Priority issues in occupational cancer research: Ontario stakeholder perspectives

K. Hohenadel, MSc (1); E. Pichora, MSc (2); L. Marrett, PhD (1,2,3); D. Bukvic, MPH (1); J. Brown, MSOD (1); S. A. Harris, PhD (1,2,3); P. A. Demers, PhD (1,2,3); A. Blair, PhD (1)

This article has been peer reviewed.

Abstract

Introduction: Workers are potentially exposed to known and suspected carcinogens in the workplace, many of which have not been fully evaluated. Despite persistent need, research on occupational cancer appears to have declined in recent decades. The formation of the Occupational Cancer Research Centre (OCRC) is an effort to counter this downward trend in Ontario. The OCRC conducted a survey of the broad stakeholder community to learn about priority issues on occupational cancer research.

Methods: The OCRC received 177 responses to its survey from academic, health care, policy, industry, and labour-affiliated stakeholders. Responses were analyzed based on workplace exposures, at-risk occupations and cancers by organ system, stratified by respondents' occupational role.

Discussion: Priority issues identified included workplace exposures such as chemicals, respirable dusts and fibres (e.g. asbestos), radiation (e.g. electromagnetic fields), pesticides, and shift work; and occupations such as miners, construction workers, and health care workers. Insufficient funding and a lack of exposure data were identified as the central barriers to conducting occupational cancer research.

Conclusion: The results of this survey underscore the great need for occupational cancer research in Ontario and beyond. They will be very useful as the OCRC develops its research agenda.

Keywords: *cancer, occupation, workplace, consultation, Ontario*

Introduction

The International Agency for Research on Cancer (IARC) has classified approximately 60 workplace agents as definite or probable human carcinogens and listed more than 100 as possible occupational carcinogens.[1] Based on initial estimates from the CAREX (CARcinogen EXposure) Canada project,[2] hundreds of thousands of Ontario workers are currently exposed to known and suspected carcinogens. This population continues to grow, so more will be potentially exposed.

Although the precise number of occupational cancers in Canada is not known, between 4% and 10% of cancer deaths in developed countries may be due to preventable occupational exposures.[3]

Despite remarkable success in identifying human carcinogens from occupational studies,[1] efforts to identify and characterize potential carcinogens in the workplace have lessened in the past few decades.[4,5,6] New research initiatives are needed to identify undetected carcinogens and better characterize suspected ones, determine which workplaces are affected, estimate the number of workers exposed to these agents and which cancers they cause, and develop and evaluate prevention efforts.[3,6]

The Occupational Cancer Research Centre (OCRC) was launched in early 2009 to address these needs in Ontario. The Centre is devoted to identifying carcinogens and preventing and ultimately eliminating exposures to them in the workplace by conducting surveillance and etiological and intervention research and promoting knowledge transfer. The OCRC is funded by Cancer Care Ontario (CCO), Ontario's cancer agency; the Ontario division of the Canadian Cancer Society (CCS), a non-profit organization; and the Workplace Safety and Insurance Board (WSIB), Ontario workers' compensation board. The Centre was developed in collaboration with United Steelworkers, a workers' union. WSIB also provides funding for several other research centres focused on other areas of occupational health including the Institute for Work and Health (IWH), the Centre for Research Expertise in Occupational Disease (CREOD) and the Centre of Research Expertise for the Prevention of Musculoskeletal Disorders (CRE-MSD).

An extensive and varied stakeholder community also supports the OCRC: academics and researchers, labour unions and workers, employers, health care practitioners, policy makers and advocates, health and safety specialists and industrial hygienists, and members of the public with a general interest in occupational health.

Author references

1. Occupational Cancer Research Centre, Toronto, Ontario, Canada
2. Cancer Care Ontario, Toronto, Ontario, Canada
3. Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

Correspondence: Karin Hohenadel, Occupational Cancer Research Centre, c/o Cancer Care Ontario, 505 University Ave., 14th floor, Toronto, ON M5G 1X3; Tel.: (416) 971-9800 x 3860; Fax: (416) 971-6888; Email: karin.hohenadel@cancercare.on.ca

Research organizations traditionally employ a variety of strategies to determine priorities in occupational health research, including reviews of published literature, standard expert consultation, and, commonly, rating systems used to reach consensus on priority topics among experts.[7,8,9,10] Since the OCRC was created, in part, to respond to the needs of the broad stakeholder community, we consider it important for input during the development of a research strategy. As a result, one of the Centre's first undertakings was to consult with stakeholders interested in the prevention of occupational cancer; our aim was to understand their views of priorities for occupational cancer research in Ontario and to use this information, along with known gaps in our understanding of the carcinogenic process, to formulate a comprehensive research agenda for the OCRC.

The OCRC stakeholder consultation consisted of an online survey of the stakeholder community in Ontario, as well as those living or working elsewhere who have a connection to the Ontario community, and targeted follow-up interviews with a small sample of survey respondents to provide additional input. The results of the online survey are the focus of this paper.

Methods

Survey

The OCRC informed individuals with an interest in occupational cancer research in Ontario of the survey. The survey included a series of open-ended questions on respondents' views of priority issues in occupational cancer research, perceived barriers to occupational cancer research and the potential solutions to these barriers, types of research currently being conducted, and ways in which stakeholders would like to engage with the Centre.* Information on the geographical location, occupational role and workplace affiliation of respondents was also collected through multiple-choice questions.

The survey protocol and questionnaire were developed in conjunction with the OCRC Steering Committee and Scientific Advisory Committee. The Office of Research Ethics at the University of Toronto determined that the project was exempt from ethics review.

Method of implementation

The online survey, created using SurveyMonkey, was available for completion from June 6 to July 25, 2009. A paper copy was also available on request at the same time. The survey was publicized through a distribution list created by the Centre that included established partners from our funders and partners, academia, industry, labour unions, worker organizations, health care institutions and government organizations. To ensure that the distribution list included active researchers in the field, the Centre performed a scan of research on occupational cancer funded by seven relevant Canadian funding agencies between 2004 and 2009. Because the Centre wanted the survey to be distributed as widely as possible, stakeholders who received the survey were encouraged to forward the survey link to others in their network. For this reason, it is unclear how many individuals were invited to participate.

Analysis

With the guidance of the interim director, two research associates grouped responses to open-ended questions by theme before tabulating frequencies. We grouped exposures based on the listing in Siemiatycki et al.,[1] occupations according to the 2000 Standard Occupational Classification,[11] and cancers by organ system. We calculated frequencies using the statistical package SAS version 9.2 (SAS Institute Inc.)

For comparison, we also stratified responses by respondents' occupational role. To do this, we classified respondents who selected more than one role into the group that was first in the following pre-determined order: worker, researcher/scientist, health and safety specialist and industrial hygienist, health care practitioner, and interested citizen/advocate. We did not include respondents who did not indicate their occupational role (n = 17) or did not fit within these groups (n = 20) in the stratified analyses.

Results

Of the 192 survey responses received, we excluded 15 because values were missing on a large number of variables, leaving 177 surveys for analysis. Most respondents (52%) were directed to the survey link by an email from the OCRC staff. Another large group (24%) learned about it from a colleague or co-worker. One respondent found the survey link on the OCRC website independently. The remainder (24%) received the link from other groups, organizations or industries.

TABLE 1
Characteristics of OCRC stakeholder survey respondents (N = 177)

Characteristic	Number, n	Percent of respondents, %
Geographic location[a]		
Canada		
Ontario	127	71.8
British Columbia	4	2.3
Alberta	3	1.7
Manitoba	3	1.7
Nova Scotia	3	1.7
Quebec	2	1.1
New Brunswick	1	0.6
Newfoundland and Labrador	1	0.6
International	8	4.5
Unspecified	25	14.1
Occupational role[b]		
Researcher/scientist	52	29.4
Health and safety specialist	47	26.6
Industrial hygienist	25	14.1
Interested citizen/ advocate	21	11.9
Health practitioner	14	7.9
Policy analyst	13	7.3
Knowledge translation specialist	12	6.8
Worker	12	6.8
Employer	5	2.8
Occupational affiliation[b]		
Academic institution	45	25.4
Government	24	13.6
Labour union	23	13.0
Non-governmental organization	21	11.9
Industry	18	10.2
Health and safety organization	15	8.5
Health care organization	14	7.9
Unaffiliated	6	3.4

[a] Percentages may not add up to 100 due to rounding.

[b] Respondents were able to select more than one occupational role and more than one occupational affiliation.

* The survey questionnaire is available upon request.

Respondent characteristics

The majority of respondents (72%) came from Ontario, nearly 10% came from other provinces in Canada, including British Columbia, Alberta, Manitoba, Nova Scotia, Quebec, New Brunswick and Newfoundland and Labrador, and about 5% came from other countries. Though the largest proportion of respondents identified themselves as either researchers and scientists from academic institutions or else health and safety specialists, there were a variety of occupational roles and affiliations among them (Table 1).

Priority issues in occupational cancer research

Exposures. We identified nearly 100 workplace exposures of interest at various levels of specificity (summarized in Table 2). These included a mix of well-established carcinogens, such as asbestos and benzene, and emergent issues, such as shift work and nano-technology. Several exposures identified by respondents have not been fully evaluated in relation to cancer, and for some a causal link may be unlikely.

Responses stratified by respondents' occupational role showed a similar concern for several broad types of exposures. All groups identified fuels and engine exhausts, contaminated air and water, and asbestos; all groups, except health practitioners, identified chemicals (in general); only researchers and health and safety specialists identified nanoparticles, but nevertheless listed these frequently; and all groups, except workers and interested citizens, frequently listed shift work.

Occupations. Many respondents proposed occupations as a research subject in relation to cancer risk, and listed 45, both broad and specific (summarized in Table 2). Respondents also mentioned several occupations in conjunction with specific exposures or cancers: landscapers, agricultural workers, and farmers in relation to pesticide exposure; miners in relation to either silica or uranium (radiation) and lung cancer; and health care workers in association with shift work. When stratified by occupational role, most groups agreed on several occupations of interest including miners, health care workers and firefighters.

TABLE 2
Priority research issues identified by survey respondents by exposure category, occupation group and cancer site

Characteristic	Number[a], n	
Exposure category		**Commonly listed exposures[b]**
Chemicals	30	—
Respirable dusts and fibres	27	Asbestos, fiberglass, silica
Radiation	24	Electromagnetic fields, nuclear, cell phone, computer, sun
Shift work	16	—
Pesticides	15	—
Nanomaterials	14	—
Exhaust	14	Diesel, gas
Metals and metal compounds	13	—
Work environment	12	Indoor air, environmental tobacco smoke
Solvents	9	Solvents, benzene
Wood, fossil fuels and oils	7	—
Pharmaceuticals	4	Antineoplastic drugs
Plastic and rubber	4	—
Food preparation exposures	2	—
Major occupation group		**Commonly listed exposures[b]**
Construction and extraction	25	Mining, construction worker, painter
Health care	20	Health care worker, carer
Production	14	Welder, nuclear technician
Protective services	10	Firefighter
Farming, fishing, forestry	9	Farmer, agricultural worker
Installation, maintenance, repair	5	Mechanic
Building and grounds cleaning	4	Landscaper
Transportation	3	—
Computer and mathematics	2	—
Food preparation and serving	2	Restaurant worker
Business and financial	1	—
Personal care and service	1	—
Cancer site		**Sub-types**
Breast	17	—
Respiratory	14	Lung, laryngeal, lung adenocarcinoma, nasal
Hematopoietic	10	NHL, lymphoma, AML, cutaneous lymphoma, leukemia, multiple myeloma
Genital	9	Prostate, ovarian, testicular
Digestive	5	Colon, esophageal, liver, pancreatic
Brain	4	—
Skin	3	—
Mesothelioma	2	—
Urinary	2	Bladder
Childhood	2	Childhood cancers, neuroblastoma
Other	2	Sarcoma, thyroid

[a] Number of respondents that identified each exposure, occupation or cancer group.
[b] Listed by two or more respondents.

Cancers. A small portion of respondents identified specific cancers as priorities for occupational research, mentioning 27 at varying levels of specificity (Table 2). Breast cancer, identified by respondents from all occupational roles, was the most commonly listed. Otherwise, groups differed in the cancers they prioritized. Interested citizens identified several specific cancers not mentioned by other groups including cutaneous lymphoma, multiple myeloma and lung adenocarcinoma. Researchers and health and safety specialists were the only groups to mention mesothelioma, a cancer highly attributable to workplace asbestos exposure. Lung cancer was commonly listed

in association with radon exposure and breast and prostate cancer were commonly listed in relationship to shift work, particularly among health care workers.

Other priority research issues. Many respondents (32%) felt that the OCRC should develop specific resources for researchers and other stakeholders, including exposure databases, disease registries and geographic information system (GIS) maps. Others recommended focusing on prevention efforts (28%) or using specific methodologies or study designs (25%) including long-term cohorts, mixed-method studies and biomonitoring. Several respondents (12%) commented on the need to evaluate interaction between two or more exposures, exposures and genes, or exposures and lifestyle factors such as diet, smoking and viral infections. All groups listed developing or improving prevention efforts among their highest priority issues, and all groups except health care practitioners identified specific research products that should be a priority.

Barriers to conducting occupational cancer research in Ontario

Stakeholders gave their opinions on some common barriers to conducting occupational cancer research in Ontario and suggested potential solutions to overcome these. All groups and stakeholders identified insufficient funding as the central barrier to conducting occupational cancer research. Another recurrent theme was a lack of data on exposures and outcomes, along with the difficulties associated with using the results from occupational cancer research in the workplace to reduce risk. Other cited barriers included a lack of awareness about occupational cancer issues, employer/industry resistance, difficulties disentangling exposure relationships, low public and political priority, lack of collaboration and small study populations.

The most commonly cited solution to these barriers was to have different groups from various geographic regions and disciplines collaborate—researchers with employers and workers, researchers with policy makers and labour unions, and stakeholders with researchers. Other popular solutions included increasing awareness of occupational carcinogens, expanding training and education, and strengthening policies and regulations. Researchers and health care practitioners identified collaboration with different groups as the central solution, while health and safety specialists and interested citizens listed awareness and education as most important. Government prioritization topped the list for workers, a solution that was not commonly cited by any other group.

Discussion

The OCRC stakeholder consultation produced a long list of exposures, occupations, cancers and other issues that the community considered a priority for occupational cancer research. The top priorities identified by respondents, namely chemicals and respirable dusts and fibres, are not unexpected as these are encountered in many workplaces. Other identified priorities included a mix of well-established carcinogens (asbestos and radiation), suspected but not proven carcinogens (pesticides and some solvents), current factors of interest (shift work) and emerging exposures whose effects are still largely unknown (nanomaterials).

Many of the exposure priorities identified by OCRC stakeholders echo the research priorities determined by the United States National Occupational Research Agenda (NORA), including the need to better characterize suspected carcinogens (e.g. chemicals), identify emergent carcinogens (e.g. nanomaterials) and continue surveillance of known occupational carcinogens (e.g. asbestos).[3] In addition, CAREX Canada identified many of the specific exposures listed by OCRC stakeholders as among the most prevalent in Ontario, including shift work (745 000 to 1 051 000 workers are exposed, depending on how it is defined), diesel exhaust (275 000 exposed), benzene (112 000 exposed) and asbestos (52 000 exposed).[13]

When we stratified priorities by occupational role, respondents who identified themselves as workers or interested citizens tended to list well-established carcinogens, while researchers, industrial hygienists and health and safety specialists listed these as well as emergent topics. These differences may represent differences in access to information, but may also be due to the size of the sample or unequal participation across groups.

Occupations most commonly listed as priorities for cancer research were a combination of jobs with well-established links with cancer, such as those in construction and extraction, as well as occupations in industries that have been more recently identified as of risk, such as health care work. Within the construction and extraction category, respondents listed occupations such as mining, construction and painting, some of which the IARC has classified as Group 1 (carcinogenic to humans).[12] Health care, which has not traditionally been considered a high-risk sector for cancer, was ranked as the second highest priority for occupational cancer research. This priority ranking is particularly interesting in light of the increased attention to shift work and exposure to antineoplastic pharmaceuticals within the health care industry, both of which were specifically identified as a concern by respondents. Other occupations listed included a variety of industries such as production (welders and nuclear workers), farming, fishing, forestry, protective services (firefighters) and food preparation.

The most frequently listed cancers, i.e. breast and respiratory cancers, are also the ones that occur most commonly in the general population. Lung cancer has been strongly linked with many occupational exposures; however, the relationship between many workplace exposures and breast cancer is not well studied.[1] Nevertheless, there is a growing concern regarding shift work and breast cancer.[14] A number of prominent researchers increasingly recognize that occupational cancer in women should be explored in greater depth.[15]

Other issues identified by respondents as priorities for occupational cancer research point toward an interest in ensuring that research findings are used to improve workplace conditions. The need to encourage and facilitate additional research in this field through the creation of databases and registries is also apparent. Barriers and

solutions identified by respondents emphasize the need to collaborate, build awareness and use innovative methodologies to deal with small populations and low exposures.

The results of this consultation will be highly useful to the OCRC as it develops its research agenda, particularly given the Centre's large community of funders, partners and stakeholders. Results have already been put to use to determine priority exposures and occupations for project development and event planning. For example, in April 2010, the Centre partnered with the Institute for Work and Health to present *Health Effects of Shift Work*, a symposium of international experts that discussed the scientific evidence for the impact of night work/rotating shift work on human health.

The results of this consultation also draw attention to the challenge of developing a research agenda in a field where the demand for information is great, but where there is variable commonality of interest across various stakeholder groups. They underscore the need for an increase in occupational cancer research in Ontario, as well as nationally and internationally; the need to evaluate cancer risks from the large number of suspected occupational carcinogens in the workplace that are of concern to workers and the occupational health community; and the need to move from research to action with greater speed.

Acknowledgements

The authors would like to thank the OCRC Steering Committee and Scientific Advisory Committee for their guidance and support. Thank you to those involved in the distribution of the survey, to Sandrene ChinCheong for compiling the initial stakeholder database and to Yen Borrego for administrative support.

References

1. Siemiatycki J, Richardson L, Straif K, Latreille B, Lakhani R, Campbell S, et al. Listing occupational carcinogens. Environ Health Perspect. 2004;112(15):1447-59.

2. CAREX Canada [Internet]. Carcinogen database. Vancouver (BC): University of British Columbia. [cited 2011 Jan 9]. http://www.carexcanada.ca/en/carcinogen_profiles_and_estimates/

3. Ward EM, Schulte PA, Bayard S, et al; National Occupational Research Agenda Team. Priorities for development of research methods in occupational cancer. Environ Health Perspect. 2003;111(1):1-12.

4. Blair A, Marrett L, Beane Freeman L. Occupational cancer in developed countries. Environ Health. 2011;10 Suppl 1:S9.

5. Vineis P, Cantor K, Gonzales C, Lynge E, Vallyathan V. Occupational cancer in developed and developing countries. Int J Cancer. 1995;62:655-60.

6. Siemiatycki J. Future etiologic research in occupational cancer. Environ Health Perspect. 1995;103(S8):209-15.

7. Choi BC, Eijkemans GJ, Tennassee LM. Prioritization of occupational sentinel health events for workplace health and hazard surveillance: the Pan American health organization experience. J Occup Environ Med. 2001; 43(2)147-57.

8. Harrington JM. Research priorities in occupational medicine: a survey of UK medical opinion by the Delphi technique. Occup Environ Med. 1994;51:289-94.

9. National Institute for Occupational Safety and Health. National Occupational Research Agenda. Atlanta (GA): DHHS (NIOSH); 1996. Publ. No.: 96-115. Available from: http://www. cdc.gov/niosh/docs/96-115/default.html

10. Iavicoli S, Marinaccio A, Vonesch N, Ursini CL, Grandi C, Palmi S. Research priorities in occupational health in Italy. Occup Environ Med. 2001;58:325-9.

11. U.S. Bureau of Labor Statistics. Division of Occupational Employment Statistics: Standard Occupational Classification [Internet]. Washington (DC): United States Department of Labor; 2000 [cited 2010 Jun 2]. Available from: http://www.bls.gov/soc/2000/soc_majo.htm

12. IARC. Agents classified by the IARC monographs Volumes 1-100. Lyon: International Agency for Research on Cancer [Internet]. Lyon (FR): IARC; [updated 2010 Oct 22; accessed 2010 Jun 2]. Available from: http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf [Accessed 2 June 2010].

13. Peters C. Occupational exposure to selected priority carcinogens in Ontario. Vancouver (BC): CAREX Canada; June 2010.

14. Straif K, Baan R, Grosse Y, Secretan B, El Ghissassi F, Bouvard V, et al. Carcinogenicity of shift-work, painting, and fire-fighting. Lancet Oncol. 2007;8:1065-6.

15. Zahm SH, Blair A. Occupational cancer among women: where have we been and where are we going? Am J Ind Med. 2003; 44:565-75.