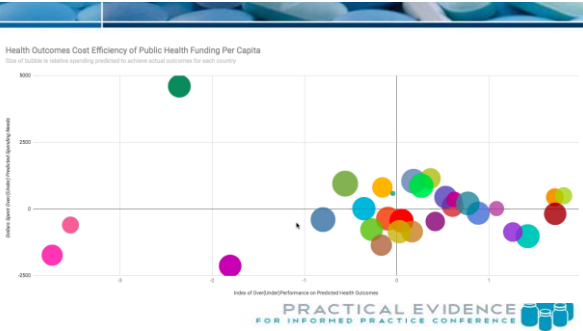
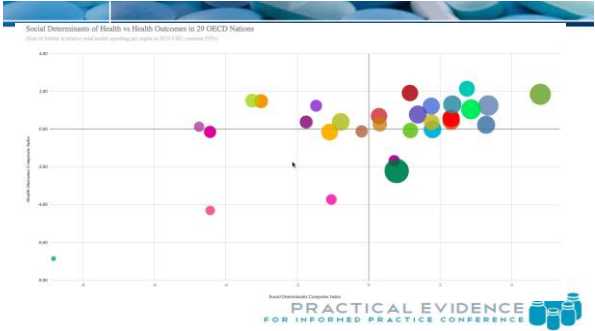
- For detailed methodology and all raw data, please contact me at nickonchuks@gmail.com
- Broadly:
 - Found determinants associated with health outcomes
 - Created composite determinants index
 - Also created outcomes index, a composition of potential years of life lost and life expectancy
- My rankings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

27. Conference Board of Canada. How Canada Performs. Available at <https://go.g02569N>



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/FjgYvo>

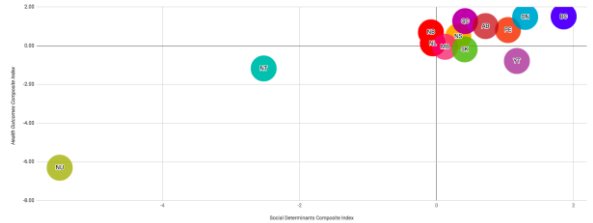


Canada and Its Provinces

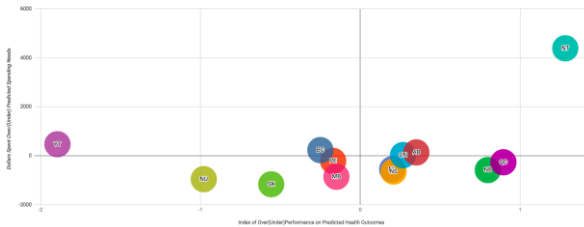
- Determinants in descending order of strength of association
 - % of housing needing major repairs
 - % population identifying as First Nations
 - % of population with high school or higher education
 - Gini coefficient (measure of income inequality)
- Outcomes
 - Potential years of life lost per 100,000 population
 - Life expectancy
- Correlation: 0.91; explains roughly 83% of differences
- Access data here: <https://goo.gl/9Zr9V4>



Social Determinants of Health vs Health Outcomes Canada's Provinces and Territories



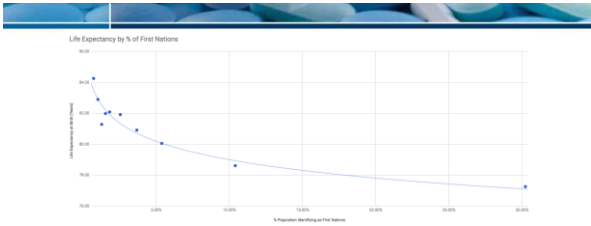
Health Outcomes Cost Efficiency of Public Health Funding Per Capita



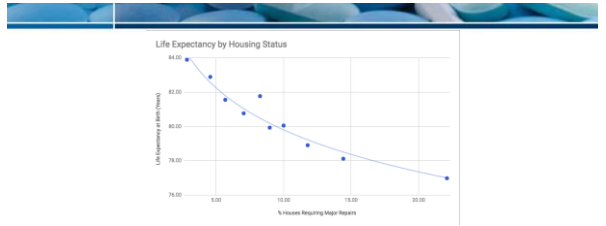
Alberta Inequality Study

- 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>

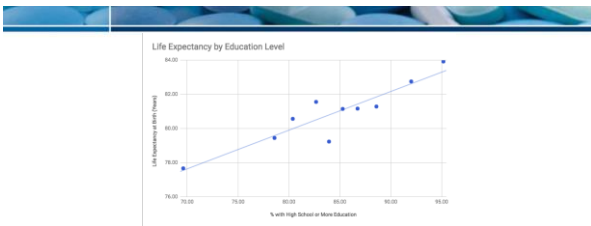




- 10% of regions in Alberta with highest proportion of First Nations have life expectancy 6.5 years less than those with lowest proportion
- Every 1% increase in First Nations population lowers regional life expectancy by ~2 months
- If every decile had same life expectancy as highest decile, would add 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 housing needing major repairs have life expectancy 6.3 years less than those with lowest proportion
- Every 1% increase in % of housing needing major repairs lowers regional life expectancy by ~2.5 months
- If every decile had same life expectancy as highest decile, would add 9.5 million person-years



Fun With Maps

- Maps of Alberta Regions by Characteristic
 - Educational attainment: <https://goo.gl/svjP2w>
 - Housing quality: <https://goo.gl/A7H4GZ>
 - % First Nations: <https://goo.gl/NeQeRj>
 - Social Determinants Index: <https://goo.gl/X4i46o>
 - Life Expectancy: <https://goo.gl/zwimWe>
 - Potential Years of Life Lost: <https://goo.gl/oVe93z>
 - Health Outcomes Index: <https://goo.gl/SLZP32>



