Meeting the Challenges of Occupational Disease Surveillance in Ontario

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January 11, 2019

Towards a cancer-free workplace

No conflicts of interest to report

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TORONTO STAR

LETHAL LEGACY

General Electric's Peterborough plant was a symbol of opportunity for generations of workers — but did it also make them sick?

By Sara Mojtehedzadeh
Work and Wealth Reporter

Photographs by Melissa Renwick

December 12, 2016

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OR EMPLOYEES ONLY

Canada set to announce a new ban on asbestos

By Staff The Canadian Press

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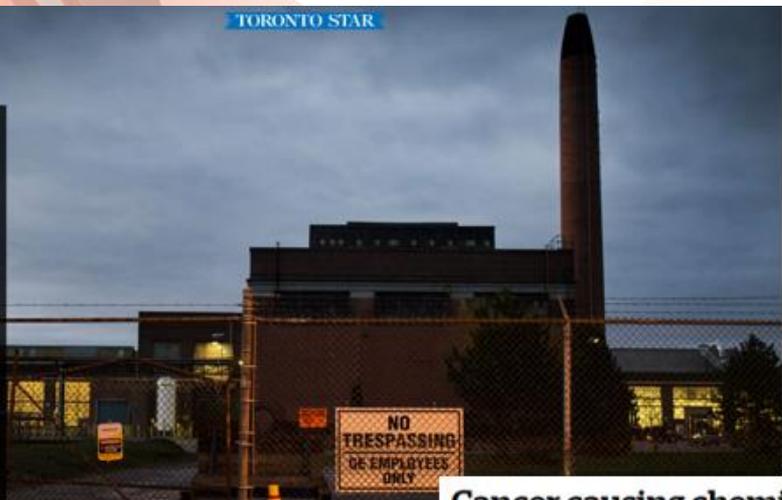
Government plans to review handling of workplace cancers in wake of GE Peterborough case

NEWS   Apr 13, 2018   by Joelle Kovach ✉ Examiner Staff Writer

f 🐦 reddit in ✉

Cancer causing chemicals prompt province-wide testing of nail salons

Katie Nicholson · CBC News · Posted: Feb 11, 2016 6:00 AM ET | Last Updated: February 12, 2016

'Miners are dying': WSIB to examine McIntyre Powder exposure in new study

Researchers from the Occupational Cancer Research Centre will study mining for the board

Olivia Stefanovich · CBC News · Posted: Aug 17, 2017 12:49 PM ET | Last Updated: August 18

'Troubling allegations' prompt Health Canada review of studies used to approve popular weed-killer

Maker of Roundup denies any hidden influence on studies used in approval proces

HEALTH   August 10, 2018 6:48 pm   Updated: August 11, 2018 10:19 pm

Monsanto ordered to pay $289M after man said its Roundup weed-killers caused his cancer

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Workplace carcinogens lead to thousands of cancer cases in Ontario each year: study

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Asbestos-related cancer costs Canadians billions

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news   Top Stories   Local   The National   Opinion   World
Politics

Health Canada rejects claim that new radon gas standards put Canadians at risk

Canadian Home Builders' Association warns of 'severe and immediate health

Ontario's Occupational Disease Action Plan (ODAP)

- In June 2016 an ODAP Working Group was created including representatives from all OHS System partners as well as Public Health Ontario & The Lung Association

- The goal of ODAP is to align the OHS System's efforts on OD prevention, specifically prevention of hazardous exposures & reduction of OD burden in Ontario workplaces
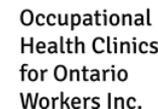
Occupational Disease Surveillance

– Accurate and timely information regarding occupational disease is necessary to support evidence-based prevention initiatives and enforcement, as well as workers compensation. It can be used to:

- Identify high risk groups

- Set priorities for policy or prevention-related activities (e.g. regulation, education, …)

- Provide data necessary for risk assessment, impact assessment research…

- Raise awareness!

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Introduction: what is surveillance

from the *Dictionary of Epidemiology*:

"the **ongoing scrutiny** [of the occurrence of disease, injury, or hazards] generally using **methods distinguished by their practicality**, uniformity, and frequently their rapidity, **rather than by complete accuracy**. Its main purpose is to detect changes in trends or distributions in order **to initiate investigative or control measures**"

Options for Occupational Disease Surveillance

- Administrative health data (tumour registry, hospital discharge, OHIP…)
- Workers compensation data
- Data from clinicians and clinics
- Death certificates
- Linked data options
  - Census and similar datasets
  - Other options

Male Mesothelioma Incidence Rates (age-standardized) by Public Health Unit, Ontario, 1986–2012

Male Mesothelioma Rates (1986–2012)
- 0.75 - 1.34
- 1.34 - 1.47
- 1.47 - 1.71
- 1.71 - 2.19
- 2.19 - 8.41

Lower than Ontario Average (p<0.05)
Higher than Ontario Average (p<0.05)

Ontario rate = 1.79
New cases = 2,768

Ottawa
Cornwall
Peterborough County
Hamilton
Sarnia
Windsor
Greater Sudbury

0   37.5   75   150
Kilometers

N
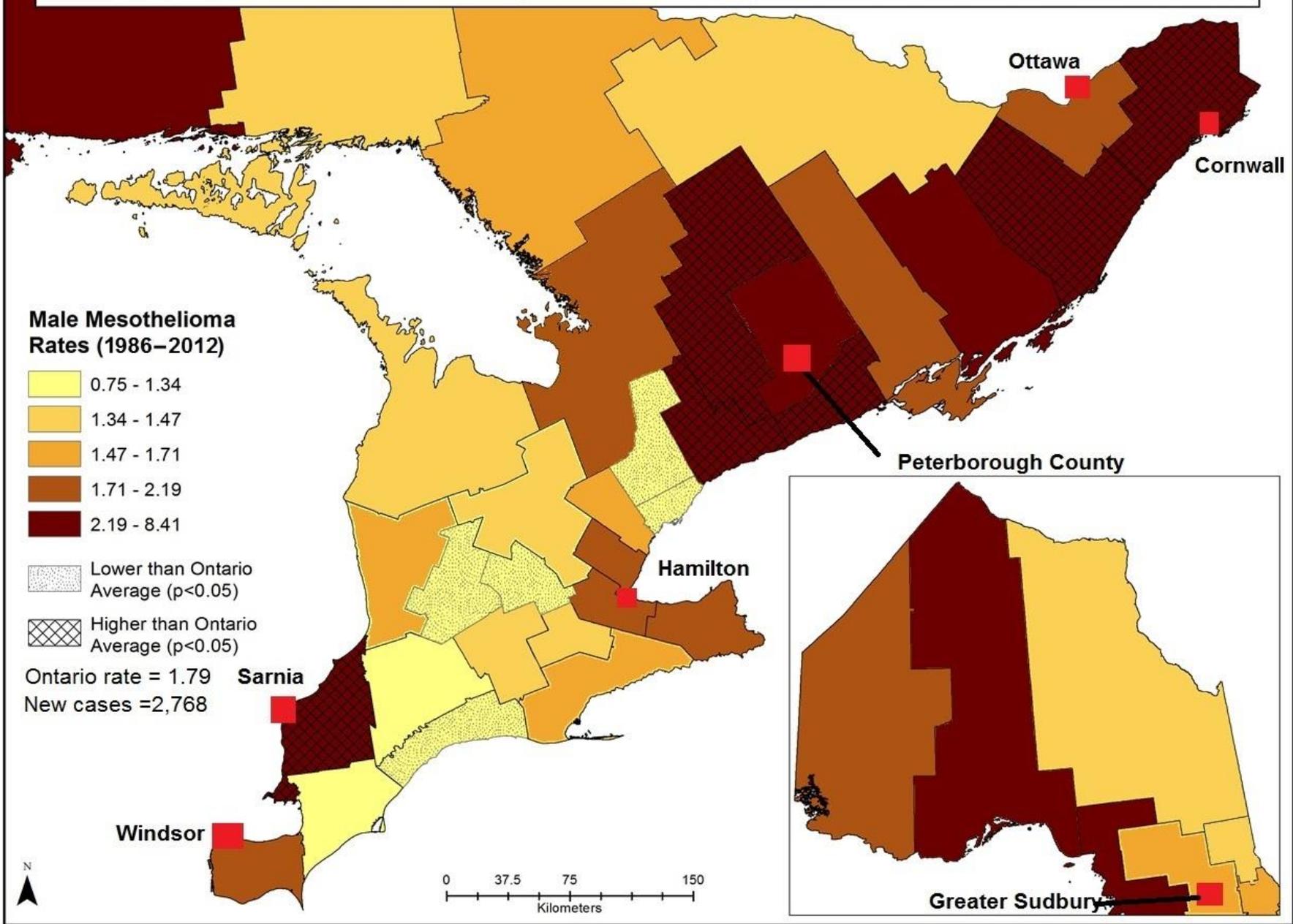
WSIB Accepted Workplace Fatalities: 1997–2010
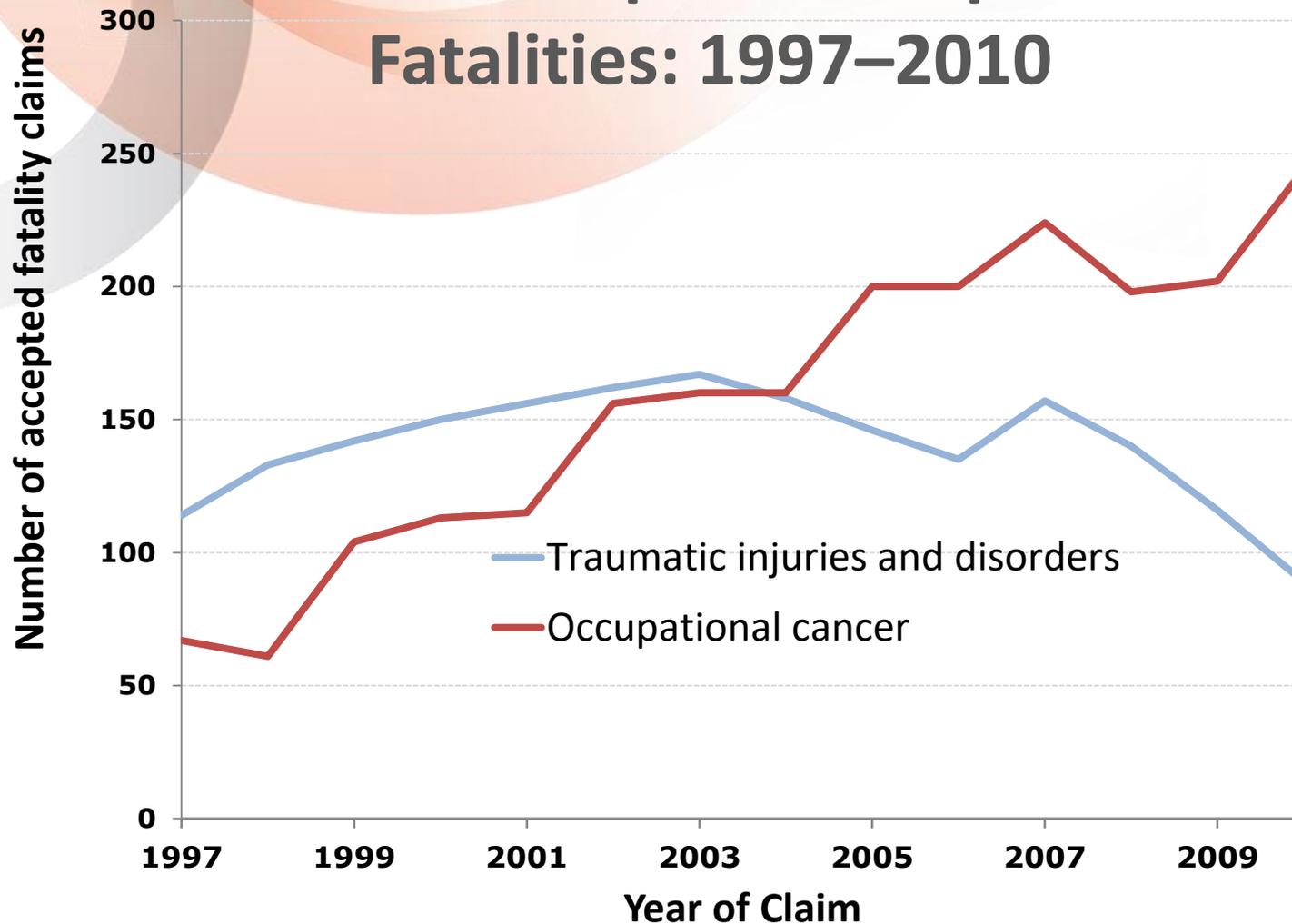
Del Bianco & Demers. Trends in compensation for deaths from occupational cancer: a descriptive study. *Can Med Assoc J Open* 2013;1:E91-E96.
Data Source: Association of Workers' Compensation Boards of Canada (AWCBC)

Compensation Rate by Gender

Compensation = Rate (CR)

$$\text{Average Fatal Claims 2011-2014} \over \text{Estimated Fatal Cancers in 2011}$$

1557
lung cancers
CR = 5%

1424
CR = 6%

133
CR = 2%

334
mesotheliomas
CR = 61%

305
CR = 64%

29
CR = 32%

Clinical Studies

- Clinical studies have been conducted in Ontario for dermatitis and asthma. These studies are not obstructed by the workers compensation system, although they usually require physician recognition of work-relatedness.

- These are valuable for identifying important characteristics of disease, but do not provide population level statistics.

  - Arrandale VH, Kudla I, Kraut AG, et al. Skin and respiratory symptoms among workers with suspected work-related disease. *Occup Med (Lond)* 2012;62:420-426.

  - Holness DL, Tabassum S, Tarlo SM, Liss GM, Silverman F, Manno M. Dermatologist and family practitioner practice patterns for occupational contact dermatitis. *Australas J Dermatol* 2007;48:22-27.

  - Holness DL, Tabassum S, Tarlo SM, Liss GM, Silverman F, Manno M. Practice patterns of pulmonologists and family physicians for occupational asthma. *Chest* 2007;132:1526-1531.

Challenges in the Recognition of Occupational Disease

- Clinical and pathological expression of diseases do not generally differ by cause

- Chronic disease can be diagnosed long after exposure, so a complete work history is needed

- Dose is a strong predictor of the likelihood of disease, but almost always unknown

- Most diseases have multiple causes

- Individuals differ in susceptibility

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Occupational Cancer Surveillance based on Death Certificates

- One Canadian study was conducted in BC using occupation and mortality information coded on death certificates for deaths occurring between 1950 and 1978

- Challenges in using death certificates

  – Underlying cause of death is not appropriate for all diseases

  – Questions regarding validity for occupation & industry

  – Limited cause of death information & questions regarding the accuracy

  – Proportionate mortality ratios may be difficult to interpret

Nocca project
- ▼ Main page
- ▷ Study protocol
- ▷ Description of the data files
- ▷ Congress abstracts
- ▷ Principles for use of data

Cancer incidence by occupation
- Acta Oncologica 2009
- ▷ Press release
- ▷ Download full-text article
- ▷ Download appendix tables
- ▷ Editorial by Dr. Aaron Blair
- ▷ Table downloads (English)
- ▷ Table downloads (Nordic)
- ▷ Occupational categories
- ▷ Utilities

Google — only search NOCCA web

- ▷ New: Yrke og kreft i Norge
- ▷ Full-text incidence article
- ▷ Full study description
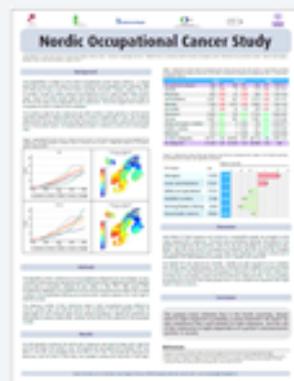
Course material from the NIVA-course held in Mariehamn, Åland 29-31 Aug 2011 can be found here

Nordic Occupational Cancer Study (NOCCA)

We present up to 45 years of cancer incidence data by occupational category for the Nordic populations. The study covers the 15 million people aged 30-64 years in the 1960, 1970, 1980/1981 and/or 1990 censuses in Denmark, Finland, Iceland, Norway and Sweden, and the 2.8 million incident cancer cases diagnosed in these people in a follow-up until about 2005.

Further studies will focus on associations between specific work-related factors and well-defined cancer diseases with the aim to identify exposure-response patterns. In addition to the cancer data demonstrated in the incidence publication, the NOCCA project produces a Nordic Job Exposure Matrix (JEM) that transforms information about occupational title histories to quantitative estimates of specific exposures. The third essential component is methodological development targeted at better interpretation of results based on averaged information of exposures and co-factors in the occupational categories.

1 Finnish Cancer Registry
2 School of Public Health, University of Tampere
3 Cancer Registry of Norway
4 University of Copenhagen
5 Center of Public Health Sciences
6 Karolinska Institute
7 Icelandic Cancer Registry
8 Samfundet Folkhälsan
9 University of Tromsø
10 Finnish Institute of Occupational Health
11 National Institute of Occupational Health
12 Danish Cancer Society
13 Administration of Occupational Safety and Health
14 University of Oulu

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http://astra.cancer.fi/NOCCA/

Large Cohort Linkage in Canada

Survey of 10% of the Canadian labour force in 1965

Annual surveys 1965-69 & 1971

~700,000 cohort members

Mortality follow-up to 1991

143,000 deaths

28,000 comparisons (specific occupation-cause of death pairs)

84-546-XCB

Occupational Surveillance in Canada: Cause-Specific Mortality Among Workers, 1965-1991

84-546-XCB

Dépistage des maladies et lésions professionnelles au Canada : Mortalité par cause chez les travailleurs, 1965-1991

Statistics Canada   Statistique Canada

Canadä

![CRDCN - Canadian Research Data Centre Network logo]

Home » Taxonomy term

CanCHEC (Canadian Census Health and Environment Cohort)

Description

1991 CanCHEC

The current version of the *1991 Canadian Census Health and Environment Cohort* (CanCHEC) was derived on linkage-based dataset compiling socio-economic, demographic, cancer, mortality, and place of residence data (as reported on T1 tax files) for 2.5 million Canadians over an eventual 20-year follow-up period.

The *1991 Canadian Census Health and Environment Cohort* contains variables measuring population characteristics, place of residence, cancer incidence, and mortality. These variables were obtained from six different data sources:

- 1991 Canadian Long-form Census (2B/2D), non-institutional population
- 1984-2011 Historical Tax Summary Files (HTSF) (place of residence only)
- 1981-1983 T1 Personal Master File (T1 PMF) (place of residence only)
- 1969-1991 Canadian Cancer Database (CCDB),
- 1992-2010 Canadian Cancer Registry (CCR), and
- 1991-2011 Canadian Mortality Data Base (CMDB).

Other Data Linkage Studies for Occupational Disease Surveillance

- Workers' compensation board claims that were linked to physician billing data through provincial health insurance agencies between 1995-2004.

  – Cherry et al. Data linkage to estimate the extent and distribution of occupational disease: new onset adult asthma in Alberta, Canada. *Am J Ind Med* 2009;52:831-840.

- Workers identified using an employer-paid health premium field in the provincial health registry, linked to physician & hospital billing, workers' compensation, and pharmaceutical records.

  – Koehoorn et al. Population-based surveillance of asthma among workers in British Columbia, Canada. *Chronic Dis Inj Can* 2013;33:88-94.

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Occupational Disease Surveillance System

OCCUPATION/INDUSTRY (3 levels)

Workers Safety and Insurance Board Accepted Lost-Time Compensation Claims
1983-2014

Worker Cohort

Ontario Cancer Registry

(1964-2014)

Hospital Discharge Data

(2006-2016)

Physician Billing Data

(1999-2016)

Ambulatory Care Data

(2006-2016)

28 cancers

9 other diseases

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Who is in the ODSS Cohort?

34%　　　　　　　**66%**

- Cohort size: 2.2 million workers
- 15+; Mean age at cohort entry: 37.4 years (±12.3)
- Mean length of follow-up: 20.8 years
- 308 industry and 598 occupation groups

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Job Title – 3 levels

- Results for hundreds of worker groups
- Broad or specific levels

Occupation Groups (Division) (Major) *(Minor)*
(81) Processing occupations

(813/814) Metal processing and related
    (8130) Foremen: metal processing
    (8133) Metal heat treating

(821/822) Food and beverage processing and related
    (8213) Baking, confectionery making and related
    (8223) Milk processing

(823) Wood processing
    (8231) Sawmill, sawyers and related
    (8235) Wood treating

Distribution of ODSS Cohort versus Full Ontario Workforce
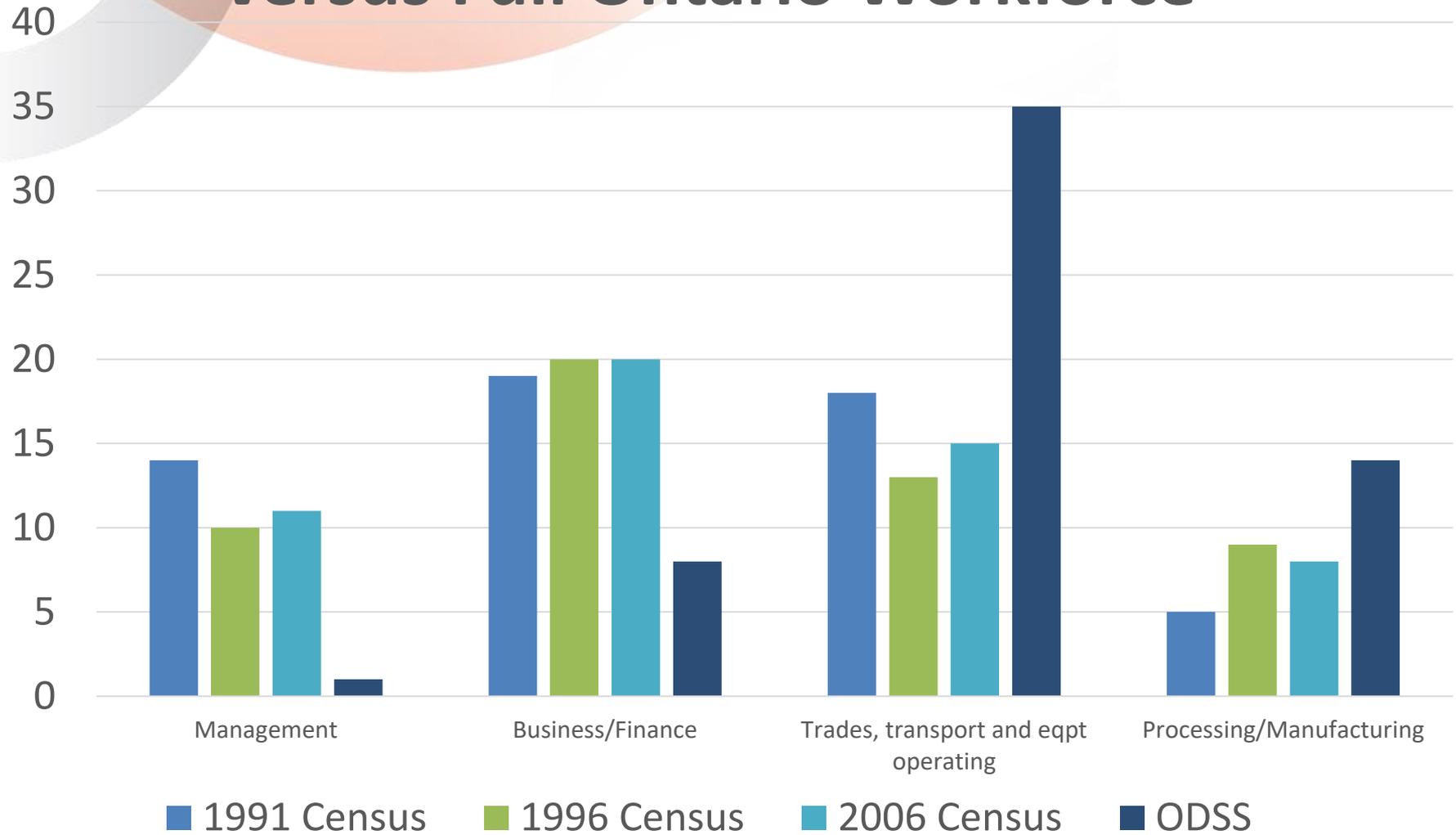
Overview – Cancer (28)

Case def'n: Diagnosis for a given cancer in the Ontario Cancer Registry during follow-up

Cancer Diagnosis	Number of Cases
Prostate	36,000
Lung	34,700
Colon	17,200
Rectum	6,800
Breast	21,400
Bladder	12,400
Non-Hodgkin's Lymphoma	10,900
Brain	4,100
Cervical	2,700
Mesothelioma	850

216,765 workers with 1+ cancer diagnosis (1983-2016)

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Overview – Other Health Outcomes (9)

Case def'n: data source(s) + number of records + age range + washout

Disease	Number of Cases
Asbestosis	860
Silicosis	250
Idiopathic Pulmonary Fibrosis	2,680
Asthma	10,300
Contact Dermatitis	23,800
Chronic Obstructive Pulmonary Disease*	38,800
Acute Myocardial Infarction*	23,900
Raynaud's Syndrome*	30,200
Carpal Tunnel Syndrome*	6,900

*Final case definitions to be selected

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Lung Cancer Results for Suspected High Risk Occupations[25]

High Risk Occupations	Lung Carcinogens	HR (99% CI)
Drilling/blasting	Silica	1.6 (1.3-2.0)
Other mining/quarrying	Silica, asbestos, radon	1.5 (1.3-1.7)
Mineral ore treating	Silica, asbestos	1.5 (1.0-2.3)
Clay, glass, stone processing	Silica	1.5 (1.0-2.3)
Boilermakers, platers, structural metal	Asbestos, welding fumes	1.9 (1.4-2.4)
Painting/decorating	Paint pigments, filaments, resin	1.2 (1.0-1.4)
Excavating, grading, paving	Silica	1.5 (1.3-1.7)
Construction trades	Silica, asbestos, diesel exhaust	1.1 (1.0-1.1)
Bus Drivers	Diesel Exhaust	1.2 (1.0-1.4)
Truck drivers	Diesel exhaust	1.5 (1.4-1.6)

Lung Cancer Results for Suspected High Risk Industries[26]

High Risk Industries	Lung Carcinogens	HR (99% CI)
Metal mines	Silica, diesel exhaust, nickel	1.5 (1.3-1.6)
Non-metal mines	Silica, diesel exhaust, radon	1.4 (0.9-2.2)
Quarries/sand pits	Silica, diesel exhaust	1.4 (1.1-2.0)
Iron foundries	Silica, PAHs	1.3 (1.1-1.6)
Smelting/refining	Cadmium, arsenic, nickel	1.2 (0.8-1.8)
Non-metallic mineral products	Silica	1.2 (1.1-1.4)
General contractors	Silica, asbestos, diesel exhaust	1.2 (1.1-1.3)
Special-trade contractors	Silica, asbestos, diesel exhaust	1.0 (1.0-1.1)
Transportation	Diesel exhaust	1.2 (1.2-1.3)
Welding shops	Welding fumes	1.3 (0.9-1.7)

Diesel Engine Exhaust

- CAREX Canada estimates that 301,000 workers in Ontario (~5% of the workforce) are occupationally exposed

- Known carcinogen
  - ✓ Lung cancer
  - ❓ Bladder cancer

FIGURE 6 Number of workers occupationally exposed to diesel engine exhaust (DEE) by level of exposure and industry in Ontario

■ Low ■ Medium ■ High

Number of workers exposed

Towards a cancer-free workplace
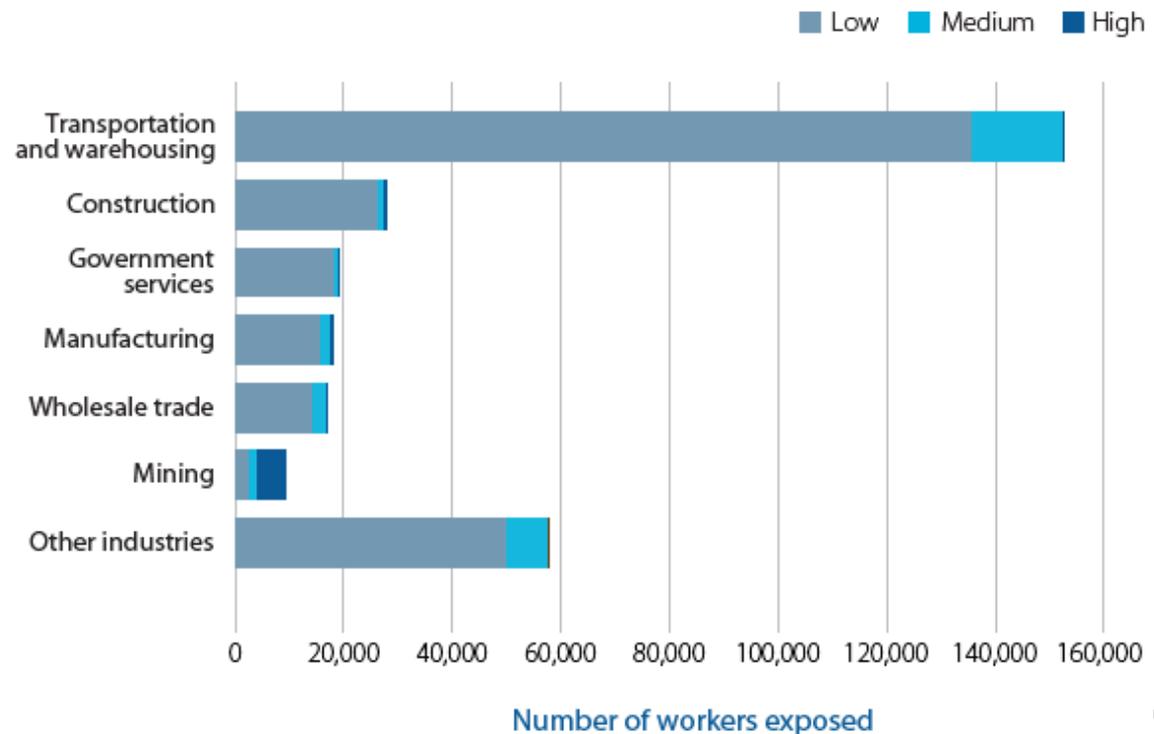
Lung Cancer & Diesel Engine Exhaust

Group	Cases (Workers)	HR (99% CI)
Mines and Quarrying Occupations	435 (12,885)	1.5 (1.3-1.6)
Construction Trades	4,012 (211,691)	1.1 (1.0,-1.1)
Excavating, paving and grating and related	527 (17,956)	1.5 (1.3-1.7)
Excavating, grading & related occupations	180 (7,918)	1.7 (1.4-2.1)
Paving, surfacing & related occupations	16 (432)	1.3 (0.7-2.5)
Railway sectionmen and trackmen	47 (2,081)	1.3 (0.9-1.9)
Labouring and other elemental work	116 (3,013)	1.5 (1.2-1.9)
Other related occupations, n.e.c.	152 (3,812)	1.4 (1.2-1.8)
Transport Equipment Operating Occupations	3,468 (154,219)	1.4 (1.3-1.5)
Other Motor Transport Operating	375 (20,799)	1.3 (1.2-1.5)
Truck Drivers	2,931 (117,375)	1.5 (1.4-1.6)
Railway Transport Operating Occupations	96 (3,828)	1.2 (1.0-1.6)
Water Transport Operating Occupations	44 (2,553)	1.0 (0.7-1.5)
Other Related Occupations	138 (12,210)	1.8 (1.4-2.2)
Other Crafts & Equipment Operating Occupations	421 (21,580)	1.0 (0.9-1.2)
Stationary Engine and Related Occupations	203 (7,214)	1.2 (1.0-1.5)

Time-Stratified Lung Cancer

Chart showing relative risk values for various occupations across four time periods (1983-1989, 1990-1999, 2000-2009, 2010-2015). X-axis ranges from 0 to 2, with a reference line at 1.

Occupations listed:
- Nursing and Related [313]
- Janitors and Cleaners [6191]
- Farm and Related Workers [7182/7199]
- Drilling and Blasting Occupations [7711/3/5]
- Metal Processing and Related [813/814]
- Excavating/Grading/Paving/Related [871]
- Truck Drivers [9175]

Legend: ■ 1983-1989 ■ 1990-1999 ■ 2000-2009 ■ 2010-2015

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Results – What about smoking and lung cancer?

Occupational Group	Respondents (Fem/Male)	Female Ever Smk	Male Ever Smk	Female Cur Smk	Male Cur Smk
All respondents (incl. not emp.)	26,200/23,000	45%	56%	25%	27%
Agriculture, logging, mining	500/1,400	35%	49%	23%	20%
Sales occupations	1,500/1,400	47%	50%	27%	28%
Managerial, admin., professional	5,000/4,300	48%	53%	26%	25%
Clerical and related	4,300/900	50%	54%	33%	28%
Services occupations	2,800/1,700	50%	50%	21%	25%
Processing occupations	1,100/3,600	54%	64%	37%	36%
Construction occupations	100/1,800	54%	75%	37%	39%
Material handling, other crafts	300/800	57%	59%	37%	41%
Transportation occupations	200/1,000	59%	71%	41%	35%

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Mesothelioma & Asbestosis

- We know about compensated cases of mesothelioma and asbestosis, but what is the full picture? Are there high risk groups we have missed?

- The mines have closed and Canada will ban at end of year – How will disease risk change across different jobs going forward?

Mesothelioma & Asbestosis: Occupations

Group	Mesothelioma, HR (95% CI)	Asbestosis, HR (95% CI)
Construction trades	2.6 (2.2-3.0)	3.1 (2.6-3.6)
Construction electricians and repairmen	2.5 (1.7-3.6)	2.9 (2.1-4.1)
Foremen	4.8 (2.8-8.1)	1.6 (0.4-6.3)
Carpenters	2.2 (1.5-3.1)	1.7 (1.2-2.4)
Plasterers	2.9 (1.4-6.2)	4.6 (2.7-7.7)
Insulators	25.2 (14.9-42.8)	23.4 (13.6-40.3)
Pipe fitting and plumbing	7.3 (5.6-9.6)	7.9 (6.2-10.0)
Machining and related	1.2 (1.0-1.5)	1.1 (0.9-1.4)
Boilermakers	5.0 (2.4-10.5)	8.4 (5.3-13.2)
Other occupations		
Industrial, farm and construction machinery mechanics and repairmen	2.4 (1.7-3.2)	1.5 (1.1-2.1)
Stationary engine and utilities equipment operating and related occupations, n.e.c.	3.9 (2.2-6.7)	1.4 (0.7-2.9)

Mesothelioma & Asbestosis: Industries

Group	Mesothelioma, HR (95% CI)	Asbestosis, HR (95% CI)
Mines (including Milling), Quarries and Oil Wells	1.6 (1.1-2.5)	1.0 (0.6-1.6)
Non-Metal Mines	15.3 (7.9-29.5)	<5 cases
Manufacturing Industries	1.1 (1.0-1.3)	1.0 (0.9-1.1)
Non-Metallic Mineral Products	2.0 (1.4-3.0)	2.2 (1.5-3.2)
Construction	1.9 (1.6-2.2)	2.3 (2.0-2.7)
General Contractors	1.6 (1.2-2.1)	1.1 (0.8-1.5)
Special-Trade Contractors	1.9 (1.6-2.4)	2.8 (2.4-3.4)
Community, Business & Personal Service Industries	0.9 (0.7-1.1)	0.8 (0.7-1.0)
Education and Related Services	2.1 (1.5-2.8)	1.5 (1.1-1.9)

Time Stratified Results for Mesothelioma
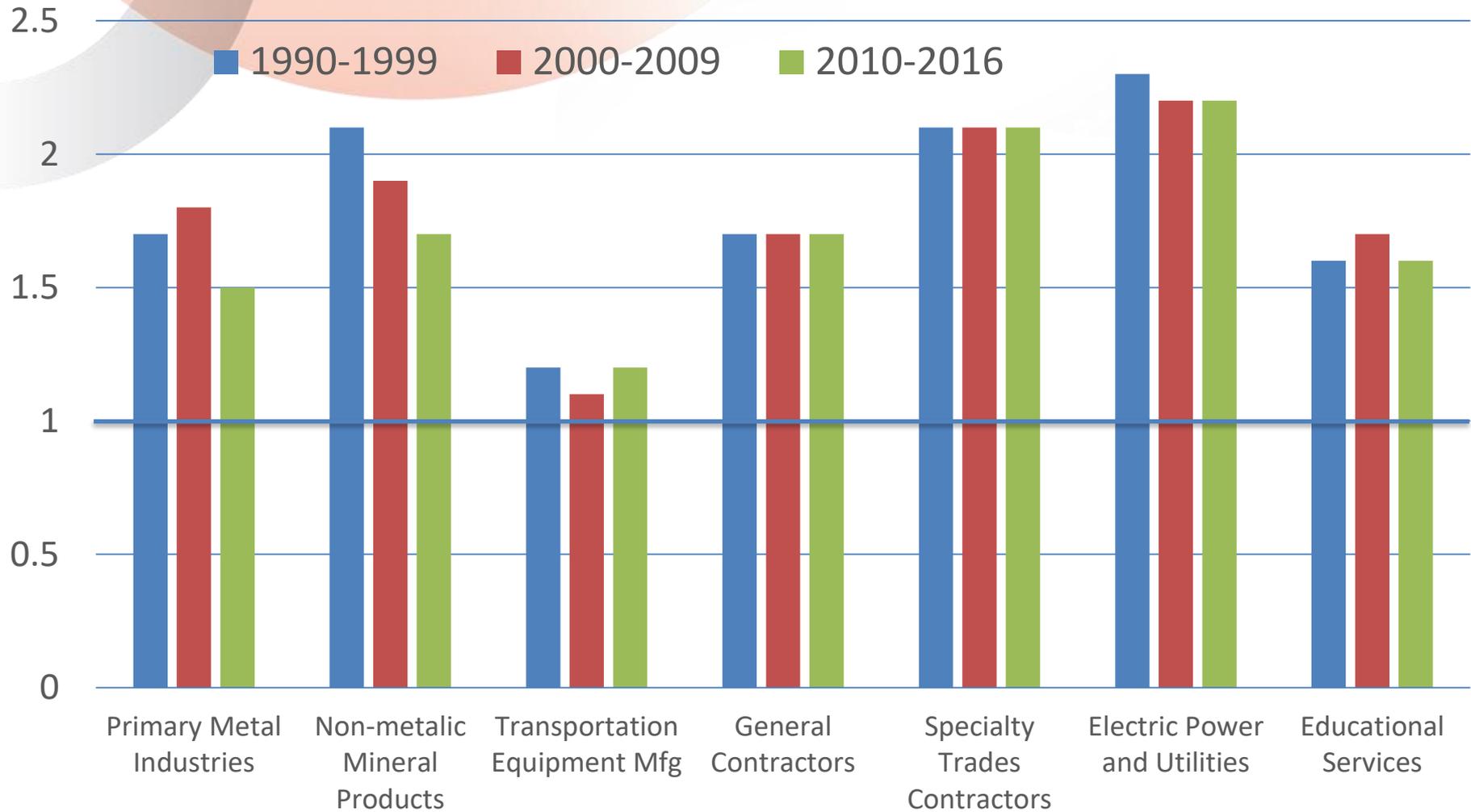
Results – Silicosis

Case def'n: 2+ OHIP billing records during follow-up

Occupation Group	Cases (Workers)	HR (95% CI)
Mining and quarrying	26 (10,012)	**15.44 (10.2-23.4)**
Drilling and blasting	9 (2,585)	**15.38 (7.9-30.1)**
Foremen	5 (655)	**28.46 (11.7-69.4)**
Processing	19 (67,221)	**2.09 (1.3-3.4)**
Chemicals, petroleum, rubber, plastic and related materials processing	8 (35,118)	1.88 (0.9-3.8)
Industry Group	**Cases (Workers)**	**HR (95% CI)**
Mines (including milling)	29 (18,126)	**9.3 (6.2-13.8)**
Metal mines	22 (10,927)	**9.6 (6.2-15.1)**
Construction	29 (175,633)	1.2 (0.8-1.8)
Primary metals	17 (35,499)	**2.6 (1.6-4.2)**
Non-metallic mineral products	7 (20,563)	**2.1 (1.0-4.5)**

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CAREX Canada: Job-Exposure Matrices

- CAREX Canada: Prevalence and level of exposure
  - 328 industries & 520 occupations

North American Industrial Classification System 2002 (NAICS)

National Occupational Classification System 2006 (NOCS)

Prev/Lev	Occ 1	Occ 2	…	Occ 519	Occ 520
Ind 1	0.2/L	1.0/L	…		
Ind 2			…	0.5/H	0.1/M
…	…	…	…	…	…
Ind 327	0.6/M		…	1.0/L	1.0/L
Ind 328	0.5/H	1.0/L	…	0.8/L	

- CAREX codes translated to SIC & CCDO codes used in ODSS
- Approach now being refined using crystalline silica & silicosis

Exploratory Analyses – Silica CAREX JEM

Exposure to Silica	Silicosis Cases (Workers)	HR (95% CI)
Low vs Unexposed	21 (128,786)	1.26 (0.80-1.99)
Moderate vs Unexposed	4 (25,897)	1.19 (0.44-3.20)
High vs Unexposed	41 (159,926)	1.89 (1.34-2.67)

Exposure to Silica	Silicosis Cases (Workers)	HR (95% CI)
<5% vs Unexposed	8 (83,879)	0.67 (0.33-1.37)
5- <10% vs Unexposed	15 (78,736)	1.46 (0.86-2.48)
10- <50% vs Unexposed	17 (84,453)	1.57 (0.95-2.61)
50-100% vs Unexposed	26 (67,541)	2.99 (1.97-4.53)

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Asthma

- **15% of cases** in industrialized countries attributable to workplace exposures and there are **100's** of suspected or causative agents

Contact Dermatitis

- Contact dermatitis (irritant and allergic) is one of the most common work-related diseases in Canada

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Asthma

PAINTING/DECORATING, EXCEPT CONSTRUCTION HR 1.67 (95% CI 1.23-2.28)

High isocyanate exposure vs. unexposed HR 1.68 (1.24-2.29)

BAKING/CONFECTIONARY MAKING HR 1.60 (95% CI 1.22-2.09)

High flour dust exposure vs. unexposed HR 1.60 (1.23-2.09)

CABINET/WOOD FURNITURE MAKERS HR 1.33 (95% CI 0.96-1.83)

DIAGNOSTIC/THERAPEUTIC SERVICE INDUSTRY HR 1.41 (95% CI 1.03-1.94)

SHIPPING/RECEIVING CLERKS HR 1.23 (95% CI 1.03-1.43)

JANITORS, CHARWORKERS AND CLEANERS HR 1.08 (95% CI 0.98-1.18) **M 1.17 (95% CI 1.02-1.35)**

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Contact Dermatitis

Food & Beverage
HR 1.12 (1.03-1.21)

PERSONAL SERVICE
HR 1.09 (1.01-1.18)

Metal Machining
HR 1.28 (1.14-1.43)

MEDICINE/HEALTH
HR 1.14 (1.01-1.29)

Bakery Products
HR 1.35 (1.14-1.62)

Fruit & Vegetable
HR 1.31 (1.02-1.67)

Barbers & Hairdressers
HR 1.49 (1.00-2.20)

Furniture & Fixture
HR 1.21 (1.06-1.39)

Dental Hygienist
HR 1.60 (0.98-2.61)

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Conclusions

- Preventing occupational disease has become a priority not only in Ontario, but across Canada

- Surveillance is challenging because recognition is very poor and electronic health records lack occupational information

- We have made good progress in occupational disease surveillance and new models, such as the ODSS, are very promising

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Moving the Agenda Forward

- Occupational disease prevention needs to remain a priority

- More data is needed to drive prevention, especially in the area of hazard/exposure surveillance

- We need more prevention research to identify the most effective ways to reduce exposure
  - We need more studies with a strong evaluation component

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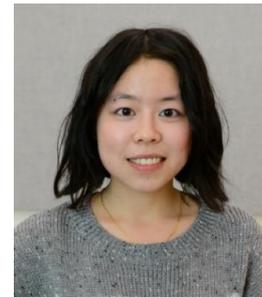
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Thank You!

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http://occupationalcancer.ca

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