



The economic burden of lung cancer and mesothelioma due to occupational and paraoccupational asbestos exposure

Occupational & Environmental Health Seminar

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Overview

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Methodological Overview

Findings

Impacts

Ongoing Work





Research team

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Tompa E, Kalcevich C, McLeod C, Lebeau M, Song C, McLeod M, Kim J, Demers P. (2017). The Economic Burden of Lung Cancer and Mesothelioma Due to Occupational Asbestos Exposure. *Occupational and Environmental Medicine*, <http://dx.doi.org/10.1136/oemed-2016-104173>.



Summary of findings

- **Total cost of mesothelioma and lung cancer from asbestos related occupational exposure for new cases in 2011 was \$2.35 billion**
- The per case average lifetime cost was \$1M
- Health-related quality of life costs were the highest proportion of the costs at 65%
- Direct and indirect costs represented 35% of the total economic burden
- Substantial economic burden from 2,331 newly diagnosed cases in 2011
- This yearly burden is likely to increase in future, given number of new cases is projected to continue to increase over next few years



Background

- Part of a large study in Canada
- 4 year study
- Four models
 1. Estimating cancer in
 2. Estimating cancer in
 3. Estimating cancer in
 4. Knowledge of cancer in

Cancer Site	Sufficient Evidence	Limited Evidence
Bladder	Painting (24) + Rubber production (3) + Aluminum production (2) + Aromatic amines (pending)	DEE (199) + Hairdressers (17) + PAHs (2) + PERC (1)
Breast		Shiftwork (248) + ETO (pending) + PCBs (pending)
Leukemia	Benzene (22) + Formaldehyde (5) + Rubber production (1)	Ethylene oxide (pending)
Lung	<i>Not summarized here</i>	
Mesothelium	Asbestos (427) + Painting (5)	
Nasopharynx	Wood dust (11) + Formaldehyde (2)	
Sinonasal	Wood dust (11) + Leather dust (2) + Nickel (1)	Chromium (1.4) + Formaldehyde (0.5)
Non-melanoma skin cancer (NMSC)	Solar UV (4556) + PAH (250) + Mineral oil (pending)	Creosotes (pending) + Solar UV lip (pending)
Stomach		Asbestos (63) + Lead (15)

cancer in
(2013-2017)
(Lead: H. Davies)
Lead: P. Demers)
er)



Methodological overview of attributable fraction and human burden modules

- Epidemiology team considered 44 recognized workplace carcinogens and 27 different types of cancers
- Labour force size (by province, sex, age, and industry) identified from 1961 through to 2001 to estimate level and duration of exposures as well as survival probability through to 2011
- Estimates of attributable fractions and relative risks based on extensive literature synthesis
- Developed estimates of numbers of cancer cases in 2011 attributable to occupational exposure or para-occupational exposure by province, sex, age, and industry





Methodological overview of economic burden module

Type of economic burden study undertaken

- Incidence costing study
- Considers only newly diagnosed cases in a particular year
- Includes lifetime costs associated with each new case incurred by all stakeholders

Key question addressed by this economic analysis

- What would be the saving to society if we did not have any cases of cancer attributable to occupational asbestos exposures in a particular year?
- Economic burden = counterfactual scenario – current scenario



Economic burden = counterfactual scenario – current scenario

The road not taken



Difference in
resources

1961

2011

Economic burden = counterfactual scenario – current scenario

World as it was in 2011



Alternative world that could have been



Difference in resources

Methodological overview (continued)

Key cost components considered



1. Direct costs (health care products & services)



2. Indirect costs (output & productivity in paid work)



3. Quality of life costs (social role engagement & intrinsic value of health)

Study framing

- Newly diagnosed cases in 2011
- Estimate total lifetime costs of these cases incurred by all stakeholders (**societal-level** economic burden)
- Discounted all (future) costs to 2011 calendar year



Impacts & related costs by stakeholder

	Individual	Family & Community	Employer	System & Public Sector
1. Direct				
2. Indirect				
3. Quality of life				



Impacts & related costs by stakeholder

	Individual	Family & Community	Employer	System & Public Sector
1. Direct	out-of-pocket expenses for healthcare products & services	informal care giving of family & community members	insurance programs costs for healthcare products & services and related administrative costs	healthcare products & services and related administrative costs
2. Indirect				
3. Quality of life				



Impacts & related costs by stakeholder

	Individual	Family & Community	Employer	System & Public Sector
1. Direct	out-of-pocket expenses for healthcare products & services	informal care giving of family & community members	insurance programs costs for healthcare products & services and related administrative costs	healthcare products & services and related administrative costs
2. Indirect	payroll benefits associated with labour-market earnings wage replacement benefits home production		friction costs insurance program costs for wage replacement benefit and related administrative costs	productivity & output
3. Quality of life				



Impacts & related costs by stakeholder

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3. Quality of life	engagement in social roles intrinsic value of health			



Impacts & related costs by stakeholder

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1. Direct	out-of-pocket expenses for healthcare products & services	informal care giving of family & community members	insurance programs costs for healthcare products & services and related administrative costs	healthcare products & services and related administrative costs
2. Indirect	payroll benefits associated with labour-market earnings wage replacement benefits home production <i>labour-market earnings</i>	<i>family income/savings</i> <i>quality of life of family and community members</i> <i>adult outcomes of children</i>	friction costs insurance program costs for wage replacement benefit and related administrative costs <i>labour relations and reputation</i>	productivity & output <i>capital accumulation, investment, and related productivity implications</i>
3. Quality of life	engagement in social roles intrinsic value of health			



Impacts & related costs by stakeholder

	Individual	Family & Community	Employer	System & Public Sector	Society
1. Direct	out-of-pocket expenses for healthcare products & services	informal care giving of family & community members	insurance programs costs for healthcare products & services and related administrative costs	healthcare products & services and related administrative costs	
2. Indirect	payroll benefits associated with labour-market earnings wage replacement benefits home production <i>labour-market earnings</i>	<i>family income/savings</i> <i>quality of life of family and community members</i> <i>adult outcomes of children</i>	friction costs insurance program costs for wage replacement benefit and related administrative costs <i>labour relations and reputation</i>	productivity & output <i>capital accumulation, investment, and related productivity implications</i>	Individual + Family & Community + Employer + System & Public Sector
3. Quality of life	engagement in social roles intrinsic value of health				



Economics versus Accounting



How much would you pay to enjoy a day at a beautiful beach?

Accountant: counts prices paid – parking, sun screen, umbrella rental

Economist: considers the value of a fun day at the beach (opportunity costs)



Direct Costs of Health Care

- Starting point was health care costs of lung cancer by type and stage identified by the Canadian Cancer Risk Management Model (CRMM)
- CRMM also provided data on survival probabilities
- For mesothelioma survival used US Surveillance, Epidemiology, and End Results (SEER) Registry
- Added health care administration costs of 16.7%
- Fraction of cases appearing in WCB system– 54% for mesothelioma and 10% for lung cancer
- Higher health care costs for WCB accepted claims





Other Direct Costs

Family & Community Time in Care Giving

- Assumed 16 hours of care giving time per week
- Care giving time valued at weighted average provincial minimum wage
- Weighted average increased by 2% per year after 2015

Out of Pocket Costs

- Assumed to be \$548/month—includes travel, parking, drugs, home health care, vitamins, accommodation
- Assumed to increase by 2% per year
- Cost assumed to be incurred for 10 years and were adjusted for survival rates

Administration

- Added WCB administrative costs of 27% of incurred expenses & transfer payments



Indirect Costs of Output & Productivity

Human Capital Approach (HCA)

- Used to estimate lost labour-market productivity & output
- Considered the wage of individual & the amount of work time lost due to poor health or premature death
- For counterfactual used average labour-market earnings in Canada adjusted for age & sex
- Included payroll costs (14%) and productivity growth (1%) in estimates

Friction Cost Approach (FCA)

- Used to reflect cost to employer to replace absent worker if sickness absence endured for a period of time (assume 6 months of annual wage)

Home Production

- Considered the value of time spent in home maintenance on a daily basis by sex and age valued at market rate (only for fatal cases)





Quality of Life Costs

- Captured through Quality Adjusted Life Years (QALYs)
- Preference-based measure of health-related quality of life
- Future QALYs were discounted using a 3% rate
- For counterfactual used population average QALY adjusted for age & sex, and population conditional life-expectancy
- Literature offers range of values for a QALY from \$US20K to US\$161K
- We use CAN\$100K for value of a QALY





Economic burden of mesothelioma

	Based on 427 cases in 2011	All cases	Per case
	Health care:	\$ 19,705,713	\$ 46,176
1. Direct	Informal care giving:	\$ 5,790,544	\$ 13,569
	Out of pocket:	\$ 6,081,422	\$ 14,251
	Workers' comp administration:	\$ 34,212,135	\$ 80,404
2. Indirect	Productivity and output:	\$ 30,212,135	\$ 70,796
	Friction:	\$ 2,360,170	\$ 5,531
	Home production:	\$ 87,632,043	\$205,347
3. Quality of life	Health-related quality of life:	\$296,303,160	\$694,325
	Total:	\$482,397,460	\$1,130,399

* 2011 Canadian dollars



Economic burden of asbestos-related lung cancer

	Based on 1,904 cases in 2011	All cases	Per case
	Health care costs:	\$ 53,781,307	\$ 28,243
1. Direct	Informal care giving:	\$ 32,857,086	\$ 17,255
	Out of pocket:	\$ 35,677,480	\$ 18,736
	Workers' Comp administration:	\$ 13,573,939	\$ 7,128
2. Indirect	Productivity and output:	\$ 141,782,530	\$ 74,458
	Friction:	\$ 10,542,816	\$ 5,537
	Home production:	\$ 356,526,546	\$187,232
3. Quality of life	Health-related quality of life:	\$1,224,370,103	\$642,986
	Total:	\$1,869,111,809	\$981,575

* 2011 Canadian dollars



Summary of findings

- **Total cost of mesothelioma and lung cancer from asbestos related occupational exposure for new cases in 2011 was \$2.35 billion**
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What the study adds

- This is the ***first published economic burden study on occupational cancer attributable to asbestos exposure***
- Findings provide ***important information for policy decision makers*** for priority setting, in particular the merits of banning asbestos in countries where products with asbestos
- Case costing can be used as an ***input to economic evaluations of exposure reduction efforts***
- Methodology provides economists a ***platform for future economic burden studies*** on the societal level burden of occupational injury and illness



Asbestos

Burden of
Occupational Cancer



WHAT IS ASBESTOS?

Asbestos is a group of fibrous silicate minerals. The use of asbestos is severely restricted in Canada, including the use of asbestos in new construction.

Asbestos has many common uses because of its heat resistance, insulating properties, and is found primarily in electrical insulation, flooring, gaskets, plastics, and textiles.

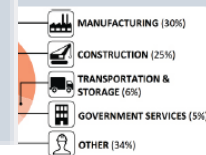
The International Agency for Research on Cancer (IARC) classifies asbestos as a **carcinogen** (IARC Group 1).

1,900

Lung cancers caused by
workplace asbestos exposure

SECTORS MOST AFFECTED?

Asbestos-related cancers occur most frequently in the **manufacturing and construction sectors** (see pie chart below). They also occur among workers in the transportation and storage sector and other services. Some of the other sectors that include communication services, educational services, and health services.



Lung cancers caused by
workplace asbestos exposure

WHAT IS THE COST?

- Manufacturing
- Construction
- Transportation & Storage
- Government Services
- Other

\$2.35 billion

Estimated yearly cost of lung
cancer and mesothelioma
caused by asbestos exposure



THE GLOBE AND MAIL

CAN

A

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tvo

Never stop learning

Current Affairs

Documentaries

Programs

TVOkids

Education

TV Sched

Carmine Tiano

Steve Paikin

Valerie Wolfe

Paul Demers

CONSTRUCTION INDUSTRY CANCERS

The Worst Offenders

-20:20

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The Agenda with Steve Paikin

Construction Carcinogens

Ontario construction workers are regularly being exposed to dangerous substances, including diesel, asbestos, silica dust, wood dust, and the sun's UV rays. The Agenda in...

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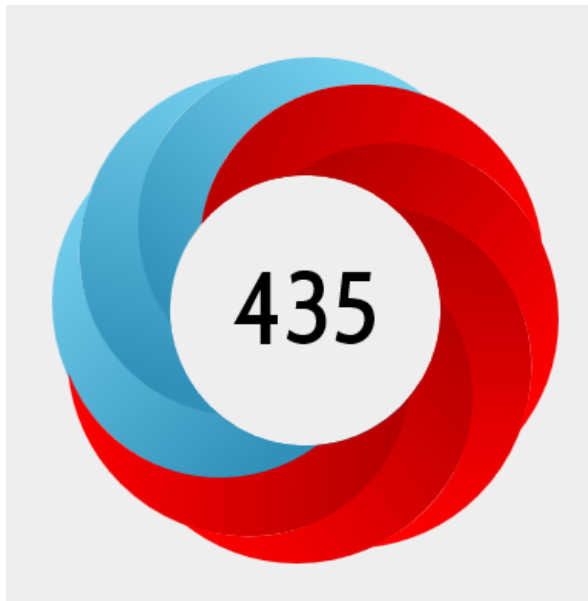
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Altmetric attention score



? About this Attention Score

In the top 5% of all research outputs scored by Altmetric

One of the highest-scoring outputs from this source (#8 of 2,950)

High Attention Score compared to outputs of the same age (99th percentile)

High Attention Score compared to outputs of the same age and source (97th percentile)



Federal prohibition of asbestos & asbestos products regulations

REGULATORY IMPACT ANALYSIS

<http://gazette.gc.ca/rp-pr/p1/2018/2018-01-06/html/reg3-eng.html>

Cost-benefit
estimated
costs for the
\$30 million
or mesothelioma
today... The

cases of lung cancer
a period of
(\$34 million) would be expected to justify the associated administrative and compliance costs (\$34 million).



“The IWH study provided us with high-quality evidence on the economic burden of asbestos-related diseases in the Canadian context. It was invaluable to our analysis”


Joe Devlin
Senior Economist
Environment and Climate Change Canada

are
compliance
d to be about
lung cancer
r \$1 million
least five
average), for
sectors
administrative and


The story continues

- Several
 - On UV
 - ed
- Case of imp constr expos
- Metho econo countr



Amir Mofidi
Visiting Researcher /
PhD Candidate



Young Jung
PhD Student

(NMSCs) in Canada in 2011 caused by workplace sun exposure.

Using a range of secondary sources, including official government records and health surveys, researchers revealed the true economic burden of NMSCs, which cost \$34.6 million in 2011 Canadian dollars.

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Questions and Discussion

