Occupational cancer in Canada: What do we know?

Kay Teschke, MPH, CIH; Maria C. Barroetavena, MD, MHSc

Objective: To examine the reporting of cases of occupational cancer in Canada in order to determine reporting requirements, the availability of data, the characteristics of reported cancers and the completeness of reporting.

Design: Descriptive epidemiologic study based on data requested from workers' compensation boards (WCBs) and cancer registries in each province and territory from 1980 to 1989.

Outcome measures: The number of claims accepted and rejected by the WCBs; year of claim, cancer site, sex of claimant, age of claimant at diagnosis, occupation, industry, exposure agent and reasons for rejection of claims; and new primary cancers according to site, age and sex.

Results: Reporting of occupational cancer by physicians is required in Alberta, Saskatchewan and Newfoundland. Only British Columbia, Saskatchewan and Ontario were able to provide all the requested information about the claims. Of the 1026 claims in these three provinces almost all were by men, and about two-thirds were for cancers of the respiratory tract. Asbestos was listed as the etiologic agent in more than one-third of the cases. A comparison of the proportion of incident cancers accepted as occupational by the WCBs with the estimated proportion of cancers in the general population attributable to occupation (based on population-attributable risk percentages from epidemiologic data) suggests that less than 10% of claims for occupational cancer are compensated. The main source of the deficit is underreporting to WCBs rather than rejection of claims.

Conclusions: The availability of data about occupational cancers in Canada is inconsistent from jurisdiction to jurisdiction, and reporting is incomplete. An active disease surveillance system and additional education of physicians and workers about work-related illnesses may be required to improve reporting.

Objectif : Analyser les rapports de cas de cancer professionnel au Canada afin de préciser les exigences de divulgation, la disponibilité des données et les caractéristiques des cancers déclarés et de vérifier si les rapports étaient complets.

Conception : Étude épidémiologique descriptive basée sur des données solicitées auprès des commissions des accidents de travail (CAT) et des registres provinciaux et territoriaux de cancérologie de 1980 à 1989.

Mesures des résultats : Le nombre de demandes acceptées et rejetées par les CAT; l'année de la demande, le site du cancer, le sexe du demandeur, l'âge du demandeur, son âge au diagnostic, sa profession, l'industrie, l'agent auquel il a été exposé et les raisons du rejet des demandes; ainsi que les nouveaux cas de cancers primitifs selon le lieu, l'âge et le sexe.

From the Department of Health Care and Epidemiology, University of British Columbia, Vancouver, BC

Reprint requests to: Ms. Kay Teschke, Department of Health Care and Epidemiology, University of British Columbia, 5804 Fairview Ave., Vancouver, BC V6T 1Z3

Résultats : La loi oblige les médecins à signaler les cas de cancer professionnel en Alberta, en Saskatchewan et à Terre-Neuve. Seules trois provinces, Colombie-Britannique, Saskatchewan et Ontario, ont pu fournir la totalité de l'information demandée au sujet des demandes de dédommagement. Des 1 026 demandes présentées dans ces trois provinces, presque toutes ont été présentées par des hommes, et pour environ les deux-tiers des cas, il s'agissait de cancers des voies respiratoires. L'amiante était mentionnée en tant qu'agent étiologique dans plus du tiers de ces cas. D'après une comparaison de la proportion des cancers incidents acceptés comme cancers professionnels par les CAT et de la proportion estimative de cancers dans la population générale attribuables à la profession (selon les pourcentages de risque attribuable à la population d'après les données épidémiologiques), il semblerait que moins de 10 % des demandes de dédommagement relatives à des cancers professionnels soient admises au mécanisme de dédommagement. La principale source du déficit est la sous-déclaration aux CAT, plutôt que le rejet des demandes.

Conclusions : L'existence de données sur les cancers professionnels au Canada diffère d'une province à l'autre et la déclaration est incomplète. Afin d'obtenir un meilleur taux de déclaration, il faudrait sans doute mettre en place un système actif de surveillance des maladies et sensibiliser davantage les médecins et les travailleurs aux maladies liées au travail.

In 1987 the International Agency for Research on Cancer concluded that 30 industrial chemicals or processes are known to be carcinogenic to humans and a similar number are probably carcinogenic.[1] Although occupational carcinogens, as compared with risk factors such as smoking and diet, are believed to account for only a small fraction of cancer cases, Doll and Peto[2] acknowledged that these cancers still represent a sizeable burden of preventable illness and death.

Occupational health personnel often use data on injury and illness to recommend interventions such as surveillance of exposed workers and implementation of control measures. Therefore, it is important to know whether the current statistics on occupational disease in Canada alert us to the extent of occupational cancer. Data on occupational disease are collected by the agencies responsible for compensating people for illness arising from employment: the workers' compensation boards (WCBs) in each province and territory.

This study examines the reporting of occupational cancers to WCBs and addresses the following questions: What are the requirements for reporting cases of occupational cancer? What data can be retrieved from WCBs? How many claims for occupational cancer were made and accepted from 1980 to 1989? How complete is the reporting of occupational cancer?

Methods

The WCB of each province and territory was asked to provide information on all cancer claims processed from 1980 to 1989. For each claim we asked for the year the claim was accepted or rejected, the site-specific diagnosis, the sex of the employee, the age of the employee at the time of diagnosis, the employee's occupation, the industry, the exposure agent claimed and, for rejected claims, the reason for rejection. The WCB and medical association of each province and territory were asked to indicate any legislation requiring physicians to report occupational disease. Each provincial cancer registry was asked to provide the number of new primary cancers from 1980 to 1989 according to site, age and sex. This period was selected to maximize the chances of retrieving complete information from both the WCBs and the cancer registries. We followed up data that were incomplete or inconsistent.

Results

Reporting requirements and data availability

In most jurisdictions there is no specific requirement that physicians report an occupational disease (Table 1), although all jurisdictions have legislation requiring physicians to file a report requested by the WCB after an employee has made a claim. This system puts the onus on patients to recognize the work-relatedness of their disease. Many jurisdictions require that physicians report occupational injuries, but the legal departments of the WCBs do not interpret injury to include disease unless there is a definition specifying this inclusion.

Eight jurisdictions were able to supply data on occupational cancer claims (Table 1), but only three provinces could retrieve all the requested data. Several provinces could not provide any details about sex, age, site, year or exposure agent; some stored files only in hard copy by claim number and therefore could not retrieve data by disease.

Estimates from Statistics Canada of the number in the labour force in 1985[3] were used to calculate the number of annual cancer claims per million

people employed for each jurisdiction reporting claims in at least 1 year (Table 1). Since certain workers are not covered by workers' compensation, the labour-force figures will overestimate the number of workers insured. The annual rates of cancer claims varied between 1.2 per million (in New Brunswick) to 64.5 per million (in the Yukon Territory), with an overall mean of 15.7. For areas in which few claims were reported, the rates are likely to be particularly unstable.

Occupational cancer claims

Since only British Columbia, Saskatchewan and Ontario (together representing about 53% of the Canadian population) were able to provide complete data, the remainder of the results will refer to the data from these provinces only.

Over the study period there were 1026 compensation claims for cancer in these provinces; there was no pattern in cancer reporting with time. Almost all of the claims (97.5%) were made by men. The proportion of claims that were accepted was much lower for women than for men (17% v. 55%). The age of the claimant was known in 772 cases: at the time of diagnosis 7% were less than 45 years, 65% were 45 to 64, and 28% were over 64. The proportion of claims accepted increased with age: 51% of the claims by people under 45 were accepted, as compared with 62% and 70% of those by people 45 to 64 and over 64 respectively.

Table 2 shows the number of accepted and rejected claims by cancer site or type. Saskatchewan accepted the highest proportion of claims (83%), British Columbia accepted 62%, and Ontario accepted 52%. Claims for cancers of the lung and pleura were the most frequent and were more often accepted than rejected. For two additional cancer sites (the nose and nasal cavities and the peritoneum) more claims were accepted than rejected. No claims were accepted for lymphomas, myelomas or cancers of the brain, mouth, liver, pancreas, kidney, small intestine, prostate or bone. The reason given for all rejected claims was that the disease was judged not to be related to employment exposure.

Table 3 lists the 15 types of exposure and the 15 occupations most frequently cited in the claims. Of the 677 claims for which there were exposure data, asbestos was the agent listed in 36%; ionizing radiation, sinter plant emissions, silica and polycyclic aromatic hydrocarbons were each listed in 5% to 10% of the cases. Claims for the following agents cited in two or more claims were never accepted: benzene, carbon monoxide, drugs, lead, pesticides, plant products, plastics, smoke and solvents.

Of the 924 claimants for which an occupation was coded, miners represented the largest group (23%). Asbestos was the exposure agent cited for a large proportion of the claims in the following occupations: brickmasons, carpenters, construction workers, electricians, industrial mechanics, insulators, miners, pipefitters or plumbers, and welders. Claims for the following occupations cited in two or more claims were never accepted: appliance assemblers, dry cleaners and firefighters.

Completeness of reporting

To determine whether the reporting of occupational cancers to the WCBs was complete, we must know the true number of occupational cancers, a figure that is elusive. However, there are two ways

Table 1: Occupational cancer reporting requirements, claims data availability and rates of cancer claims to workers' compensation boards (WCBs), by province or territory

Province or territory	Physicians required to report occupational disease?	Period for which data on claims supplied*	Annual no. of claims per million people employed
British Columbia	No	1980–1989	14.5
Alberta	Yes†	1990‡	11.6
Saskatchewan	Yes†	1980–1989	4.0
Manitoba	No	NA	–
Ontario	No	1980–1989	18.8
Quebec	No	NA	–
New Brunswick	No	1980–1989‡	1.2
Nova Scotia	No	NA	–
Prince Edward Island	No	NR	–
Newfoundland	Yes	1984–1989‡	14.2
Northwest Territories	No	1989–1991	50.5
Yukon Territory	No	1991	64.5

*NA = not able to provide data, NR = no response.
†Legislation requires reporting of "notifiable" occupational diseases, including certain types of cancer.
‡Unable to present claims characteristics as requested.

one might make estimates.[4] Epidemiologic data may be used to calculate the proportion of cancers in the general population that are attributable to occupation (population-attributable risk percentage [PAR%]).[2,5-12] In addition, a known occupational cancer can be used as a sentinel event to determine

Table 2: Number of claims for occupational cancer in British Columbia, Saskatchewan and Ontario from 1980 to 1989, by cancer site or type

Cancer site or type	Province; no. of claims					
	British Columbia		Saskatchewan		Ontario*	
	Accepted	Rejected	Accepted	Rejected	Accepted	Rejected
Bladder	9	10	0	0	4	16
Bone	0	0	0	0	0	3
Brain	0	1	0	0	0	6
Breast	0	0	0	0	1	3
Intestinal tract	3	6	0	0	3	13
Kidney	0	0	0	0	0	5
Leukemia	0	2	0	0	1	15
Liver	0	2	0	0	0	6
Lung	17	25	14	2	262	179
Lymphoma and myeloma	0	6	0	0	0	6
Mouth	0	0	0	1	0	6
Nose and nasal cavities	0	2	0	0	14	4
Pancreas	0	1	0	0	0	6
Peritoneum	0	0	0	0	4	1
Pharynx and larynx	3	5	1	0	5	23
Pleura	72†	0	0	0	101	10
Prostate and testes	0	0	0	0	1	21
Skin	2	4	0	0	15	14
Stomach and esophagus	3	1	0	0	10	33
Unspecified	1	3	0	0	4	27
All sites	110	68	15	3	425	397

*Eight cases were excluded because the status of the claim was unknown.
†No pleural cancers were reported; however, the 72 cases of mesothelioma reported were all assumed to be pleural.

Table 3: Exposures and occupations most frequently cited in British Columbia, Saskatchewan and Ontario combined

Exposure	No. of claims		Occupation	No. of claims	
	Accepted	Rejected		Accepted	Rejected
Asbestos	196	47	Miner	108	108
Ionizing radiation	23	39	Industrial mechanic	36	24
Sinter plant emissions	25	26	Assembler	9	46
Silica	23	16	Insulator	44	2
Polycyclic aromatic hydrocarbons	19	16	Electrician	27	12
Solvents	1	22	Melter or roaster	13	26
Foundry emissions	8	14	Pipefitter or plumber	28	7
Gases	10	11	Furnace operator	16	19
Chemicals	4	15	Carpenter	22	8
Metals	3	16	Steel worker	7	16
Arsenic	8	5	Brickmason or stonemason	16	6
Solar radiation	9	2	Welder	9	11
Dust	2	6	Metal processor	14	4
Complication of injury	3	5	Smelter worker	9	8
Welding	2	5	Construction worker	10	4

the numbers of cancers expected at other sites — for example, the number of mesothelioma cases might be used to estimate the number of expected cases of lung cancer due to asbestos exposure.[13] We used both these approaches. Since most epidemiologic data about the proportions of occupational cancer refer to men only, we included only our data on men in the evaluation. Cases of nonmelanoma skin cancer were excluded, because this type of cancer was not included in the figures for cancer incidence from some provinces.

Table 4 lists the numbers of incident primary cancers in men reported to the cancer registries of British Columbia, Saskatchewan and Ontario. A composite figure for all sites is given as well as figures for four cancer sites with known occupational causes: pleura, lung, bladder, and nose and nasal cavities. In addition, Table 4 shows the proportion of incident cases for which claims were accepted by the WCBs. The years reported by the cancer registries (the year of diagnosis) did not necessarily correspond to those reported by the WCBs (the year the claim was accepted or rejected). Because the period covered was long we expect that the proportions reported here should be stable, although this will be less true for the rarer cancers (at nasal and pleural sites). In addition, cancers were not necessarily diagnosed in the province where the exposures occurred. This would result in the greatest discrepancies in provinces with strong migration patterns.

In Table 4 the PAR% estimates for all cancers are the often-cited estimates of Doll and Peto,[2] which were based on US data. Other investigators have made similar estimates for the United States[5,6,12] and England.[7] We are unaware of any PAR% estimates for all cancers that use Canadian data. In British Columbia, Saskatchewan and Ontario less than 0.25% of all incident cancers in men were accepted by the WCBs as occupationally related. In contrast, the lowest estimated PAR% due to occupation given by Doll and Peto was 2%. Since less than half of the cancer claims in our study were rejected the deficit was mainly due to the paucity of cancer claims made to the WCBs and not to the number of claims rejected.

Of the specific cancer sites, the pleura had the highest proportion of incident cases accepted for compensation (more than 90% of which were expected to be mesothelioma). This proportion was within a factor of two of the epidemiologic PAR% estimates based on case interviews in the United States and Canada.[11,14,15]

The proportion of accepted claims for lung cancer was four or more times lower than the lowest PAR% estimate from descriptive analyses of this disease in the United States and England[2,7] and from case–control studies in the United States.[10] An alternative approach is to use the epidemiologic estimate that between 1.5 and 2.5 cases of lung cancer occur in asbestos-exposed workers for every case of pleural mesothelioma.[4] In British Columbia the fewer claims for lung cancer than for pleural cancer strongly suggests an underreporting of lung cancer. In Sas-

Table 4: Number of incident cancer cases reported to cancer registries, number of claims accepted by WCBs and estimated proportion of occupational cancer in the population for men only, by cancer site

Province; cancer site	No. of incident cases	Accepted claims, no. (and %*)	Estimated PAR%†
British Columbia			
All sites	56 247	107 (0.19)	2–8
Pleura	196	71 (36.7)	47–76
Lung	11 118	17 (0.15)	3–17
Bladder	2 762	9 (0.33)	8–21
Nasal sites	120	0	12–19
Saskatchewan‡			
All sites	19 710	15 (0.08)	2–8
Lung	3 279	14 (0.43)	3–17
Bladder	1 310	0	8–21
Ontario§			
All sites	151 691	360 (0.24)	2–8
Pleura	316	78 (24.7)	47–76
Lung	31 368	239 (0.76)	3–17
Bladder	11 047	4 (0.04)	8–21
Nasal sites	356	12 (3.37)	12–19

*Of incident cases.
†Percent population-attributable risk due to occupation.[2,5–12,14–17]
‡Data on pleural and nasal cancers were not included because they were not listed in the data from the Saskatchewan Cancer Foundation; there were no WCB claims for these sites.
§Data for 1989 were not included since they were not available from the Ontario Cancer Treatment and Research Foundation.

katchewan there were no cases of mesothelioma reported to the WCB, but there were four of asbestos-related lung cancer. In Ontario the ratio of lung cancer to pleural cancer claims was greater than 2.5. However, of the claims for lung cancer in which the suspected exposure agent was recorded, asbestos was listed for only 19%; this suggests underreporting of asbestos-related lung cancer in this province.

The proportion of accepted claims for bladder cancer was much lower than the PAR% for *a priori* at-risk occupations estimated from case-control studies in Canada and the United States.[8,9]

Ontario had a higher proportion of accepted claims for nasal cancer than did British Columbia, although neither compensated the proportion expected. The PAR% estimates for this cancer site were calculated with the use of data from case-control studies in British Columbia and Washington State.[16,17]

Discussion

The availability of data on occupational cancer in Canada was inconsistent from jurisdiction to jurisdiction, and reporting was incomplete. Although the reporting of workplace injuries and accidents is mandatory in most provinces, only three provinces require physicians to report work-related disease. Mandatory disease reporting may not improve completeness, however, since studies in countries where it is required still show evidence of substantial underreporting.[18,19] Government occupational health personnel in two provinces suggested that mandatory reporting requirements are neither observed nor enforced.

Record keeping was very inconsistent. Several provinces were unable to retrieve data on cancer, and of those that could, many were unable to retrieve useful companion data, such as cancer site, age of claimant and exposure agent. Information that was available was often recorded in different ways — for example, some provinces used the *International Classification of Diseases*[20] to specify cancer site, whereas others used their own systems. Industries, occupations and exposure agents were classified in such a way that even within a province there were often different levels of specificity. Although Statistics Canada provides national standards for the reporting and coding of occupational disease data, the level of detail required is not sufficient to prevent these inconsistencies between provinces.

The number of occupational cancer cases compensated in British Columbia, Saskatchewan and Ontario represented less than 10% of the number expected on the basis of epidemiologic data. Studies in Denmark and the United States have suggested that occupational diseases are routinely underreported.[5,18] Underreporting to the WCBs rather than rejection of claims was responsible for most of the deficit. This confirms Finkelstein's finding among Ontario asbestos insulators that less than half of the people with asbestos-related cancer filed claims.[21]

There are many reasons why claims may not be filed. Both the physician and the worker may be unaware of the potential work-relatedness of the disease. Finkelstein[21] showed that almost all the Ontario insulators with mesothelioma were compensated, as compared with less than half of the claimants with other asbestos-related cancers. In our study the proportion of pleural cancer cases compensated was the closest to PAR% estimates in the literature. Physicians and workers are likely to suspect the occupational origin of this disease because of the wide publicity about the health effects of asbestos and because there are few other exposure agents suspected of being causal.[15] In contrast, lung and bladder cancers are multifactorial diseases, with cigarette smoking the leading cause.[8] Physicians may not question further the etiology of these diseases in patients who are smokers. Potential claimants may also be discouraged by the relatively high rejection rate of claims for occupational diseases (46% in this study), as compared with that of claims for occupational injuries. A study in Washington state showed that less than 10% of claims for occupational injury were rejected, whereas diseases like cancer with a long latency period had rejection rates between 30% and 80%.[22] In addition, claims may not be filed if physicians and workers believe that they must have proof of occupational causation. However, adjudication of the work-relatedness of a case is the responsibility of the WCBs, and most of them would encourage the reporting of suspected cases.

There are many limitations to comparing epidemiologic data and the proportion of incident cancers accepted for compensation by WCBs in Canada. The PAR% estimates reported in the literature are specific to the population under study and would be expected to change with distributions of exposure over time or location. For example, because Canadian industry is not identical to that in England or the United States, one would expect the population-attributable risks to differ. Similarly, one would expect differences in the number of cases of occupational cancer in each province; for example, the small number of claims in Saskatchewan may reflect its smaller industrial base. We did include Canadian PAR% estimates for bladder cancer,[8] nasal cancer[16] and mesothelioma,[15] although the provinces in those studies did not always match the three for which WCB data were complete.

Even if the data were available for the exact time and location of interest, estimating the contribution of occupational exposures to cancer incidence

would still be extremely difficult. Additional problems include incomplete knowledge of which agents are carcinogens, uncertainty of risk and dose–response estimates and an inadequate understanding of the interaction with nonoccupational risk factors or between occupational agents.[4] Because most cancers are believed to be multifactorial, the risk for an individual may be distributed among many factors. For a worker to receive compensation, the probability that occupation is a contributing factor must be greater than 50%, but estimates of population-attributable risk may include workers for whom occupation is not the main risk factor.

These caveats notwithstanding, the proportions of cancer cases compensated by the WCBs in three Canadian jurisdictions fell short of the most conservative estimates of the proportions of cancer due to occupation, and underreporting was confirmed when mesothelioma was used as a sentinel event for asbestos-related lung cancer. Danish investigators, who recently found underreporting of pleural mesothelioma and sinonasal adenocarcinoma, suggested that a formal screening interview be conducted whenever cancer with a potential occupational link is diagnosed.[18] This coincides with calls for establishing more active systems of occupational disease surveillance in the United States[23,24] and, more recently, in Canada.[25] As a component of surveillance, the education of physicians and workers is required to ensure their awareness of the potential work-relatedness of certain diseases, including occupational cancer.

We thank the workers' compensation boards, cancer registries and medical associations in each province and territory, as well as the Labour Division of Statistics Canada, for providing information for this project.

References

1. Overall evaluations of carcinogenicity: an updating of IARC monographs volumes 1 to 42. *IARC Monogr Eval Carcinog Risk Chem Hum Suppl* 1987: 7
2. Doll R, Peto R: *The Causes of Cancer*, Oxford U Pr, Oxford, Engl, 1981: 1191–1308
3. Statistics Canada: *The Canada Year Book*, Dept of Supply and Services, Ottawa, 1989
4. Samet JM, Lerchen ML: Proportion of lung cancer caused by occupation: a critical review. In Bernard J, Gee L, Morgan WKC et al (eds): *Occupational Lung Disease*, Raven, New York, 1984: 55–67
5. Landrigan P, Markowitz S: Current magnitude of occupational disease in the United States. Estimates from New York State. *Ann NY Acad Sci* 1989; 572: 27–45
6. Cole P: Cancer and occupation: status and needs of epidemiologic research. *Cancer* 1977; 39: 1788–1791
7. Higginson J, Muir CS: Environmental carcinogenesis: misconceptions and limitations to cancer control. *J Natl Cancer Inst* 1979; 63: 1291–1298
8. Howe GR, Burch JD, Miller AB et al: Tobacco use, occupation, coffee, various nutrients, and bladder cancer. *J Natl Cancer Inst* 1980; 64: 701–713
9. Silverman DT, Levin LI, Hoover RN et al: Occupational risks of bladder cancer in the United States: 1. White men. *J Natl Cancer Inst* 1989; 81: 1472–1479
10. Vineis P, Thomas T, Hayes RB et al: Proportion of lung cancers in males, due to occupation, in different areas of the USA. *Int J Cancer* 1988; 42: 851–856
11. Wolf KM, Poitrowski ZH, Engel JD et al: Malignant mesothelioma with occupational and environmental asbestos exposure in an Illinois community hospital. *Arch Intern Med* 1987; 147: 2145–2149
12. Wynder EL, Gori GB: Contribution of the environment to cancer incidence: an epidemiologic exercise. *J Natl Cancer Inst* 1977; 58: 825–832
13. McDonald JC, McDonald AD. Mesothelioma as an index of asbestos impact. In Peto R, Schneiderman M (eds): *Quantification of Occupational Cancer* (Banbury rep ser, vol 9), Cold Spring Harbor Lab, Cold Spring Harbor, NY, 1981: 83
14. Peto J, Henderson B, Pike MC: Trends in mesothelioma incidence in the United States and the forecast epidemic due to asbestos exposure during World War II. Ibid: 51–69
15. McDonald AD, McDonald JC: Malignant mesothelioma in North America. *Cancer* 1980; 46: 1650–1656
16. Elwood JM: Wood exposure and smoking: association with cancer of the nasal cavity and paranasal sinuses in British Columbia. *Can Med Assoc J* 1981; 124: 1573–1577
17. Vaughn TL, Davis S: Wood dust exposure and squamous cell cancers of the upper respiratory tract. *Am J Epidemiol* 1991; 133: 560–564
18. Skov E, Mikkelsen S, Svane O et al: Reporting of occupational cancer in Denmark. *Scand J Work Environ Health* 1990; 16: 401–405
19. Freund E, Seligman PJ, Chorba TL et al: Mandatory reporting of occupational diseases by clinicians. *JAMA* 1989; 262: 3041–3044
20. *International Classification of Diseases*, 9th rev, WHO, Geneva, 1978
21. Finkelstein M: Analysis of mortality patterns and workers' compensation awards among asbestos insulation workers in Ontario. *Am J Ind Med* 1989; 16: 523–528
22. Blessman JE: Differential treatment of occupational disease vs occupational injury by workers' compensation in Washington State. *J Occup Med* 1991; 33: 121–126
23. Mullan RJ, Murthy LI: Occupational sentinel health events: an updated list for physician recognition and public health surveillance. *Am J Ind Med* 1991; 19: 775–799
24. Baker EL: Sentinel Event Notification System for Occupational Risks (SENSOR): the concept. *Am J Public Health* 1989; 79 (suppl): 18–20
25. Spiegel J, Yassi A: Occupational disease surveillance in Canada: a framework for considering options and opportunities. *Can J Public Health* 1991; 82: 294–299