

Surveillance of Australian workplace Based Respiratory Events (SABRE): notifications for the first 3.5 years and validation of occupational asthma cases

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Aims	In Australia, the SABRE programme, a notification scheme, has been established to collect incidence data on occupational lung disease. This paper reports the first 3.5 years of this scheme and the results of an occupational asthma validation study.
Methods	A notification form is mailed regularly to thoracic physicians and occupational physicians in the Australian states of Victoria and Tasmania, who use this to report new cases of occupational lung disease. The validation study was performed by a blinded panel of two doctors, who reviewed information extracted from the medical files of a sample of reported cases of occupational asthma.
Results	A total of 520 diagnoses were reported. The mean ($\pm$ SD) age of the 448 patients notified was 55.7 ± 16.2 years. There were 394 (88%) males and 54 females. The most common single condition was asthma for which the most common causative agent was wood dust. However, the most commonly reported agent overall was asbestos. The validation study of occupational asthma found only fair agreement ($\kappa = 0.4$) between the panel and notifying doctors. However, agreement was better ($\kappa = 0.5$) when the analysis was restricted to those cases where the reporting doctor considered the likelihood of the diagnosis was high.
Conclusions	Occupational asthma is the most common occupational respiratory condition reported, which suggests increasing importance for this disease over more traditional forms of occupational lung disease. The validation study suggests that such schemes should restrict notifications only to those cases where the likelihood of the diagnosis is considered high.
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Introduction

Occupational respiratory disease surveillance schemes exist in Finland [1], the UK [2], the USA [3] and Canada

[4], and are being developed in France and South Africa. There are few such comprehensive and systematic data collection systems in place to monitor the extent of occupational respiratory disease in Australia. Those programmes that do exist, such as the Australian Mesothelioma Surveillance Program [5], only collect data on a single respiratory disease, or are of such a general nature (e.g. the infectious disease notifications schemes in each state) that information about occupational respiratory disease is difficult to identify within the total data collected. The incidence of

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occupational respiratory diseases in Australia is therefore not known.

Reporting schemes can provide data on incidence of occupational respiratory diseases and responsible industries. They help identify and investigate new potentially causative agents. In turn, this can help inform the development of policy and exposure limits. Long-term follow-up of identified cases is also facilitated [6–9].

No published surveillance scheme has attempted to validate its notified data. McDonald *et al.* [10] have stated that the essential validity of the SWORD data has been tested systematically only to a very limited extent and that it needs to be done, but that this validation will be neither a simple nor easy task.

The aims of this paper are: (i) to describe the first 3.5 years of notifications to an occupational respiratory disease surveillance scheme called the Surveillance of Australian workplace Based Respiratory Events (the SABRE scheme), which was established in two of the southern states of Australia (Victoria and Tasmania); and (ii) to attempt to validate the SABRE data using the occupational asthma notifications.

Materials and methods

In the last quarter of 1997, letters were sent out to all medical members (respiratory physicians) of the Victoria State branches only of the Thoracic Society of Australia and New Zealand and the Fellows and Trainees of the Australasian Faculty of Occupational Medicine. Letters were sent to Tasmanian members in 1998. A total of 219 eligible doctors were sent the letter, which gave information about the scheme and asked those doctors who saw respiratory cases as part of their normal practice to complete the notification form and return it at the end of each monthly reporting period. The doctors were asked to make a professional judgement about whether the patient's disease had been caused by exposure at work, either past or present. They were also requested to include the likely causative exposures. Demographic data were collected on each notified case, while allowing the patient's identity to remain confidential. The project, including the validation study, was approved by the Standing Committee on Ethics in Research involving Humans at Monash University.

The notification form included a list of 10 possible diagnoses: allergic alveolitis, asthma, bronchitis, inhalational injury, lung cancer, mesothelioma, pneumoconiosis, non-malignant pleural disease (predominantly plaque or predominantly diffuse), infectious disease and other. The doctors were given no diagnostic criteria by which to make the diagnosis, which is the case in similar overseas schemes. This was left entirely to their professional opinion, but they were requested to assess the

likelihood of the diagnosis as high, moderate or low. No data were collected on results of diagnostic tests, if any were used to make the diagnosis. Occupation, industry and smoking history were also collected.

The coding and data entry of the diagnosis, occupations, industry and agents were undertaken by one of the authors (D.E.) to ensure consistency of coding. The occupations were coded using the Australian Standard Classification of Occupations [11], while the industry type was coded using the Australian and New Zealand Standard Industrial Classification [12].

Population-based incidence rates for each disease type were calculated by using the incident cases reported to the scheme as the numerator, while the denominator used was the population figures for the two states as published in the Australian Bureau of Statistics 1996 Census. The 95% confidence intervals were calculated according to published tables of exact confidence limits for the Poisson distribution [13].

Validation

The five most frequent reporters of asthma notifications were contacted and asked to permit access to their original files. Asthma was chosen as it was the most common diagnosis and had sufficient numbers of cases for a validation exercise to be undertaken. Forty notified cases of occupational asthma were accessed, along with 43 other patients seen by the same five doctors for a respiratory disease not thought to be caused by the patient's work. These files were then copied and all identifying data and other data which could have led to an obvious diagnosis were removed, such as the diagnosis being stated in the letter to the referring doctor. A review panel of one respiratory physician (A.J.) and one occupational physician (D.F.) then independently reviewed the extracted data from the original case files and were required to state whether the patient had occupational asthma, non-occupational asthma or another disease. They also had to identify the industry, the occupation and the agent involved in the occupational asthma cases. They were asked to comment on the likelihood of the disease as high, moderate or low. Their results were then compared with the notification data from the original doctors and with each other's results for each case. Kappa (κ) was used to estimate the agreement beyond chance. Confidence intervals were calculated by bias-corrected [14] bootstrap methods [15], using the bs and kap procedures of Stata [16], with 1000 bootstrap samples. The same methods were also employed to calculate the confidence interval for the difference between kappa coefficients from a single sample, extending the technique of McKenzie *et al.* [17], which was also used to perform a significance test [18].

Table 1. Number of diagnoses by type of practitioner

Diagnosis	Practitioner (<i>n</i>)		
	Occupational physician	Respiratory physician	Total (%)
Allergic alveolitis	0	5	5 (1%)
Asthma	22	148	170 (33%)
Bronchitis	3	34	37 (7%)
Infectious disease	0	6	6 (1%)
Inhalational injury	11	21	32 (6%)
Lung cancer	0	12	12 (2%)
Mesothelioma	0	42	42 (8%)
Non-malignant pleural disease: predominantly diffuse	0	23	23 (4%)
Non-malignant pleural disease: predominantly plaque	2	118	120 (23%)
Other	8	22	30 (6%)
Pneumoconiosis	3	40	43 (8%)
Total	49	471	520

Results

A total of 520 diagnoses were notified in 448 patients over the 3.5 year period from November 1997 to April 2001. Table 1 shows the number of diagnoses broken down by type of practitioner. Of the 209 practitioners originally thought to be eligible, 140 replied, with 84 agreeing to take part. Forty-seven practitioners of the original 209 were not eligible, as they did not see patients. Respiratory physicians, who comprised the majority with 57 practitioners, sent in the bulk (91%) of the notifications. The mean ($\pm$ SD) age of the 448 patients notified was 55.7 ± 16.2 years, with a range of 20–92 years. There were 394 (88%) males and 54 (12%) females. Asthma was the most common notification with 170 (33% of total) reports. However, asbestos-related diseases, as a group, were the most commonly reported cases from a single causal agent, with 204 notifications.

Infectious respiratory disease was the only notification where there were more females than males [4 (67%) to 2 (33%)], but the numbers were very small.

Table 2 shows the top 24 agents notified as causing occupational asthma. Many of the well-recognized causes of occupational asthma were present, with wood dust (including Western red cedar) being the most common, with 23 cases (13.5% of the total). Other common agents included isocyanates, latex and flour. An agent which has never been reported in any of the established surveillance schemes was almond dust and this case series is being followed up and will be reported later. Formaldehyde asthma is as commonly reported as glutaraldehyde asthma.

Incidence rates

The incidence rates and exact 95% confidence intervals were calculated for those diagnoses with sufficient numbers of cases, i.e. asthma, bronchitis, inhalational

Table 2. Agents notified in asthma cases

Agent	Frequency	%
Wood dust (including Western red cedar, <i>n</i> = 4)	23	13.5
Dust (not elsewhere classified)	12	7.1
Isocyanates	10	5.8
Paint fumes	6	3.5
Potroom gas/fume (including aluminium fumes, <i>n</i> = 3)	6	3.5
Products of thermal combustion (including tobacco smoke, <i>n</i> = 3)	6	3.5
Solvents	5	2.9
Welding fumes	5	2.9
Latex	5	2.9
Metal fumes	4	2.4
Flour	4	2.4
Exposure (temperature)	4	2.4
Formaldehyde	4	2.4
Animal excretion	4	2.4
pvc/plastic fumes	4	2.4
Glutaraldehyde	4	2.4
Almond dust	3	1.8
Ammonia	3	1.8
Chlorine	3	1.8
Solder fumes	3	1.8

injury, mesothelioma, non-malignant pleural disease and pneumoconiosis. The most commonly reported diagnosis was occupational asthma, with an estimated incidence of 30.9 [95% confidence interval (CI) = 26.8–35.5] cases/million workers/year.

Validation

We compared agreement for all cases between the original notifying doctor and the two members of the review panel and for only the cases where the likelihood of diagnosis was reported as high by the original notifying doctor. Agreement [19] was only fair between the notifying doctor and either observer A (κ = 0.34; 95%

CI = 0.18–0.49) or observer B (κ = 0.32; 95% CI = 0.18–0.50).

Agreement rose to moderate when analyses were restricted to those observations for which the likelihood of diagnosis was rated as high for observer A (κ = 0.53; 95% CI = 0.35–0.71) and observer B (κ = 0.54; 95% CI = 0.35–0.71). There was no statistically significant difference between the kappa values for observers A and B. There was moderate agreement between the two independent observers (κ = 0.48; 95% CI = 0.31–0.63), and this agreement did not substantially change when the analysis was restricted to those cases with high likelihood: κ increased to 0.53 (95% CI = 0.35–0.71).

Discussion

The SABRE scheme has recorded 520 cases of occupational respiratory disease occurring in 448 individual patients from Victoria and Tasmania over its first 3.5 years. Occupational physicians more commonly reported the diseases with short latency periods, such as inhalational injury or asthma, whereas the respiratory physicians reported almost all of the diseases with longer latent periods such as lung cancer, mesothelioma and asbestos related lung diseases. This is likely to be because occupational physicians have greater accessibility to the workplace and see such patients closer to the time of exposure, while respiratory physicians need to rely on referrals. This finding demonstrates the importance of including both types of specialists in notification schemes. However, the scheme has only been running for 42 months, and the absolute numbers involved are still quite small, in comparison with overseas schemes. As these numbers increase, a different pattern may emerge.

Comparison of the asthma incidence rate of 30.9 (95% CI = 26.8–35.5) per million workers per year with other schemes shows that SABRE's rate is lower than SWORD [10] (37), SHIELD [8] (43), PROPULSE [4] (79) and Finland [1] (153). A comparison of male to female incidence rates for asthma shows a rate ratio of 2.4 (95% CI = 1.8–3.4), suggesting that the incidence of occupational asthma is significantly greater in men than in women.

A comparison of the incidence rates of asthma found in our study to the other schemes discussed above shows that SABRE had the lowest incidence rate. We recognize several reasons for this:

1. Under-ascertainment of cases: SABRE is more prone to under-reporting as it is a newer scheme. Only 49% of eligible doctors have so far chosen to take part. We hope this will improve as the scheme becomes more established.
2. Under-diagnosis: doctors in Australia may be less knowledgeable regarding occupational respiratory disease than in countries with more established

surveillance schemes. Better training in case recognition and continued encouragement to take part could be of help (as it is well known that enthusiasm to report tends to diminish over time).

3. Legal influences: Victoria and Tasmania have adversarial workers' compensation systems which may reduce doctors' willingness to ascribe disease to occupation.
4. Different patterns of occupational exposure exist in Australia to those in other countries, which have occupational respiratory disease surveillance schemes reported in the literature.

It should also be noted that difficulty exists in extrapolating SABRE findings to Australia as a whole, since some high risk industry sectors, such as underground mining, are not here represented as they operate mostly in non-participating states. Expansion of SABRE into other states has recently occurred in New South Wales, under the direction of one of the authors (A.J.). This will ensure that more sectors known to cause occupational respiratory disease are included in future results and make the findings more representative of the true national situation.

SABRE is the first scheme to attempt to validate notified diagnoses of asthma. It would appear from our findings that to ensure reliability of data, only highly likely diagnoses should be notified to schemes of this kind. However, our numbers were small and our attempt to blind the review panel may have resulted in some relevant information being omitted, which could have reduced the agreement. The process of validation itself had to be restricted due to limited access to data by the case reviewers. Ideally they would have had access to the patients themselves or uncensored records; however, this was restricted by the privacy and ethical considerations of the original study design. The most prolific reporters may have had a lower threshold for diagnosing occupational asthma and therefore are more likely to have the diagnosis revised on review. Other measures which could increase the reliability of notified data could include peer review of notes. However peer review may reduce the participation level of the reporters. We hope that another surveillance scheme may attempt validation and thus allow comparison with our findings.

We believe SABRE will play an important role in occupational respiratory disease prevention in Australia and have initiated steps to expand the scheme to other states, with the ultimate hope of collecting national occupational respiratory disease data in the future.

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