ADVANCING WORKPLACE EXPOSURE SURVEILLANCE IN CANADA

REPORTING HIGHLIGHTS FROM THE *ADVANCING WORKPLACE EXPOSURE SURVEILLANCE IN CANADA* WORKSHOP

FALL 2023

Occupational Cancer Research Centre

REPORT PRODUCTION TEAM

Paul A Demers
Director and Senior Scientist, Epidemiology, OCRC | Professor (Status), Dalla Lana School of Public Health, University of Toronto

Tracy Kirkham
Associate Director and Senior Scientist, Exposure, OCRC | Assistant Professor (Status), Dalla Lana School of Public Health, University of Toronto

Kate Jardine
Lead, Knowledge Translation and Exchange, OCRC

Tiffany Lieu
Specialist, Knowledge Translation and Exchange, OCRC

Brenda Koster
Senior Research Associate, Exposure, OCRC

WITH THE ASSISTANCE OF:

Anya Keefe
Occupational & Public Health Consultant, Anya Keefe Consulting | Adjunct Professor, School of Population and Public Health, University of British Columbia

Jill MacLeod
Manager, OCRC

Jeavana Sritharan
Scientist, Surveillance, OCRC | Assistant Professor (Status), Dalla Lana School of Public Health, University of Toronto

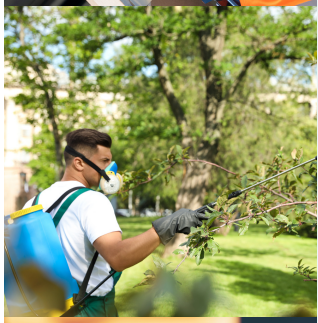
Colin Berriault
Senior Research Associate, Epidemiology, OCRC

Linh Nguyen
Research Associate, Exposure, OCRC

Carmel Hilal
Research Associate, Exposure, OCRC

Fateme (Sepide) Kooshki
PhD Student, Dalla Lana School of Public Health, University of Toronto

Stephanie Ziembicki
PhD Student, Dalla Lana School of Public Health, University of Toronto


FUNDING

The Occupational Cancer Research Centre (OCRC) is based at Ontario Health and funded by the Ontario Ministry of Labour, Immigration, Training and Skills Development (MLITSD), the Ontario Ministry of Health (MOH), and Ontario Health. This workshop was funded using MLITSD core funds. The views expressed in this report are those of OCRC and workshop participants, and do not necessarily reflect those of the MLITSD, MOH, or Ontario Health.

LAND ACKNOWLEDGEMENT

The land on which OCRC operates, and on which the in-person portion of this meeting was held, has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit for thousands of years. Today, this land is still home to many Indigenous people from across Turtle Island, and we are grateful to have the opportunity to work here.

HOW TO CITE THIS PUBLICATION

Occupational Cancer Research Centre, Ontario Health. Advancing workplace exposure surveillance in Canada. Toronto, ON: 2023.

Produced by the
Occupational Cancer Research Centre

Occupational Cancer Research Centre,
Ontario Health
525 University Avenue, 5th Floor
Toronto, Ontario M5G 2L3

Telephone: 416-217-1849

Email: ocrc@ontariohealth.ca
www.occupationalcancer.ca

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AWR	Asbestos Worker Registry
BC	British Columbia
CANJEM	Canadian Job Exposure Matrix
CWED	Canadian Workplace Exposure Database
IMIS	Integrated Management Information System
IRSST	Institut de recherche Robert-Sauvé en santé et en sécurité du travail
JEM	Job Exposure Matrix
LIMS	Laboratory Information Management System
MLITSD	Ministry of Labour, Immigration, Training and Skills Development
MOH	Ministry of Health
NDR	National Dose Registry
NIOSH	National Institute for Occupational Safety and Health
OCRC	Occupational Cancer Research Centre
OEL	Occupational Exposure Limit
OLIS	Ontario Laboratories Information System
OSHA	Occupational Safety and Health Administration
SCT	Silica Control Tool
SIREP	Italian Information System on Occupational Exposure to Carcinogens
SWMB	Safe Work Manitoba
US	United States

EXECUTIVE SUMMARY

ABOUT THE WORKSHOP

Exposure surveillance is the ongoing, systematic collection, analysis and interpretation of exposure data or other data that provides an indication that potentially hazardous exposures have occurred. It is a key tool for occupational disease prevention. Despite its importance, exposure surveillance has been identified as a major gap in occupational disease prevention in Canada. To address this gap and identify priorities and next steps, the Advancing Workplace Exposure Surveillance in Canada workshop was held on March 6-7, 2023, in Toronto.

The objectives of the workshop were to:

1. Assess the current state of occupational exposure surveillance in Canada and identify the most important gaps.
2. Identify the skills and resources needed to fill the gaps.
3. Develop recommendations to advance workplace exposure surveillance in Canada.

This report includes summaries of the presentations, outlines the major gaps and challenges identified at the workshop, and provides recommendations on the resources, actions and projects needed to address these gaps.

PRESENTATIONS

Presentations outlined current workplace exposure surveillance initiatives in Canada, and successful approaches in other jurisdictions. Challenges around data access, data quality and completeness, and securing sustained funding were strong themes throughout the presentations. Presentation topics included:

- The Canadian Workplace Exposure Database
- Exposure surveillance efforts at IRSST and uses of OSHA's IMIS database
- Targeted sampling of high-risk workplaces
- International exposure databases
- The continuing development of CAREX Canada
- Exposure surveillance using the Asbestos Worker Registry
- Using environmental reporting programs for workplace exposure surveillance
- Using population-level data sources to understand exposure
- Patch testing to understand dermal exposures
- Surveillance of psychosocial and physical exposures at work
- The Silica Control Tool

KEY GAPS AND CHALLENGES IDENTIFIED AT THE WORKSHIP

The single most important gap identified by workshop participants was the lack of access to current, high quality exposure data. This gap is due to several factors, including minimal data collection by public institutions, failure to digitize existing data, and lack of public access to data collected by employers, consultants, and researchers. In particular, data collected from small companies, and data on emerging hazards, multiple exposures or complex mixtures, and most non-chemical exposures were identified as gaps in data collection.

Workshop participants also identified a lack of coordination and data sharing within and across jurisdictions, as well as inconsistent data collection, storage, and job coding, leading to challenges in merging data from different sources.

SKILLS AND RESOURCE NEEDS IDENTIFIED AT THE WORKSHOP

Workshop participants discussed several skills and resources needed to advance exposure surveillance in Canada. These include:

- Standards and training to ensure consistent data collection, storage, job coding, and statistical analysis.
- Centralized data repositories, and tools to allow users to query the data for prevention, compensation, research and policy purposes.
- Sustained, long-term funding to create, maintain and update new exposure databases, including centralized data repositories.

RECOMMENDED ACTIONS AND PROJECTS IDENTIFIED AT THE WORKSHOP

Workshop participants identified short-term, medium-term, and long-term actions and projects to advance Canadian exposure surveillance. Short-term actions include identifying existing Canadian exposure data holdings, identifying priority hazards, developing a standardized database format and data sharing agreement, and engaging with relevant stakeholders. Medium-term actions include digitizing existing exposure data, creating centralized data repositories, and developing a strategic plan to define goals and objectives. Long-term actions include developing a national occupational exposure surveillance program, securing sustainable funding to maintain the program, and using the data to support occupational disease prevention and research.

FOREWORD

The Advancing Workplace Exposure Surveillance in Canada workshop was held on March 6-7, 2023, in Toronto. The workshop was organized by the Occupational Cancer Research Centre (OCRC) with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development (MLITSD).

Organizing a workshop on occupational exposure surveillance at this time was motivated by several factors. Exposure surveillance was identified as the largest gap that needed to be filled in the report of the National Occupational Disease and Exposure Surveillance workshop held in Toronto in 2019 (1). In addition, the 2020 report on Using Scientific Evidence and Principles to Help Determine the Work-Relatedness of Cancer made substantial recommendations on increasing access to exposure data to improve compensation, as well as prevention (2). There is also an increased interest by occupational health and safety regulators, particularly the Ontario MLITSD, in developing the necessary tools and resources to facilitate an evidence-informed approach to occupational disease prevention.

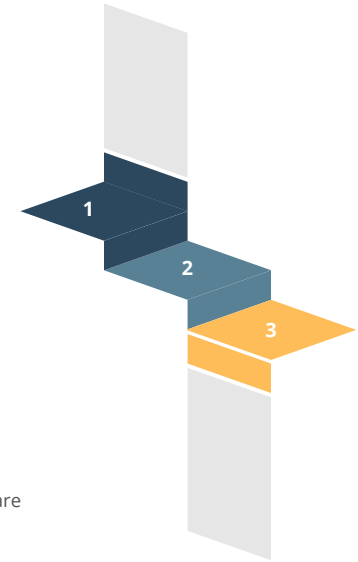
IMPORTANCE OF EXPOSURE SURVEILLANCE

Exposure surveillance is the ongoing, systematic collection, analysis and interpretation of exposure data or other data that provides an indication that potentially hazardous exposures have occurred. These data are needed to track patterns and trends, identify groups in need of intervention, and assess the effectiveness of previous interventions. Exposure surveillance can have many roles across the prevention spectrum (Figure 1).

Despite its importance, there are relatively few examples of effective exposure surveillance in Canada (3). The **National Dose Registry (NDR)** is one example of a successful exposed worker surveillance system, which also collects exposure measurements. The NDR is Canada's national repository for radiation dose records. It includes records of radiation exposure for Canadian workers across a variety of industries, including nuclear power plants, uranium mines, dental offices, and hospitals. It has been in operation since 1951 and contains records for about one million individuals, including approximately 170,000 members of the current workforce. The NDR has been used to track patterns and trends in radiation exposure (4). It has also been linked to national cancer records to help understand the risk of cancer associated with radiation exposure. Finally, workers can request their dose records, for example to help support a workers' compensation claim.

Three Categories of Prevention

The goal of prevention is to reduce risks or threats to health.



1

Primary Prevention

Aims to prevent disease or injury before it occurs.

Examples of how exposure surveillance can be used:

- To determine whether current exposure levels are below occupational exposure limits (OELs).
- To identify which exposure circumstances (e.g., exposed groups) should be prioritized for prevention efforts to reduce exposure.
- To support research studies on the causes of disease.
- To assess the effectiveness of interventions to reduce exposure.

2

Secondary Prevention

Aims to identify diseases in the earliest possible stages.

Examples of how exposure surveillance can be used:

- To identify workers with high exposure to prioritize for screening.

3

Tertiary Prevention

Aims to reduce the impact of disease or injury after diagnosis.

Examples of how exposure surveillance can be used:

- To provide records of past exposure to assist in workers' compensation claims.
- To facilitate investigations of past exposure in workplaces with suspected disease clusters.

Figure 1. Prevention Spectrum

WORKSHOP AGENDA, OBJECTIVES AND PARTICIPATION

The workshop brought together 63 participants to exchange information on the current state of occupational exposure surveillance in Canada and to identify key gaps and priorities in the Canadian context (Figure 2). The participants included researchers, government and non-government representatives from across Canada, including Alberta, British Columbia, Manitoba, Ontario, Quebec, and national and Federal organizations. System partners from Ontario included representatives from the MLITSD; the Workplace Safety and Insurance Board; Public Health Ontario; Occupational Health Clinics for Ontario Workers; Workplace Safety and Prevention Services; Public Services Health and Safety Association; Infrastructure Health and Safety Association; the Centre for Research Expertise in Occupational Disease; the Institute for Work and Health; the Centre for Research in Occupational Safety and Health; the Occupational Hygiene Association of Ontario; and unions.

Day one of the workshop began with presentations summarizing current Canadian occupational exposure surveillance initiatives, including exposure measurement databases, exposed worker approaches, and non-traditional sources of data for exposure surveillance.

Participants discussed the challenges and opportunities that arose during the presentations. Day two focused on discussions of gaps, priorities and recommendations facilitated by breakout sessions and broader group discussions.

This report begins with summaries of the presentations, focusing on the challenges, opportunities and themes that arose during the talks. It outlines the major gaps identified at the workshop, highlights the resources and skills needed, and recommends actions and projects needed to address these gaps.

The objectives of the workshop were to:

1. Assess the current state of occupational exposure surveillance in Canada and identify the most important gaps.
2. Identify the skills and resources needed to fill the gaps.
3. Develop recommendations to advance workplace exposure surveillance in Canada.

Figure 2. Workshop Participants

PRESENTATIONS ON CURRENT OCCUPATIONAL EXPOSURE SURVEILLANCE INITIATIVES

The workshop began with presentations that outlined current workplace exposure surveillance initiatives in Canada, as well as some successful approaches in other jurisdictions. The summaries below highlight the key themes, challenges, and opportunities discussed during the presentations. Biographies of the speakers are available in Appendix I.

THE CONTINUING DEVELOPMENT OF THE CANADIAN WORKPLACE EXPOSURE DATABASE (CWED)

HUGH DAVIES, PHD, CIH
UNIVERSITY OF BRITISH COLUMBIA

Dr. Davies presented on the development and uses of the **Canadian Workplace Exposure Database (CWED)**, as well as its limitations and future directions (5,6). Based at the University of British Columbia, CWED is a national repository of occupational exposure data. It began as part of the CAREX Canada project and, to date, includes approximately 500,000 occupational exposure measurements representing 336 substances.

A major limitation of CWED is its historical nature. Most of the measurements in the database are from the 1980s and 1990s and accessing more recent data has proven challenging (7). This has resulted from changes in regulatory policies in the 1990s that virtually eliminated the collection of exposure data by governmental agencies (except in Quebec). While exposure data is still being collected by industry and researchers, there is no centralized data-capture mechanism. A major goal for CWED is to move from an archival status to an active exposure database that reflects current exposures and would support ongoing exposure surveillance activities. This requires ongoing support and continual input of contemporary data through innovative data capture strategies.

Other challenges include ensuring that data is nationally representative, and quality control of data that was, for the most part, not collected for research purposes. Dr. Davies discussed the need for developing standards to harmonize data collection across jurisdictions, developing relationships needed to secure access to new sources of data, and building user-friendly data access and analysis tools. Critically, CWED needs to create a sustainable and stable funding model so that its objectives can be achieved.

KEY TAKEAWAYS

- CWED is a national resource comparable to Occupational Exposure Databases from around the world in size and scope.
- CWED is a valuable resource to researchers; it is building tools and resources to increase utility to a broader stakeholder community.

THE IRSST'S EXPOSURE SURVEILLANCE EFFORTS AND POTENTIAL USES OF THE OSHA'S IMIS DATABASE

DR. PHILIPPE SARAZIN
INSTITUT DE RECHERCHE ROBERT-SAUVÉ EN SANTÉ ET EN SÉCURITÉ DU TRAVAIL (IRSST)

Dr. Sarazin presented on Quebec's Laboratory Information Management System (LIMS) database, and the IRSST's work comparing it with the United States (US) Occupational Safety and Health Administration's (OSHA) Integrated Management Information System (IMIS) (8). Both databases are repositories for data collected as part of governmental compliance monitoring activities, and the IMIS is a potential source of additional information that could supplement Quebec's (or other province's) databases.

In comparing LIMS and IMIS, Dr. Sarazin emphasized the need to critically appraise data from other jurisdictions before integrating it into any project or database, such as understanding how and why it was originally collected (9–11). Combining data can also be technically challenging, and may require significant time and effort, such as developing crosswalks between different occupation and industry coding systems.

Dr. Sarazin also discussed the differences between laboratory databases, which lack contextual information such as determinants of exposure and sampling protocols, and exposure databases. He highlighted that it is not enough to have a level of exposure – context is critical. Quebec's LIMS is a laboratory database with little contextual information, and this limits its usefulness (8). This is a common issue with much of the available exposure data in Canada.

Finally, Dr. Sarazin discussed an ongoing project that aims to identify work situations that result in multiple exposures, and whether the exposure mixtures are associated with high cumulative risk. This project uses LIMS and IMIS as well as other exposure databases to identify situations where co-exposures are likely to occur (12). In the context of this work, Dr. Sarazin emphasized the need for creative data visualization and communication tools to better share the results of this project.

KEY TAKEAWAYS

- Exposure data sources, such as LIMS and IMIS, should be used in combination in future exposure assessment projects.
- Evaluative research designed to improve our understanding of possible bias in exposure databases is encouraged, keeping in mind that there are very few other sources of information.
- Global combination patterns and the agents most often implicated in co-exposure situations in the IMIS database were revealed using novel big data analysis approaches.

TARGETED SAMPLING CAMPAIGNS OF HIGH-RISK WORKPLACES

MR. MICHAEL BOILEAU
SAFE WORK MANITOBA

Mr. Boileau talked about the recent successes of Safe Work Manitoba's (SWMB) **Occupational Disease and Illness Prevention Strategy**. SWMB partners with industry, physicians, regulators, and special interest groups to develop and enact the strategy, and meet its goals of improving workplace safety, enhancing safety culture, and reducing occupational disease.

A major facet of the strategy is the collection of new exposure data to fill gaps in available data. Mr. Boileau discussed SWMB's use of direct reading instruments as a financially and logistically manageable solution to measuring certain exposures, compared to the cost and time involved with laboratory analysis. He highlighted the need for new equipment and methodologies for monitoring exposure that are quick, cost effective, and can be used for a wide range of exposures. Many of the regulatory organizations across Canada no longer collect exposure data, and Mr. Boileau's presentation highlighted the need for more efforts in this area, as well as creative ways to increase the feasibility of data collection.

One of the key components of SWMB's strategy is engagement with workplace partners, including industry and unions to ensure support for data collection. Mr. Boileau discussed the importance of being able to show the value of data collection, such as potential cost savings and the value of data-driven solutions. Sharing data back in a timely, accessible format is critical, and SWMB works with Knowledge Translation specialists to create accessible materials to share with partners. The success of SWMB's data collection program offers a roadmap for other groups looking to access or collect new exposure data.

KEY TAKEAWAYS

- Manage risk at the onset of the project, not all solutions require intensive capital investment!
- Data is your friend. Establish a baseline and implement practices that strive to improve worker exposures then re-test to prove that the needle has in fact moved in the right direction.
- Platform common, beneficial practices out to industry groups who can leverage the findings across the industry.

WHAT WE CAN LEARN FROM INTERNATIONAL EXPOSURE DATABASE EFFORTS

DR. JÉRÔME LAVOUÉ
UNIVERSITÉ DE MONTRÉAL

Dr. Lavoué shared details of exposure databases from other countries, including France (COLCHIC and SCOLA) (13,14), Germany (MEGA) (15,16), Korea (WEMD) (17,18), and Italy (SIREP) (19,20). In discussing these databases, Dr. Lavoué emphasized that data on exposure level alone is not enough; contextual information is also critical. He highlighted the importance of data on exposure probability, which is rare in exposure databases. Most exposure data cannot be used to assess exposure probability as samples are generally only taken when there is a risk of exposure. Of those presented, only SIREP allows estimates of both prevalence and level of exposure to be calculated.

Dr. Lavoué explored how combining data from several databases, or combining exposure databases with job exposure matrices (JEM) such as **CANJEM**, might allow us to overcome the limitations of each to obtain better exposure surveillance tools. However, there are several challenges to merging databases, such as merging different occupation and industry coding systems via post-hoc crosswalks. To facilitate mergers, Dr. Lavoué suggested identifying the best coding systems to use during the planning stage of new projects, and in the long term, harmonizing and standardizing the coding systems used in Canada. Different databases may also have different sampling methods, or there may be large variations in the measures or types of data available. These challenges exist when combining data from different countries, but also different jurisdictions within Canada. Bayesian approaches may provide methods for combining larger international databases with small amounts of provincial data.

In creating new databases, he also mentioned that requiring too much contextual information in the main database can lead to incomplete entries and low success. He suggested keeping the main file simple, but allowing a link to scanned, detailed hygiene reports where further data can be extracted if needed.

KEY TAKEAWAYS

- National exposure databases are an essential source of information for exposure surveillance.
- Current existing databases are used extensively by their proprietors to feed exposure surveillance needs and research on exposure sciences.
- Methodological challenges associated with the non-randomness of most archived exposure data warrants continued research on approaches to limit bias and misclassification.

THE CONTINUING DEVELOPMENT OF CAREX CANADA

DR. CHERYL PETERS
CAREX CANADA, BC CENTRE FOR DISEASE CONTROL, AND BC CANCER

The main objective of the **CAREX Canada** project is to identify which carcinogens Canadians are exposed to at work, the proportion of workers exposed, and their levels of exposure (21). It has been used to identify groups at risk of high exposure, set priorities for prevention, predict future cases of disease, identify gaps in data, and to set research priorities. Expansion of the project includes plans to incorporate exposure to other types of hazards (i.e., substances not recognized/classified as carcinogens).

While CAREX Canada has and continues to provide valuable insights with respect to occupational exposure to carcinogens in Canada, Dr. Peters discussed several challenges the project is currently facing. Firstly, the CAREX Canada model is based on data from CWED combined with expert assessment. Much of the exposure data is older and may not reflect current exposures. Many emerging exposures may lack measurement data altogether, or may not have an OEL to compare to. Funding is also an issue. CAREX Canada began as a pilot project in 2003 and is currently funded through 2027. Dr. Peters emphasized the challenge of securing long-term funding to maintain and update ongoing programs such as this.

KEY TAKEAWAYS

- CAREX Canada has developed estimates of exposure for over 50 occupational carcinogens.
- A key partnership between CAREX Canada and CWED underpins the development of occupational carcinogen estimates, but this will be challenged in the future given that the exposure data is becoming dated.

THE ASBESTOS WORKER REGISTRY – OPPORTUNITIES FOR IMPROVED EXPOSURE SURVEILLANCE IN ONTARIO

DR. VICTORIA ARRANDALE
UNIVERSITY OF TORONTO

Dr. Arrandale shared her work using **Ontario's Asbestos Workers Registry (AWR)** for surveillance research (22). The AWR is an exposure registry that tracks asbestos-exposed workers in Ontario. Employers are required to register any worker doing Type II and/or Type III work with asbestos-containing materials into the AWR, and report their relevant work hours.

Dr. Arrandale emphasized that surveillance is not simply the existence of data; it implies action. One of the main strengths of exposure registries lies in the opportunity to intervene before the onset of disease. The AWR supports screening and early detection by prompting high-risk workers to visit their healthcare provider after 2000 hours of reported work. However, analyses of the AWR show that workers may be at significantly increased risk of disease well before reaching this level. Adjusting the notification level and providing more relevant information to workers could help improve the opportunities for intervention. Exposure registries like the AWR can also help support workers' compensation claims by providing a record of exposure. If linked to workplace investigations or enforcement, exposure registries such as the AWR can also be a tool for primary prevention.

Exposure registries may not achieve their goals if they are not set up well (3). Exposure registries should ideally include all exposed individuals within the specified population; for this reason, mandatory registries are often stronger than voluntary registries. While the AWR is a mandatory registry, the completeness of the reporting is unknown. Establishing systems to check for employer compliance could improve its completeness. Exposure registries can also vary in their level of detail. The AWR lacks information on level of exposure (only hours of work are reported), prevalence of exposure, and co-exposures to other occupational hazards which might contribute to disease, which limits its use for exposure surveillance.

KEY TAKEAWAYS

- Well-designed exposure registries can provide an opportunity to intervene before the onset of disease, or primary prevention.
- Exposure registries can also help support workers' compensation claims by providing a record of exposure.
- Exposure registries that have clear goals, careful design and dedicated resources are more likely to be successful.

USING THE NATIONAL POLLUTANT RELEASE INVENTORY AND OTHER ENVIRONMENTAL REPORTING PROGRAMS FOR WORKPLACE EXPOSURE SURVEILLANCE

DR. CATHERINE SLAVIK
UNIVERSITY OF OREGON

Dr. Slavik explored the interface between environment and occupation in describing how environmental monitoring data can be used for occupational exposure surveillance purposes. Information on use and emissions of hazardous substances from industrial facilities, when combined with information about the facilities' activities and workforce, can be used as an indicator of potential occupational exposures. The type of data collected in an environmental monitoring database allows investigation of a given substance by industry sector, over geographical region and over time. For example, the **National Pollutant Release Inventory** has tracked industrial activities for more than 300 substances over a wide range of industries in Canada since 1992 (23), while Ontario's program under the **Toxics Reduction Act** collected information on industrial use of chemicals from 2010 to 2020 (24,25).

This type of data can support surveillance of lesser-studied chemicals whose health effects may not yet be known. It can also be used to identify priorities for risk management measures, and study trends in the use of hazardous substances or the numbers of workers employed in major industrial facilities. However, there are limitations to using this type of data to estimate occupational exposure. Firstly, industrial use or release of a substance is only an indicator of potential exposure. There is no data on the length or intensity of exposure, route of exposure, or determinants of exposure. Also, data is self-reported and typically reported as ranges, which can lead to inaccuracies. Lastly, generally only large facilities report, while smaller facilities are exempt.

KEY TAKEAWAYS

- Data from environmental reporting programs can provide indicators of potential occupational exposures inside industrial facilities.
- They can fill data gaps around historical and current industrial chemical activities.

POPULATION-LEVEL DATA SOURCES TO UNDERSTAND EXPOSURES IN ONTARIO

DR. ELAINA MCINTYRE AND
DR. GARTHIKA NAVARANJAN
PUBLIC HEALTH ONTARIO

Dr. MacIntyre and Dr. Navaranjan described different data sources used to understand environmental exposures in Ontario, including their application to monitoring occupational exposures. They gave an overview of some of the projects Public Health Ontario has completed, including mapping chemical concentrations in untreated water bodies (26), tracking self-reported exposure to heavy metals, pesticides and carbon monoxide using data from the **Ontario Poison Centre**, investigating potential carbon monoxide exposures using data from the **Ontario Technical Standards and Safety Authority**, and examining lead exposure in the Ontario population using an administrative database, the **Ontario Laboratories Information System (OLIS)**.

There are several challenges in using administrative databases like OLIS for occupational purposes. For example, OLIS is a population-based database that includes test results for individuals in the general population who were tested for a clinical reason (e.g., suspected lead exposure), and is not designed to specifically capture occupational exposures, though some may be included. Occupation and industry information is also not available as part of OLIS, or administrative health databases in general.

Despite these challenges, there may be opportunities to use administrative health data for occupational purposes. For example, occurrences of poisonings or overexposures could be viewed as sentinel events, which indicate potential out-of-control exposures and trigger further investigations. This has been done in other jurisdictions, such as the US National Institute for Occupational Safety and Health's (NIOSH) **Sentinel Event Notification System for Occupational Risk (SENSOR)** program. OLIS has also been linked to OCRC's Occupational Disease Surveillance System to investigate **COVID-19 among Ontario workers**, and other opportunities are being investigated.

KEY TAKEAWAYS

- Several possible exposure databases exist, including administrative databases and self-reported databases that have utility for estimating population-level exposure.
- Population-based databases may have utility in identifying high exposures, which could represent occupational exposures.

PATCH TESTING TO BETTER UNDERSTAND HAZARDOUS DERMAL EXPOSURES

DR. LINN HOLNESS
UNITY HEALTH, UNIVERSITY OF TORONTO

Dr. Holness reviewed the work being done by the **Occupational Medicine Clinic** at St. Michael's Hospital to use patch testing data to understand dermal exposures (27,28), as well as international efforts (29,30). Patch testing is an important tool in diagnosing occupational allergic contact dermatitis. Common occupational allergens include metals, rubbers, preservatives and resins.

Patch testing can be an important tool for exposure surveillance. A positive test indicates exposure to a specific allergen or group of allergens. Often, the route of exposure is obvious from the patch testing result, which can indicate specific opportunities for prevention. Dr. Holness highlighted the European Union's ban on chromium (VI) in cement as an example of patch testing data being used to successfully drive prevention. Dermatologists advocated strongly for the ban and have seen a resulting decrease in chromium-related contact dermatitis in their patch testing data.

The St. Michael's clinic also collects information on determinants of exposure as part of their patch test database. This can help identify other areas for intervention; for example, their studies have found that size of workplace, unionization, and training can all impact exposure to dermal allergens and irritants. This type of database can also be used to investigate trends over time. Finally, many skin sensitizers are also lung sensitizers, so actions taken to reduce dermal exposure may also result in reduced lung sensitivities.

KEY TAKEAWAYS

- Patch testing is critical to the diagnosis of occupational allergic contact dermatitis.
- Patch testing results can identify new occupational allergens or changes in exposure settings for known allergens and show trends over time.

BROADENING THE SCOPE OF WORKPLACE SURVEILLANCE TO PSYCHOSOCIAL AND PHYSICAL EXPOSURES AT WORK

DR. PETER SMITH
INSTITUTE FOR WORK AND HEALTH

Dr. Smith spoke about the importance and challenges of including non-chemical exposures such as ergonomic, physical, and psychosocial hazards in surveillance systems. Hazards such as psychosocial and ergonomic exposures require different approaches to measurement compared to chemical or environmental exposures. However, issues such as mental health are major challenges, and comprehensive surveillance of all types of workplace hazards is needed to better understand how work environments are related to these outcomes, and to monitor trends.

Dr. Smith outlined three approaches to assessing physical, ergonomic and psychosocial exposures at work. Observational studies are objective, but often lack generalizability and have high cost. Surveys can capture detailed information and changes over time, but are subjective, can have high costs if done on a large scale, and may not be representative of the target population. Finally, JEM approaches are objective, potentially more representative, and generally have a lower cost. While JEMs provide a feasible and timely approach to assessing occupational psychosocial and ergonomic hazards when other data is not available, they may not capture changes over time or variability within occupations.

There are several challenges with using a JEM approach to assess exposure. JEMs from other jurisdictions may be based on occupations that lack similarity to Canadian occupations, or may use different occupational coding systems. Building a JEM requires primary data on exposure, or experts to derive exposures across occupational categories. JEMs may become out of date if exposures within occupations change over time. They also lack information on protections across occupations, or other determinants of exposure.

Finally, Dr. Smith highlighted the absence of demonstrated threshold values, particularly for psychosocial exposures, and described how this represents a challenge for defining potentially hazardous levels of exposure (OELs) for these measures.

KEY TAKEAWAYS

- Psychosocial and ergonomic exposures can be difficult to measure and assess at a population level.
- The absence of demonstrated threshold values, particularly for psychosocial exposures, represents a challenge for defining the proportion of the labour market above and below specific OELs.

THE SILICA CONTROL TOOL: A MODEL FOR USING EXPOSURE DATA TO PREVENT OCCUPATIONAL DISEASE

DR. MELANIE GORMAN NG
BC CONSTRUCTION SAFETY ALLIANCE

The **Silica Control Tool (SCT)** is an online tool for predicting a worker's exposure to silica while performing tasks common in the construction industry (31). Employers can use the tool to estimate exposure for a worker given their tasks, work environment, and the controls in place. The model generates a written plan that can be used for risk assessment. While developed for the BC construction industry, the SCT is being adapted for other jurisdictions, including Alberta and Ontario, and other industries, such as open-pit mining. There is also ongoing work to develop a similar tool to predict exposure to welding fumes. Finally, a Bayesian plug-in is currently in development. The plug-in will allow users to add in their own data to create a more personalized exposure estimate.

Dr. Gorman-Ng underlined the challenge of data availability in expanding tools like the SCT, as well as developing new tools. While the construction industry is predominantly small companies that may not have much data available, many that do have data are hesitant to share due to concern that data collection may interfere with work, or repercussions if their levels are high. She highlighted the importance of engaging industry partners and showing the value of the tool, for both access to data and uptake of the tool. Partnering with other organizations with strong workplace ties can also improve participation.

KEY TAKEAWAYS

- Through using the SCT, employers can see the value in collecting and sharing exposure data.
- Data mobilization tools like the SCT can provide data-driven guidance to employers who can't easily access hygienists.

THEMES FROM THE PRESENTATIONS

Several themes arose during the presentations on current occupational exposure surveillance initiatives. Several presenters commented on the challenges in accessing and digitizing current exposure data, as well as the difficulties involved in combining data from different sources. A key challenge noted in several presentations was the need for resources to maintain data quality, collect new data, and update databases over time. The importance of stakeholder engagement in collecting and accessing new data was also a strong theme.

Presenters also highlighted the importance of critically evaluating exposure data and the context in which it is collected to ensure it presents an accurate, complete picture of workers' exposures. Similarly, several presenters also touched on the need to collect a variety of data, not just compliance data. Incorporating data from other sources, such as employer data and data collected for research purposes, may give a more robust understanding of occupational exposure. Leveraging other types of data, such as environmental or administrative health data can also help fill gaps.

Finally, a strong theme throughout the presentations was the need for action. Presenters noted that surveillance is not just the existence of data, and more work is needed to make exposure data accessible and usable for multiple purposes, including research, surveillance, policy, and compensation.

- **Accessibility and digitization of exposure data**
- **Need for resources to collect new data and update databases**
- **Stakeholder engagement in collecting and accessing new data**
- **Critical evaluation of exposure data, its collection and its sources**
- **Need for action in using exposure data for multiple purposes**

GAPS AND PRIORITIES IDENTIFIED AT THE WORKSHOP

Day two of the workshop was aimed at addressing three questions:

1. **What are the most important gaps in exposure surveillance in Canada?**
2. **What skills and resources are needed to fill these gaps?**
3. **What actions and projects are necessary to make progress?**

The day began with small group discussions, followed by a broader group discussion of recommendations, including key short-, medium-, and long-term steps that must be taken to advance workplace exposure surveillance in Canada. This section provides a summary of the key points raised during these discussions and in the workshop presentations.

KEY GAPS AND CHALLENGES FOR EXPOSURE SURVEILLANCE IDENTIFIED AT THE WORKSHOP

Across most of Canada, government agencies and stakeholders involved in the prevention of occupational disease lack access to current exposure data. An exception to this is in Quebec, where data are still collected by government hygienists during prevention and compliance visits, and analyzed at the IRSST; however, only a limited amount of information on each measurement is digitized, and the database is not publicly available. The largest accessible exposure dataset in Canada is CWED, which contains primarily historical measurement data collected in the 1980s and 1990s for compliance purposes. The challenges in addressing this gap in current exposure data are related both to what data are collected and what data are accessible.

KEY GAP: LACK OF ACCESS TO CURRENT EXPOSURE DATA

CHALLENGES:

- Outside of Quebec, only small amounts of exposure measurement data are collected by workplace inspectors for compliance purposes and these data are not regularly digitized.
- Data collected for non-compliance purposes by employers, consultants, and researchers are very rarely accessible.

Workshop participants noted that even if all exposure data currently being collected were made publicly available, some important gaps would remain, including:

OTHER DATA GAPS

- Data from small companies.
- Data on emerging hazards.
- Data on multiple exposures or complex exposure mixtures.
- Data on most non-chemical exposures.

Many other challenges were identified by workshop participants. Examples include a lack of coordination and data sharing both within and across jurisdictions and a lack of partnerships between different groups of stakeholders. In addition, data collection and storage are inconsistent and there is no single, standardized occupation and industry coding system, making it difficult and costly to merge data from different sources.

Workshop participants identified the need for centralized data repositories that contain both compliance and non-compliance exposure measurements, and include standardized occupation and industry information, data collection and laboratory analysis methods, and information on exposure controls and other determinants of exposure. Ideally, measurements associated with job-specific tasks should also be included.

OTHER GAPS AND CHALLENGES

- Centralized data repositories.
- Coordination and data sharing.
- Partnerships between stakeholders.
- Consistent data collection and storage.
- Single, standardized occupation and industry coding system.

SKILLS AND RESOURCE NEEDS IDENTIFIED AT THE WORKSHOP

A need for both standards and training were identified by workshop participants. Standards are needed to ensure consistent data collection, storage, and statistical analysis across jurisdictions and organizations. In addition, standardized coding systems are needed to facilitate the merging of datasets. This could also be facilitated by effective crosswalk software or artificial intelligence systems to code free text job information and assist with crosswalks between systems. Training is needed to provide data analysis skills and a better understanding of methods for creating exposure databases. This training is essential for both occupational hygienists and others involved in data collection, coding, and analysis.

The key resource need identified by workshop participants is a centralized data repository or network of data repositories for exposure data throughout Canada, to provide harmonization and coordination of data collected from all sources that can be easily shared across the country. Some participants suggested that such a repository should be coordinated and facilitated by an independent body to hold data from multiple partners and assure accessibility for all. The development of tools allowing users to query the data quickly and easily would assist in accessibility of the data. CWED was discussed as a possible model, but it would require an injection of substantial new funding.

Substantial ongoing efforts will be need to establish fully functional surveillance systems. Participants specifically highlighted that sustained long-term funding will be needed to create, maintain, and update new exposure databases, as well as to eventually create centralized data repositories. Participants recognized that sources of funding are limited, especially for national initiatives such as CWED. Approaching not only provincial but federal agencies was also discussed.

KEY TAKEAWAYS | SKILLS AND RESOURCES

- Standards for data collection, storage and statistical analysis.
- Standardized job coding systems.
- Effective software and artificial intelligence systems for crosswalks and free text job coding.
- Training in data analysis.
- Training in exposure database creation methods.
- Centralized data repositories.
- Funding.

ACTIONS AND PROJECTS IDENTIFIED AT THE WORKSHOP

Short-Term Actions and Projects

Workshop participants agreed on the need to identify existing data holdings and how these data can be accessed. As a first step, conducting a comprehensive survey to identify data held by Canadian ministries of labour, employers, unions, health and safety associations, and researchers was discussed. This survey should include members of occupational hygiene organizations, whose membership spans all potential data holders and who may have first-hand knowledge of data holdings, as well as organizations and individuals holding data. The need to identify priority hazards across and within jurisdictions was also discussed as an important means of prioritizing the data to be acquired, digitized, or analyzed.

Other actions that could be implemented with relatively few new resources are the development of a standardized database format that is compatible with CWED and other existing databases, that could also be used as a template for future efforts by a wide range of data holders to digitize and make their data available. This would also facilitate their eventual merger or linkage into some kind of federated dataset, where data could be held locally but accessed centrally through record linkage to address privacy or other concerns. A model data sharing agreement, which could be easily modified to suit the specific needs of data holders and stakeholders, could be developed. Preferred occupation and industry coding systems could also be identified, as well as the best automated coding tools that could be used with free text job information. Participants also stressed the need to engage with stakeholders and develop a business case to convince a wide range of data holders (but particularly employers) to participate. Such a business case should stress the benefits to prevention, as well as the downstream benefits of reduced claims, premiums, healthcare costs, and other incentives. Lastly, the participants also identified the need for leadership to coordinate and champion this effort.

Several initiatives already in motion were also discussed. In Ontario, the MLITSD and the OCRC are collaborating to develop a plan for the digitization of measurement data collected by inspectors and MLITSD consultants, or provided by employers, and held by the MLITSD in their inspection report files, starting with recent data but going back to the period when the provincial laboratory was closed. Developing pilot projects to digitize recently collected exposure data in other jurisdictions should be a priority and may be initiated with relatively modest funding. The OCRC was also recently awarded a grant from the Ontario Workplace Safety and Insurance Board to explore the use of US OSHA and US Mining Safety and Health Administration exposure databases to fill data gaps in Ontario.

KEY TAKEAWAYS | SHORT-TERM ACTIONS AND PROJECTS

- Identify existing data holdings.
- Identify priority hazards.
- Develop a standardized database format.
- Develop a model data sharing agreement.
- Identify preferred occupation and industry coding systems.
- Identify effective automated job coding tools.
- Engage with stakeholders.
- Develop a business case.
- Identify leadership.
- Develop pilot projects to digitize exposure data.
- Explore the use of international databases to fill data gaps in Canada.

Medium-Term Actions and Projects

The primary medium-term objectives are the digitization of existing exposure measurement data and the creation of highly functional centralized data repositories. Participants agreed that centralized data repositories with data storage and analytical resources, as well as strong data security, were necessary for stakeholders to feel comfortable with contributing their data. Standardized data entry and coding protocols will be necessary to allow sharing and pooling of data. Participants also felt that developing tools to allow users to query the data for compliance, compensation, research, and policy purposes is essential. In contrast to the pilot projects, this effort will require more substantial funding.

Starting with public institutions is logical because this data should be publicly accessible and there appears to be an interest among some Ministries of Labour to collaborate. For example, as described above, the Ontario MLITSD would like all the data they have collected during the years since the Ministry lab was closed in 1996 to be digitized. While projects such as this will be a great resource, participants felt strongly that data collected for compliance purposes provides a limited view of exposure and that data from other sources is necessary. However, gaining access to data that is privately held may be challenging. Participants discussed different approaches to foster stakeholder engagement in building an exposure surveillance system. A key component is developing approaches to actively recruit stakeholders and effectively share data and reports with employers, consultants, labour unions, and health and safety associations, as well as government. The concept of creating a 'social dialogue' to develop relationships with stakeholders that foster trust and promote sharing of information was discussed.

Strong leadership and planning will be necessary to meet these objectives, and workshop participants also discussed the potential need for an advisory committee to steer progress. A strategic plan may be necessary to clearly define the goals and objectives of these initiatives. Participants also discussed the need to develop a knowledge translation plan for communication between different stakeholder groups. Another important role for leadership is to foster collaboration between jurisdictions. Participants discussed making the workshop a regular event, perhaps as an annual meeting, and having different provinces host.

KEY TAKEAWAYS | MEDIUM-TERM ACTIONS AND PROJECTS

- Digitize existing exposure data.
- Create centralized data repositories.
- Develop tools to query exposure databases.
- Build relationships with stakeholders.
- Develop an advisory committee.
- Develop a strategic plan.
- Develop a knowledge translation plan.
- Hold annual meetings.

Long-Term Actions and Projects

The long-term objective is a sustainable, national occupational exposure surveillance program or network of collaborating programs. This would need to be supported by national leadership and sustainable funding. It seems logical to build on the CWED project as the base for a national (likely federated) repository, but it would require substantial new resources to do so. Funding at the national level poses a particular challenge and national projects such as CWED and CAREX Canada have found it very difficult to identify potential sources. Although federal resources have been directed towards data science and infrastructure, they have focused on disease and genetic data and other sources will need to be identified for occupational data.

However, once a national occupational exposure database is developed, it will become a major resource for primary, secondary, and tertiary prevention. National collaboration will allow the provinces to fill in provincial gaps, share data on new and emerging hazards, and support prevention and compensation policy development. The data could feed into the CAREX Canada project to continually improve and update estimates of the numbers of workers exposed in each province and nationally. The data could be linked with health data at the provincial or federal level to support occupational disease surveillance and research.

KEY TAKEAWAYS | LONG-TERM ACTIONS AND PROJECTS

- Develop national occupational exposure surveillance program.
- Secure sustainable funding.
- Use the data to support occupational disease prevention, compensation, surveillance and research.

REFERENCES

(1) Shakik S, Logar-Henderson C, MacLeod J, Demers PA. National Occupatioal Disease and Exposure Surveillance Workshop Summary and Observations [Internet]. Toronto: Occupational Cancer Research Centre, Ontario Health; 2019. Available from: https://www.odsp-ocrc.ca/wp-content/uploads/2020/03/NODES-Workshop-Report_Final.pdf

(2) Demers PA. Using scientific evidence and principles to help determine the work-relatedness of cancer [Internet]. Toronto; 2020 [cited 2023 Aug 17]. Available from: http://www.ontario.ca/document/using-scientific-evidence-and-principles-help-determine-work-relatedness-cancer

(3) Arrandale VH, Bornstein S, King A, Takaro TK, Demers PA. Designing exposure registries for improved tracking of occupational exposure and disease. Can J Public Health Rev Can Sante Publique. 2016 Jun 27;107(1):e119–25.

(4) Chen J, Prendergast T, Prince P, Gaw A, Quayle D. The National Dose Registry-Canadian occupational exposure to ionising radiation, 1998-2018. J Radiol Prot Off J Soc Radiol Prot. 2021 Jun 1;41(2).

(5) Davies H, Peters CE, Hall A, Demers PA, Nicol AM. Capacity Development for a Canadian Workplace Exposure Database [Internet]. WorkSafeBC; 2014 Jul [cited 2023 Aug 17]. Available from: https://www.worksafebc.com/en/resources/about-us/research/capacity-development-for-a-canadian-workplace-exposure-database?lang=en

(6) Sauvé JF, Davies HW, Parent MÉ, Peters CE, Sylvestre MP, Lavoué J. Development of Quantitative Estimates of Wood Dust Exposure in a Canadian General Population Job-Exposure Matrix Based on Past Expert Assessments. Ann Work Expo Health. 2019 Jan 7;63(1):22–33.

(7) Hall AL, Peters CE, Demers PA, Davies HW. Exposed! Or not? The diminishing record of workplace exposure in Canada. Can J Public Health Rev Can Sante Publique. 2014 Apr 17;105(3):e214-217.

(8) Sarazin P, Labrèche F, Lesage J, Lavoué J. A Comparative Study of the IMIS (OSHA) and LIMS (IRSST) Exposure Databases [Internet]. Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST); 2018 Nov [cited 2023 Aug 17]. Available from: https://www.irsst.qc.ca/en/publications-tools/publication/i/101009/n/imis-lims

(9) Sarazin P, Burstyn I, Kincl L, Lavoué J. Trends in OSHA Compliance Monitoring Data 1979-2011: Statistical Modeling of Ancillary Information across 77 Chemicals. Ann Occup Hyg. 2016 May;60(4):432–52.

(10) Sarazin P, Burstyn I, Kincl L, Friesen MC, Lavoué J. Characterization of the Selective Recording of Workplace Exposure Measurements into OSHA's IMIS Databank. Ann Work Expo Health. 2018 Mar 12;62(3):269–80.

(11) Burstyn I, Sarazin P, Luta G, Friesen MC, Kincl L, Lavoué J. Prerequisite for Imputing Non-detects among Airborne Samples in OSHA's IMIS Databank: Prediction of Sample's Volume. Ann Work Expo Health. 2023 Jul 6;67(6):744–57.

(12) Bosson-Rieutort D, Sarazin P, Bicout DJ, Ho V, Lavoué J. Occupational Co-exposures to Multiple Chemical Agents from Workplace Measurements by the US Occupational Safety and Health Administration. Ann Work Expo Health. 2020 Apr 30;64(4):402–15.

(13) Mater G, Sauvé JF, Sarazin P, Lavoué J. Exposure Determinants in the French Database COLCHIC (1987-2019): Statistical Modeling across 77 Chemicals. Ann Work Expo Health. 2022 Jun 6;66(5):563–79.

(14) Mater G, Paris C, Lavoué J. Descriptive analysis and comparison of two French occupational exposure databases: COLCHIC and SCOLA. Am J Ind Med. 2016 May;59(5):379–91.

(15) Kendzia B, Pesch B, Koppisch D, Van Gelder R, Pitzke K, Zschiesche W, et al. Modelling of occupational exposure to inhalable nickel compounds. J Expo Sci Environ Epidemiol. 2017 Jul;27(4):427–33.

(16) Kendzia B, Van Gelder R, Schwank T, Hagemann C, Zschiesche W, Behrens T, et al. Occupational Exposure to Inhalable Manganese at German Workplaces. Ann Work Expo Health. 2017 Nov 10;61(9):1108–17.

(17) Park JH, Choi S, Koh DH, Lim DS, Park D, Kim HC, et al. A Pilot Establishment of the Job-Exposure Matrix of Lead Using the Standard Process Code of Nationwide Exposure Databases in Korea. Saf Health Work. 2022 Dec;13(4):493–9.

(18) Koh DH, Park JH, Lee SG, Kim HC, Choi S, Jung H, et al. Combining Lead Exposure Measurements and Experts' Judgment Through a Bayesian Framework. Ann Work Expo Health. 2017 Nov 10;61(9):1054–75.

(19) Scarselli A, Montaruli C, Marinaccio A. The Italian information system on occupational exposure to carcinogens (SIREP): structure, contents and future perspectives. Ann Occup Hyg. 2007 Jul;51(5):471–8.

(20) Scarselli A, Corfiati M, Di Marzio D, Marinaccio A, Iavicoli S. Gender differences in occupational exposure to carcinogens among Italian workers. BMC Public Health. 2018 Mar 27;18(1):413.

(21) Peters CE, Ge CB, Hall AL, Davies HW, Demers PA. CAREX Canada: an enhanced model for assessing occupational carcinogen exposure. Occup Environ Med. 2015 Jan;72(1):64–71.

(22) Occupational Cancer Research Centre [Internet]. [cited 2023 Aug 17]. Occupational cancer and asbestosis among asbestos-exposed workers in Ontario. Available from: https://www.occupationalcancer.ca/2018/occupational-cancer-and-asbestosis-among-asbestos-exposed-workers-in-ontario/

(23) Slavik CE, Demers PA, Tamburic L, Warden H, McLeod C. Do patterns of past asbestos use and production reflect current geographic variations of cancer risk?: mesothelioma in Ontario and British Columbia, Canada. Cancer Causes Control CCC. 2023 Apr;34(4):349–60.

(24) Slavik CE, Kalenge S, Demers PA. Recent trends in the industrial use and emission of known and suspected carcinogens in Ontario, Canada. Rev Environ Health. 2018 Mar 28;33(1):99–107.

(25) Slavik CE, Kalenge S, Demers PA. Industry and geographic patterns of use and emission of carcinogens in Ontario, Canada, 2011-2015. Can J Public Health Rev Can Sante Publique. 2018 Dec;109(5–6):769–78.

(26) Public Health Ontario [Internet]. [cited 2023 Aug 17]. Raw Water Chemicals Map. Available from: http://www.publichealthontario.ca/en/Data-and-Analysis/Environmental-Health/Raw-Water-Chemicals

(27) Holness DL, Kudla I, DeKoven JG, Skotnicki S. The Utility of an Occupational Contact Dermatitis Patch Test Database in the Analysis of Workplace Prevention Activities in Toronto, Canada. Ann Work Expo Health. 2021 Mar 3;65(2):196–200.

(28) Arrandale VH, Holness DL. Using health insurance administrative data to explore patch testing utilization in Ontario, Canada-An untapped resource. Contact Dermatitis. 2019 Jun;80(6):386–90.

(29) DeKoven JG, DeKoven BM, Warshaw EM, Mathias CGT, Taylor JS, Sasseville D, et al. Occupational contact dermatitis: Retrospective analysis of North American Contact Dermatitis Group Data, 2001 to 2016. J Am Acad Dermatol. 2022 Apr;86(4):782–90.

(30) Bauer A, Pesonen M, Brans R, Caroppo F, Dickel H, Dugonik A, et al. Occupational contact allergy: The European perspective-Analysis of patch test data from ESSCA between 2011 and 2020. Contact Dermatitis. 2023 Apr;88(4):263–74.

(31) Davies HW, Gorman-Ng M. Development of a Web-Based Tool for Risk Assessment and Exposure Control Planning of Silica-Producing Tasks in the Construction Sector. Front Public Health. 2020;8:371.

APPENDIX I. SPEAKER BIOGRAPHIES

DR. VICTORIA ARRANDALE
UNIVERSITY OF TORONTO

Dr. Victoria Arrandale is an Assistant Professor with the Dalla Lana School of Public Health at the University of Toronto. Her research interests include occupational hygiene, exposure assessment, the development of new methods for measuring exposure, and intervention research to prevent occupation exposure and disease. She received her PhD in Medical Science from the University of Toronto. Recent projects include research to improve health and safety in nail salons, occupational exposure to flame retardants, and analyses of silicosis, asbestosis, and pulmonary fibrosis in Ontario.

MR. MICHAEL BOILEAU
SAFE WORK MANITOBA

Michael Boileau is an occupational hygienist with Safe Work Manitoba, a public agency dedicated to the prevention of workplace injury and illness in Manitoba. He was instrumental in the development of Safe Work Manitoba's Occupational Disease and Illness Prevention Strategy. Prior to joining Safe Work Manitoba he worked with Workplace Safety and Health, Manitoba's enforcement agency, and prior to that as a consultant for a large, national firm.

DR. HUGH DAVIES
UNIVERSITY OF BRITISH COLUMBIA

Dr. Hugh Davies is the leader of the Canadian Workplace Exposure Database (CWED) project. He is also a Professor at the University of British Columbia, and a co-investigator of the CAREX Canada project. His research interests focus on occupational hygiene and exposure assessment and include the impact of noise exposure on heart disease and other non-auditory health outcomes, exposure to antineoplastic drugs among healthcare and veterinary workers, and silica exposure in construction. He is a board-certified industrial hygienist, and a member of the ACGIH chemical substances TLV committee.

DR. MELANIE GORMAN NG
BC CONSTRUCTION SAFETY ALLIANCE

Dr. Melanie Gorman Ng is a Health and Exposure Scientist with the British Columbia Construction Safety Alliance, and an Adjunct Professor at the University of British Columbia's School of Population and Public Health. She holds a PhD in Occupational and Environmental Medicine from the University of Aberdeen. She is also a Certified Industrial Hygienist. Her research focuses on health hazards and exposure assessment in the construction industry. She developed the statistical model that underpins the Silica Control Tool.

DR. LINN HOLNESS
UNITY HEALTH TORONTO AND UNIVERSITY OF TORONTO

Dr. Linn Holness is an occupational medicine physician. She is the Director of the Centre for Research Expertise in Occupational Disease, and a Professor Emerita with the Dalla Lana School of Public Health and the Department of Medicine at the University of Toronto. She is also a staff physician in the Division of Occupational Medicine, Department of Medicine at St. Michael's Hospital and a scientist with the MAP Centre for Urban Health Solutions. Her primary research focus is occupational skin disease, including prevention, diagnosis, outcomes, health care utilization, and return to work.

DR. JÉRÔME LAVOUÉ
UNIVERSITÉ DE MONTRÉAL

Dr. Jérôme Lavoué is a Professor with the Department of Environmental and Occupational Health, École de santé publique, Université de Montréal and a Research Scientist with the Université de Montréal Hospital Research Centre. He holds a PhD in Public Health from the Université de Montréal. His research focuses on occupational exposure assessment, particularly exposure databases, the development of job-exposure matrices, and Bayesian statistical modeling. Major projects include building a Canadian JEM from past expert assessments, studying and comparing major exposure databases in North America and Europe, and developing user friendly tools to support decision making for compliance with OELs.

DR. ELAINA MCINTYRE
PUBLIC HEALTH ONTARIO

Dr. Elaina MacIntyre is the Manager of Toxicology and Exposure Assessment with the Environmental and Occupational Health department at Public Health Ontario. She is also an Adjunct Professor with the Dalla Lana School of Public Health at the University of Toronto. She holds a PhD in Environmental and Occupational Hygiene from the University of British Columbia. Her areas of expertise include environmental epidemiology and exposure assessment, environmental health surveillance, and non-communicable disease clusters.

DR. GARTHIKA NAVARANJAN
PUBLIC HEALTH ONTARIO

Dr. Garthika Navaranjan is an Epidemiologist Specialist at Public Health Ontario. She received a PhD in Occupational and Environmental Health from the Dalla Lana School of Public Health, University of Toronto, studying the association between chemical exposures in the indoor environment and the development of asthma in children. She previously worked as a Research Associate with the OCRC and was involved in a variety of projects investigating the causes of work-related cancer, including the association between pesticide exposure and the risk of Hodgkin lymphoma and an update of the risk of cancer among Ontario uranium miners.

DR. CHERYL PETERS
CAREX CANADA, BC CENTRE FOR DISEASE CONTROL, AND BC CANCER

Dr. Cheryl Peters is the Senior Scientist for Cancer Prevention with the BC Centre for Disease Control and BC Cancer, an Adjunct Professor with the School of Population and Public Health, University of British Columbia, and an Adjunct Assistant Professor in the Department of Oncology, University of Calgary. She is the Principal Investigator of CAREX Canada and holds a PhD in occupational and environmental hygiene. Her research focuses on occupational exposure assessment, the impact of sex and gender on occupational exposure, and exposure in construction. She is an expert in solar radiation exposure assessment and controls.

DR. PHILIPPE SARAZIN
INSTITUT DE RECHERCHE ROBERT-SAUVÉ EN SANTÉ ET EN SÉCURITÉ DU TRAVAIL (IRSST)

Dr. Philippe Sarazin works in the Chemical and Biological Hazard Prevention research group at the IRSST. He is also an Adjunct Professor with the Department of Environmental and Occupational Health, School of Public Health, Université de Montréal. His research focuses on occupational exposure assessment and exposure modelling, including identifying determinants of occupational exposure through statistical modelling. His recent work includes an analysis of exposure to metals and fumes during welding activities, a description of high-risk multiple exposure situations in Québec workplaces, and development of recommendations for less hazardous alternatives to dichloromethane for specific industries and applications.

DR. CATHERINE SLAVIK
UNIVERSITY OF OREGON

Dr. Cathy Slavik is a Banting Postdoctoral Research Fellow and Courtesy Research Associate at the Centre for Science Communication at the University of Oregon. She received her PhD in Health Geography from McMaster University (2022) and her Master of Public Health in Environmental and Occupational Health from the University of Toronto (2016). Previously, she also worked as a research associate with OCRC. She investigates environmental and occupational exposures and develops evidence-based tools for risk communication and education. Her current research explores how maps can educate the public about harmful risks and exposures.

DR. PETER SMITH
INSTITUTE FOR WORK AND HEALTH

Dr. Peter Smith is President and Senior Scientist at the Institute for Work and Health. He is also a professor at the Dalla Lana School of Public Health at the University of Toronto. He holds a PhD in Social Epidemiology from the Institute of Medical Science at the University of Toronto. His research interests include gender and sex differences in work and health, the relationship between labour market inequalities and health outcomes, the labour market experiences of vulnerable groups, and trends in working conditions over time.