



Economic and quality of life impacts of poor health caused by air pollution

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Presentation to the
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Impacts économiques et sur la qualité de vie des problèmes de santé causés par la pollution de l'air

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14,400 morts

“The Government of Canada estimates that 14,400 premature deaths per year in Canada can be linked to air pollution, as outlined in the technical report *Health Impacts of Air Pollution in Canada – An Estimate of Premature Mortalities.*”

« Selon le gouvernement du Canada et comme souligné dans le rapport technique *Les impacts sur la santé de la pollution de l'air au Canada – Une estimation des décès prématurés*, 14 400 décès prématurés par année au Canada sont liés à la pollution de l'air causée par les activités humaines. »

<https://www.canada.ca/fr/sante-canada/services/qualite-air/effets-pollution-air-interieur-sante.html>



“Economic” impacts?

- 14,400 deaths per year!
- What is the economic impact of that?

Over \$108 billion!!

- A big number. Where does it come from!
- We'll see soon, but first . . .



Using the economic value of health in federal regulations

- Treasury Board guidelines require that when regulations impact the health of Canadians these impacts must be identified and measured.
- The resulting economic impacts must also be measured.
- These economic impacts must be included in a cost-benefit analysis and published in a regulatory impact assessment statement (RIAS).
- For air pollution regulations, these impacts make a big impact.

(The EPA and OMB in the US, the EU, and the OECD all have similar requirements / expectations for the assessment of regulation)



Secteur de l'électricité (2012)

- Règlement sur la réduction des émissions de dioxyde de carbone — secteur de l'électricité thermique au charbon
 - <http://www.gazette.gc.ca/rp-pr/p2/2012/2012-09-12/html/sor-dors167-fra.html>
- **Mortalité prématurée évités: 900**
- Crises d'asthme évités: 120 000
- Jours avec des difficultés à respirer évités: 2 700 000
- « La valeur actualisée des avantages pour la santé est évaluée à **4,2 milliards de dollars**. Ils sont plus importants en Alberta (65 %), suivie de la Saskatchewan (15 %) et du Manitoba (9 %). Les réductions de $MP_{2,5}$ représentent plus de 69 % des avantages pour la santé découlant du Règlement en 2030, tandis que les améliorations pour l'ozone représentent 26 % de ces avantages. »



Règlement sur les émissions des véhicules (2015)

- Règlement modifiant le Règlement sur les émissions des véhicules routiers et de leurs moteurs et d'autres règlements pris en vertu de la Loi canadienne sur la protection de l'environnement (1999)
 - <http://www.gazette.gc.ca/rp-pr/p2/2015/2015-07-29/html/sor-dors186-fra.html>
- « On a estimé que de 2017 à 2030, les améliorations de la qualité de l'air découlant des modifications préviendront quelque **1 400 décès prématurés** liés à la pollution atmosphérique. On a également estimé que les modifications empêcheront près de 200 000 jours de symptômes d'asthme, 910 000 jours d'activité limitée imputable à des problèmes respiratoires et 2,8 millions de jours de problèmes respiratoires aigus. »
- « les améliorations de la qualité de l'air découlant des modifications produiront des avantages relatifs à la santé cumulatifs évalués à **7,4 milliards de dollars** »



Moteurs dans la secteur du pétrole et du gaz en amont (2016)

- Règlement multisectoriel sur les polluants atmosphériques
- <http://www.gazette.gc.ca/rp-pr/p2/2016/2016-06-29/html/sor-dors151-fra.html>
- « Entre 2016 et 2035, les réductions de polluants associées à cette initiative devraient se traduire par une diminution d'environ **1 200 décès prématurés**, de 1 000 visites aux urgences, de 370 000 jours de symptômes d'asthme et de 1 300 000 jours d'activité restreinte pour les non-asthmatiques. La valeur actualisée de ces avantages pour la santé pendant cette période est estimée à **6 milliards de dollars**, dont près des trois quarts surviendront en Alberta. »



2016-17 Federal Regulations with Significant Costs and/or Benefits

- <https://www.canada.ca/en/treasury-board-secretariat/corporate/reports/annual-report-parliament-2016-2017-fiscal-year-implementation-one-for-one-rule.html>

<u>Department</u>	<u>Regulation</u>	<u>Benefit</u>	<u>Cost</u>	<u>Net Benefit</u>
ESDC	EI amendments	\$368,156,829	\$373,888,383	-\$5,731,554
ESDC	Student Loan changes	\$2,965,140,310	\$2,440,603,876	\$524,536,434
ESDC	EI amendments	\$2,204,737,834	\$2,252,500,785	-\$47,762,951
Environment	Multi-Sector Air Pollutants Regulations	\$6,851,470,000	\$492,598,000	\$6,358,872,000
Health	Food and Drug regs	\$1,817,197,984	\$522,649,612	\$1,294,548,372
Health	Pest Control Fee Changes	\$31,981,628	\$31,981,628	\$0
IRCC	Immigration and Refugee Protection	\$168,698,744	\$414,104,788	-\$245,406,044
NRCan	Energy Efficiency Regs	\$1,753,855,573	\$360,228,179	\$1,393,627,394
ESDC	EI amendments	\$61,327,630	\$61,327,630	\$0
ESDC	Labour Code amendments	\$19,669,188	\$2,868,625	\$16,800,562
Environment	Special at Risk: Chorus Frog	\$566,047	\$9,019,008	-\$8,452,961
Health	Food and Drug regs	\$53,124,820	\$27,234,375	\$25,890,446
Health	Cribs and Cradles regs	\$32,832,253	\$12,217,763	\$20,614,490
Transport	Fishing vessel inspection regs	\$274,018,854	\$14,905,022	\$259,113,832
Total		\$16,602,777,694	\$7,016,127,674	\$9,586,650,020



What the numbers mean

- \$7 billion in benefits from reducing car exhaust.
- \$108 billion per year in damages from anthropogenic air pollution.
- Where do these huge numbers come from?
- How are they calculated?
- What do they include?
- What are they?



Quality of life measures

- Economic values for health used in a CBA are:
 - Not estimates of medical treatment cost
 - Not estimates of lost wages and worker productivity
 - Not estimates of the “economic” (read: GDP) impacts of sickness
- They are attempts to measure the impacts that poor health have on a person’s quality of life.
- This includes medical treatment costs and lost wages, but much, much more.



Why is it bad if people get sick?



Cost of illness or “Economic costs”

- Medical costs (Dr, hospitals, drugs, equipment)
- Productivity (sick days, missed school, less productive workforce)

True social impact

- Pain
- Suffering
- ***Death!***
(or risk of death)



Measuring Quality of Life

- How do we determine the impact that health risks have on quality of life?
- We look at the decisions people make around their health.
- Health is important for quality of life. Very important.
- But it's not the only thing that people value. It's not the only thing that contributes to quality of life.
- By looking at the choices and tradeoffs people make related to health we can see how they value health, relative to other things that matter to them.



Health Risk Trade-off examples

- Jay walk, or cross at lights (safety vs time)
- Drive fast (safety vs time & risk of a ticket)
- Buy a safer car or a bigger TV (safety vs viewing pleasure)
- Play hockey (concussion risk vs fun)
- Go heli-skiing (safety vs adrenaline rush)
- Wear a bike helmet (safety vs coolness)
- Eat bacon (cholesterol vs deliciousness)

Let's explore a numeric example to see how similar decisions can factor into a CBA.



Smoke detector



- Cost: \$10
- Chance that it's going to save your life some day:
1 in 5,000
- Good investment?



Carbon Monoxide Detector




- Cost: \$30
- Chance that it's going to save your life some day:
1 in 40,000
- Good investment?



Geiger Counter



- Cost: \$200
- Chance that it's going to save your life some day:
1 in 100,000,000
- Good investment?



Safety at any cost a good government policy?

“nothing is worth your health”

“you can’t put a price on health”

“good health is priceless”

- Really?
- Evidence shows that small health and safety benefits with large price tags are not worth the price.
- People don’t want them and won’t choose them!
- Should the government force everyone to pay for something that nobody wants?



Efficient regulation

- People can choose to buy a carbon monoxide detector or not.
- But individuals can't easily choose "cleaner air".
- Government can effectively choose cleaner air on behalf of the people. But should we?
- People will benefit from clean air, but they will also have to pay more for cars, gasoline, and electricity.
- Is government justified in effectively forcing people to pay for an air quality improvement?
- Yes, but only if people are willing to pay for the health benefits that they will receive.



Efficient regulation, cont

- Reduce risk of death by 1 in 5,000, at a cost of \$10 per person
(Effectively, force everyone to buy a smoke detector)
= Great policy!
- Reduce risk of death by 1 in 40,000, at a cost of \$30 per person
(Effectively, force everyone to buy a CO detector)
= Sound policy
- Reduce risk of death by 1 in 100,000,000, at a cost of \$200 per person
(Effectively, force everyone to buy a Geiger counter)
= Terrible policy!
- A CBA, in which we estimate the economic value of health benefits, is designed to help us figure out which regulations and policy are going to provide Canadians with benefits that they're actually willing to pay for.



Measuring Health Benefits

- Economists don't want to tell people how much their health is (or should be) worth.
- We want to understand how important their health is to them, compared with other things that matter to them.
- Two general approaches:
 - Ask people
 - Observe their behaviour



Asking about health ("stated preference")

- Surveys with questions about hypothetical scenarios
- Ask people what they are willing to sacrifice (income, leisure time, recreational activities) in order to improve their health or reduce their risks.

Pros:

- Can focus explicitly on the population and health risk of concern.

Cons:

- Surveys are complicated and/or annoying. No guarantee that people will understand the question, or bother to think very hard about their answer even if they do understand.



Observing health decisions (“revealed preference”)

- Look at the choices people make related to their health.
- EG: Do people buy smoke detectors? Do they buy Geiger counters for home protection?

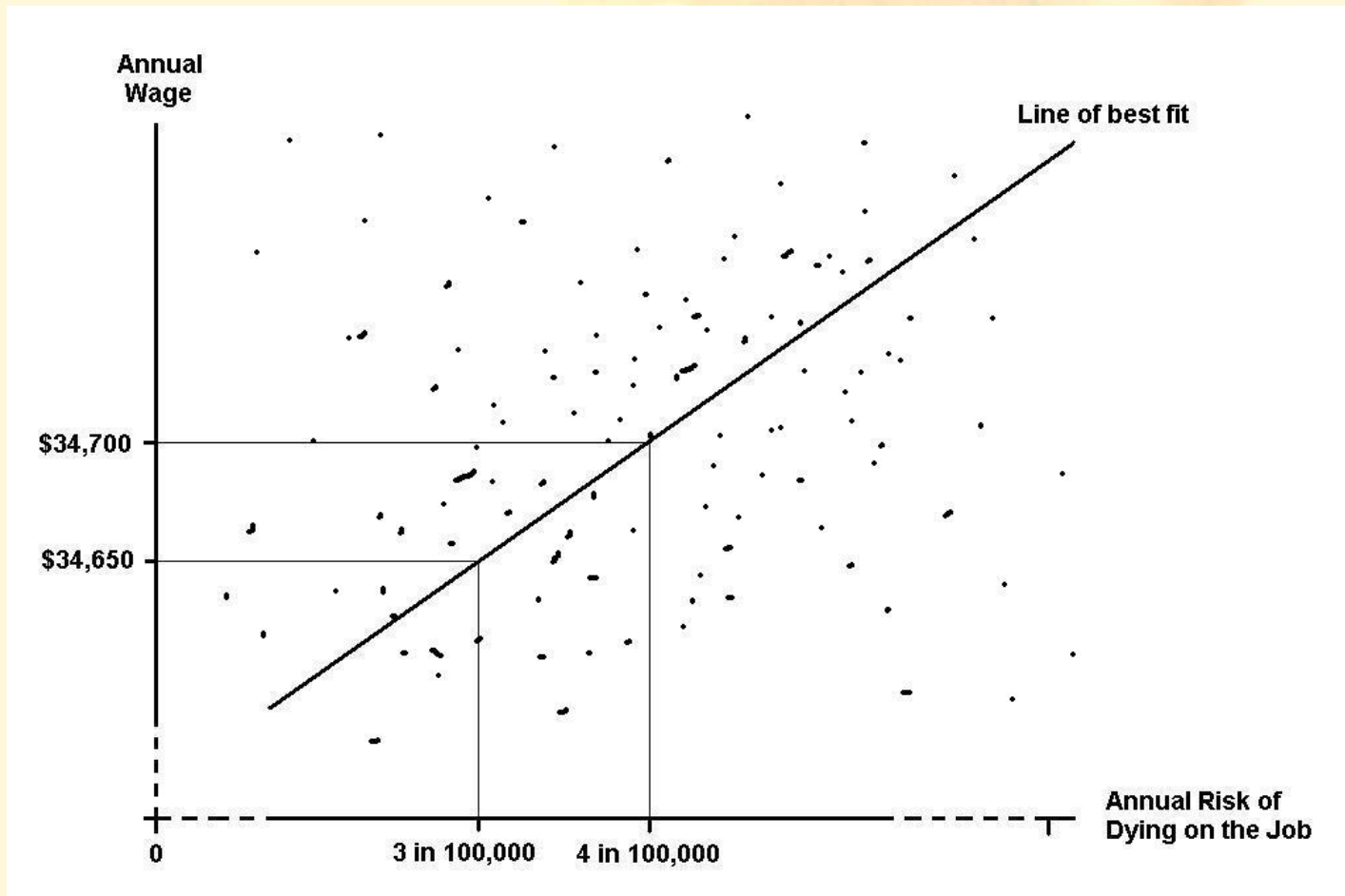
Pros:

- Decisions are real, not hypothetical. Results grounded in reality.

Cons:

- We can see what people do, but we don't always know why.
- Health is only one of several possible motivators. Can't say for sure to what extent a particular decision was driven by health concerns.

Wages compared to Risks



- In this example of revealed preferences, the average across industries is that for every 1 out of 100,000 increase in the risk that workers will be killed on the job, workers have to be paid an extra \$50 in compensation to be willing to take that risk.



And the research says . . .

- Based on a comprehensive literature review of both revealed and stated preference research, with particular emphasis given to Canadian studies (Chestnut 2009):
- **Value of a 1 in 100,00 mortality risk reduction = \$75**
<http://publications.gc.ca/site/eng/346309/publication.html>
- That is, an average Canada would be willing to sacrifice \$75 of their income if it would reduce their risk of death by about 1 in 100,000.
- It will be much higher for some Canadians, and much lower for others. But \$75 is an average, suitable for air pollution analysis affecting large populations.
- This value is similar to other jurisdictions. Slightly lower than the EPA's number. Slightly higher than the one recommended by the OECD.



From 14,400 to \$108 B

- 14,400 deaths / 37,000,000 Canadians.
 - = 1 death per 2,569 Canadians
 - = 39 deaths per 100,000 Canadians
- The chance that a random (average) Canadian will be killed by air pollution from human causes is about 39 / 100,000 per year.
- Average Canadian values a 1 in 100,000 chance of death at \$75.
- Air pollution risk should be valued about 39 times higher than that.
- $\$75 / 100,000 \times 39 / 100,000 = \$2,925$
- Air pollution increases risks, reducing quality of life and socio-economic wellbeing.
- To an average Canadian, this reduction in quality of life is valued at \$2,925.
- $\$2,925 / \text{person} \times 37,000,000 \text{ Canadians}$
- = \$108 billion
- The elevated risk of death caused by exposure to anthropogenic air pollution reduces the social welfare of Canadians by over \$108 billion per year!



We value risks, not Lives (the wrong way to do math)

- Let's say regulation X reduces exposure to anthropogenic air pollution by 1%.
- This regulation will reduce risks of death, resulting in an expected 144 fewer deaths.
- By math on previous slide, this would provide Canadians with a total benefit valued at \$1.08 billion.
- The regulation “saves” 144 lives, and generates \$1 billion in economic benefits.
- $\$1.08 \text{ B} / 144 = \7.5 million .
 - “The regulation generates \$7.5 million in benefits for every life saved.”
 - The “value of a statistical life” is \$7.5 million.
 - “A single human life is worth \$7.5 million.”
- **No!**
 - Mathematically that might make sense but it is ethically unsound and it totally misses the point of what it is that we are doing.
 - We are measuring the value of risk reductions, not the value of “lives”.



Merci

Questions

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