Surveillance of Australian workplace Based Respiratory Events (SABRE) in New South Wales

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Background The Surveillance of Australian workplace Based Respiratory Events (SABRE) New South Wales (NSW) scheme is a voluntary notification scheme established to determine the incidence of occupational lung diseases in NSW Australia.

Aims Data presented in this paper summarize the last 7 years of reporting to SABRE (June 2001 to December 2008).

Methods Every 2 months, participating occupational physicians, respiratory physicians and general practitioners (accredited by the NSW WorkCover Authority) reported new cases of occupational lung disease seen in their practices. Data collected include gender, age, causal agent and the occupations and industries believed responsible. Estimated incidence was calculated for each disease.

Results Three thousand six hundred and fifty-four cases were notified to the scheme, consisting of 3856 diagnoses. Most of the cases were males (76%). Pleural plaques [1218 (28%)] were the most frequently reported condition, followed by mesothelioma [919 (24%)]. Silicosis [90 (2%)] and occupational asthma [OA; 89 (2%)] were the most frequently reported non-asbestos-related diseases. Estimated rates for mesothelioma, diffuse pleural thickening (DPT) and OA were 83, 83 and 5 cases per million employed males per year, respectively. Trades such as carpenters and electricians associated with the building industry, electricity supply and asbestos product manufacture were the most common occupations and industries reported.

Conclusions Asbestos-related diseases are the most frequently reported conditions to SABRE NSW. The very low incidence of OA for NSW most likely reflects under-diagnosis as well as under-reporting. Occupational lung disease is still occurring in NSW despite current preventative strategies. The SABRE scheme currently provides the only available information in this area.

Key words Asbestos-related disease; occupational asthma; occupational respiratory disease; surveillance.

Introduction

It is likely that several thousand cases of work-related disease occur every year in Australia, many of which go unreported [1]. The proportion of these affecting the respiratory system is unknown. Monitoring the incidence of occupational lung diseases is important to determine if appropriate preventive measures have been adopted in workplaces and to identify where excessive exposure to respiratory toxins occurs. Occupational lung disease is preventable, yet is associated with considerable morbidity and mortality.

Monitoring trends in incidence of occupational lung diseases provides confirmation of the adequacy of workplace exposure limits and control measures. Potential sources of data for occupational lung diseases include death certificates, hospital discharge records, workers’ compensation records and national health surveys. However, these data sources have usually been established to serve other functions and occupational information is often not collected or is incomplete, limiting the ability to accurately identify work-related cases.

Occupational respiratory disease surveillance schemes provide a centralized coordinated system to collect, analyse and report on work-related respiratory diseases. Reporting to surveillance schemes can either be mandatory or voluntary. In Finland, it is mandatory for all
notifications of known or suspected occupational diseases to be forwarded to the Finnish Registry of Occupational Diseases. Consequently, coverage of the Finnish system is excellent (95%), and the resulting data are very complete [2]. Voluntary surveillance schemes have been established in many other countries including the UK [3], USA [4], Canada [5], South Africa [6] and Spain [7]. The Surveillance of Work related and Occupational Respiratory Disease (SWORD) scheme in the UK was one of the first schemes and the results of this scheme have provided important information on occupational respiratory disease data over the past decade [8] and highlighted the emergence of occupational asthma (OA). The strengths and limitations of voluntary surveillance studies have been discussed previously [9, 10]. Their success is dependent on voluntary participation and response rates as well as continued financial and administrative support.

The Surveillance of Australian workplace Based Respiratory Events (SABRE) scheme was launched in Victoria and Tasmania [11] in 1997 and in New South Wales (NSW) in 2001. SABRE NSW objectives were (i) to develop and maintain a notification scheme involving thoracic and occupational physicians and general practitioners (GPs) with a special interest in occupational medicine; (ii) to determine the incidence of work-related respiratory disease in NSW and (iii) to disseminate information about the burden of occupational respiratory disease in NSW. This article summarizes the results of 7.5 years (June 2001 to December 2008) of reporting to the SABRE NSW scheme.

Methods

A total of 464 doctors were initially invited to participate. These were members of specialist societies involved in occupational lung disease. Participants were respiratory physicians, occupational physicians and GPs with a special interest in occupational medicine belonging to the Thoracic Society of Australia and New Zealand (TSANZ), the Australasian Faculty of Occupational & Environmental Medicine and/or the NSW WorkCover Authority.

The project was initially approved by the TSANZ Inc. Human Research Ethics Committee (HREC). From June 2001 to December 2003, physicians were required to obtain written consent from patients to include their information in the study due to changes in privacy legislation and as specified by the TSANZ Human Research Ethics Committee.

Participating doctors notified SABRE NSW of all newly diagnosed cases of occupational lung disease over a two-monthly notification period. The reporting form used was identical to that of the SWORD scheme (used with kind permission), as this had been previously validated and would allow international comparisons. Diagnoses were asthma due to sensitization or irritation [Reactive Airways Dysfunction Syndrome (RADS)], inhalation accidents, allergic alveolitis, chronic obstructive pulmonary disease (COPD)—bronchitis/emphysema, infectious disease, non-malignant pleural disorders [pleural plaques (PPs) or diffuse pleural thickening (DPT)], mesothelioma, lung cancer, pneumoconiosis or ‘other’, as specified by the physician. SABRE NSW did not supply any diagnostic criteria to participating doctors and relied upon each doctor’s professional opinion when making a diagnosis. The following patient details were registered: gender, smoking history, present occupation and occupation thought to have caused the disease (if different), industry, location of industry (postcode), the presumed agent and the diagnosis. Cases were coded using the first two initials of both the first and the surname and their date of birth. All data entered into the database were screened using this code to detect duplicates.

Using the categories high, moderate or low, doctors were asked to classify the likelihood of each diagnosis. Participating doctors were encouraged to return all notification forms even if they had no cases to report. The response rate for participating doctors was determined.

Because of a fall-off in notifications, feedback from non-participating doctors was obtained. This indicated that obtaining written consent was reducing participation in the study and ethics approval was therefore granted for data collection without requiring individual consent from January 2004 onwards. Patient initials and postcode of industry were no longer collected, age was recorded in place of date of birth and doctors had to notify anonymously so that cases could not potentially be tracked back to the notifying doctor. Subsequent to the disbanding of the TSANZ Ethics committee, approval was granted from the South Eastern Sydney Area Health Service HREC. Coded cases were able to be collected from doctors who returned notifications with their unique code, facilitating follow-up.

For all cases, recognized occupation [12] and industry [13] codes were used for the coding of these categories, as supplied by the Australian Bureau of Statistics (ABS). For each diagnosis, the average number of male cases per year over the study period was used as the numerator. For the denominator, NSW Labour Force survey (LFS) data were used. The ABS has conducted the household LFS since 1960, aiming to provide timely information on the labour market activity of the usually resident civilian population of Australia aged ≥15. For long latency diseases including asbestos-related disorders, NSW LFS data for total employed males from the period 1966 to 1976 were averaged and used as the denominator [14]. For short latency diseases, NSW Labour Force Data for employed males from 2003 were used [15].
Results

A total of 157 doctors (response rate 34%), 66 respiratory, 66 occupational and 25 GPs, agreed to participate in the study by returning one or more notification forms during the period June 2001 to December 2008. Physicians who have reported to SABRE NSW serve areas with >75% of the NSW workforce [16]. A subgroup of 34 core doctors who most frequently returned notifications (return rate 83% over entire study period) consisted of 11 respiratory physicians, 15 occupational physicians and 8 GPs. Of the remaining reporters, on average, only 49% responded during each notification period. When patient initials and date of birth were collected, duplicates accounted for <1% of all cases. In total, 5400 notification forms were returned to SABRE NSW. Of these, 3654 (68%) were patient cases consisting of 3856 diagnoses. The remaining 1746 notifications were 'nil to report' returns. Of the 226 patients with multiple diagnoses, 55 (24%) had pneumoconiosis and DPT, 44 (20%) had pneumoconiosis and lung cancer, 25 (11%) had PPs and DPT and 22 (10%) had DPT and lung cancer. The remaining cases with multiple diagnoses had other combinations of asbestos-related disorders. For 3379 (94%) cases, doctors reported that their diagnosis was 'highly likely' with respect to the clinical presentation and industrial and occupational exposures.

Age was not specified for 256 (7%) cases, while gender was not specified for 119 (3%) cases. Of the cases with these details recorded, almost all were males (3352 95%), of age range 18–95 years of age and a mean age (at diagnosis) of 70 (SD 11) years. Three thousand one hundred and seventy-eight (94%) cases were males, of age range 18–95 years of age and a mean age (at diagnosis) of 70 (SD 11) years. Age distribution also varied with diagnosis. Individuals with asbestos-related diseases were older, as expected for a long latency disease (Table 1). In the 1533 cases for which a smoking history was recorded, 182 (12%) were smokers, 999 (65%) were former smokers and 352 (23%) had never smoked. During 2001–2003, the location of the industry where exposure occurred was collected for 421 cases. Most cases (186; 44%) were reported to have been exposed to the agent within the inner suburbs of Sydney. The remaining industry locations were mostly spread throughout metropolitan Sydney.

All respiratory conditions reported to SABRE NSW during the 7.5 year period, including their estimated incidence rates, are shown in Table 1. Asbestos-related disorders accounted for a large proportion [3584 (93%)] of diseases notified and included non-malignant pleural disorders such as PPs, DPT and asbestosis, and mesothelioma. Of the lung cancers, 196 (or 95% of a total of 207) were reported as asbestos-related. Silicosis was the most frequently notified non-asbestos-related conditions. Of the 89 cases of OA, 42 were diagnosed as asthma due to sensitization, 40 diagnosed as RADS and the remaining 7 were unspecified (see Table 2). The commonest notification in women was of mesothelioma (78 or 9% of total mesothelioma cases) and asthma [25 (28% of total asthma cases)]. The only condition to have had more female than male cases notified was infectious disease with six female cases; however, the gender was unspecified for four cases and the total number was small.

The most frequently reported occupations with asbestos exposure were carpenters, maintenance fitters and turners, electricians, plumbers, pipe laggers, waterside workers and construction workers associated with the building industry, asbestos product manufacture, electricity supply and shipbuilding. Construction workers and labourers employed to perform ‘in site’ preparation (demolition and excavation) in the building industry were most frequently reported to have silica exposure and to have developed silica-related disease (pneumoconiosis

Table 1. Conditions most frequently reported to SABRE NSW (June 2001 to December 2008)

<table>
<thead>
<tr>
<th>Diagnoses</th>
<th>All diagnoses, n (%)</th>
<th>Age, mean ± SD (years)</th>
<th>Males, n (% of all diagnoses)</th>
<th>Estimated average annual incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPs</td>
<td>1218 (32)</td>
<td>69 ± 9</td>
<td>1108 (91)</td>
<td>110</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>919 (24)</td>
<td>72 ± 8</td>
<td>828 (90)</td>
<td>83</td>
</tr>
<tr>
<td>DPT</td>
<td>839 (22)</td>
<td>74 ± 7</td>
<td>829 (99)</td>
<td>83</td>
</tr>
<tr>
<td>Asbestosis</td>
<td>366 (10)</td>
<td>72 ± 8</td>
<td>361 (99)</td>
<td>36</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>207 (5)</td>
<td>66 ± 8</td>
<td>203 (98)</td>
<td>20</td>
</tr>
<tr>
<td>Silicosis</td>
<td>90 (2)</td>
<td>43 ± 14</td>
<td>90 (100)</td>
<td>9</td>
</tr>
<tr>
<td>Occupational asthma</td>
<td>89 (2)</td>
<td>44 ± 15</td>
<td>60 (67)</td>
<td>5</td>
</tr>
<tr>
<td>Inhalation injury</td>
<td>36 (1)</td>
<td>36 ± 11</td>
<td>26 (72)</td>
<td>2</td>
</tr>
<tr>
<td>Infectious disease</td>
<td>12 (0.3)</td>
<td>59 ± 18</td>
<td>2 (17)</td>
<td>NC</td>
</tr>
<tr>
<td>Other</td>
<td>80 (2)</td>
<td>58 ± 7</td>
<td>58 (73)</td>
<td>NC</td>
</tr>
<tr>
<td>Total</td>
<td>3856</td>
<td></td>
<td>3365</td>
<td>NC</td>
</tr>
</tbody>
</table>

Denominator for each diagnosis based on NSW Labour Force Data (see text for details). NC, not calculated.
and lung cancer [7 (3%)]. Flour, grains and fodders [22] were the most frequently notified causal agent of OA in bakers and farmers. Other common agents included isocyanates, animal proteins and wood dust (including Western Red Cedar; Table 2). Infectious disease cases were mainly *Legionella* pneumonia and were few, approximately two per year.

### Discussion

During the 7.5 years of reporting to SABRE NSW, 3856 diagnoses of occupational lung diseases in 3654 patients were notified. Most diseases were of long latency, related to asbestos exposure and almost all cases were males. A large proportion of cases were >50 years of age, which is considerably older than populations described for other surveillance schemes [5,8,11]. This is most likely a consequence of the heavy industrial usage of asbestos in NSW following the Second World War [17], as well as differences in reporting.

The response rate for our study (34%) was low, but comparable to that in other studies, e.g. British Columbia, Canada (38%) [18]. It was, however, lower than that reported for Victoria/Tasmania (40%) [11], PROPULSE in Quebec (68%), Canada [5], Spain (74%) [7] and SWORD in the UK (83% of a group of core physicians) [8]. We believe that this was a consequence of difficulties not only with making a diagnosis but also with the day-to-day obstacles to reporting faced by busy practitioners, e.g. lack of time to participate in the scheme, the increasing administrative burden of medical practice, as well as potential failure of recognition of occupational causation.

We also believe that changes in privacy legislation had a significant effect.

Similar to the SWORD scheme, SABRE NSW did not provide participating physicians with diagnostic criteria but all participants were encouraged to return completed forms irrespective of whether they had cases to notify, in order to determine return rates. However, information on individual diseases was available on the SABRE NSW Website. Doctors who did not participate regularly were contacted to determine their willingness to report less frequently and encouraged to report more often, and web-based notification was introduced in 2006.

Under-reporting of disease cases, a major consequence of a low response rate, has a significant impact on the validity of estimated incidence rates. Meredith *et al.* [3] suggested that the true incidence of disease in the UK was likely to be at least three times greater than reported, in spite of SWORD’s better participation rates. For SABRE NSW, this scenario seems unlikely because incidence rates for asbestos-related diseases are higher than those reported by other schemes, but under-reporting of OA is likely to be real. It also seems likely that under-reporting occurred more in regional than in metropolitan areas, as most of the cases were reported from Sydney. This may well be a reflection of regional differences in numbers of specialty physicians as well as heavy workloads. Public awareness of the hazards of asbestos exposure is currently high, with significant media interest in asbestos health effects and the ongoing enquiry into James Hardie. These factors are all likely to have affected diagnosis and reporting patterns, both in medical practitioners and in patients. The existence of the NSW Workers’ Compensation (Dust Diseases) Board is also likely to

<table>
<thead>
<tr>
<th>Agents</th>
<th>n</th>
<th>Occupations</th>
<th>Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour: grains, fodders</td>
<td>22</td>
<td>Baker</td>
<td>Bakery operation</td>
</tr>
<tr>
<td>Isocyanates</td>
<td>16</td>
<td>Spray painter, mechanic, flexography printer,</td>
<td>Motor vehicle smash repairing, printing</td>
</tr>
<tr>
<td>Solvents</td>
<td>10</td>
<td>Teacher, industrial chemist, chemical</td>
<td>Education, medicinal and pharmaceutical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mechanical officer, printer, motor mechanic</td>
<td>product mfr, printing, automotive</td>
</tr>
<tr>
<td>Wood dust (includes Western</td>
<td>6</td>
<td>Carpenter</td>
<td>Building construction</td>
</tr>
<tr>
<td>Red Cedar)</td>
<td></td>
<td>Labourer, process worker, fitness instructor</td>
<td>Basic chemical mfr, water supply, sports grounds</td>
</tr>
<tr>
<td>Chlorine</td>
<td>5</td>
<td>General clerk, truck driver, labourer, able</td>
<td>Higher education (university), sugar mfr, aluminium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>merchant seaman</td>
<td>smelting, defence</td>
</tr>
<tr>
<td>Dust (NEC)</td>
<td>5</td>
<td>Painter, mechanic, storeperson</td>
<td>Building construction, automotive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mechanical vehicle repair, building supplies</td>
</tr>
<tr>
<td>Paint fumes</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal epithelia, hairs,</td>
<td>3</td>
<td>Animal technical officer, life scientist, zookeeper</td>
<td></td>
</tr>
<tr>
<td>secretions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Incidence rates = per million employed males per year. NEC, not elsewhere classified; mfr, manufacture.
be a factor, as this exists only in NSW, and several reporting doctors were then affiliated with the Board. Given the frequency of asbestos exposure in the workforce, it is also likely that a significant proportion of the denominator had been exposed to asbestos. Unfortunately, these effects cannot be measured but should all be considered in interpreting the study’s results.

In the UK, SWORD has been publishing data for many years, providing an insight into disease trends, and SABRE was established in collaboration with the SWORD investigators to allow international comparison. Overall, PPs and DPT account for 28% of all SWORD notifications, while they account for nearly half of all SABRE NSW notifications. The proportion of mesothelioma notifications is similar in NSW and the UK [8]. South Africa reported high levels of asbestos-related disease accounting for >67% of notifications to the SORDSA scheme, most of which were cases of asbestosis [6]. SABRE in Victoria and Tasmania reported that 39% of all notifications were asbestos related, and over half of these were PPs [11]. Other schemes have also reported much less asbestos-related disease [2,5,7,18] than NSW. It is difficult to disentangle potential reporting and diagnostic biases in NSW from true differences in incidence. NSW has always been one of the most heavily populated and industrialized states in Australia, and the different disease incidences reported in our study could potentially also represent different patterns of exposure resulting from the geographical location of high-risk industries, e.g. the major asbestos product manufacturers and chrysotile mines at Barraba and Baryulgil in NSW.

Comparisons of incidence rates between the various schemes should be made with caution. In the past, some schemes have used contemporary populations to calculate the incidence of long latency diseases where occupations and industries at greatest risk of asbestos exposure no longer exist. Others have used the total employed population although the ‘at risk’ population is predominantly male. Allowing for these methodological differences, the incidence for asbestos-related diseases overall is known to be higher in Australia than elsewhere [7,8,18,19]. In particular, the high incidence of mesothelioma in Australia has been shown previously [20] and is predicted to peak between 2014 and 2021 [17]. In NSW, mesothelioma numbers continue to rise and the number of women affected is of interest [21].

OA is usually the most common disease reported to most occupational respiratory surveillance schemes, with the proportion of notifications ranging from 33 to 63%. In contrast, the number of cases OA reported to SABRE NSW was low. The incidence of OA in NSW, five per million employed males, was considerably lower than that of the UK—44 [22] and more recently Spain—72.3 [7]. OA incidence from SABRE NSW’s sister scheme, SABRE Victoria, was 30 for Victoria and Tasmania [11]. OA incidence reported from the Finnish scheme, where notification is much more complete, was 174, using the total working population as the denominator [2]. Estimates of OA incidence from Canada depend on the data source, with estimates from compensation registries [23] considerably lower than estimates from the PROPULSE scheme [5] and data from British Columbia [18]. We believe that this is likely to reflect under-diagnosis as well as low reporting rates in NSW, where there is currently little emphasis on OA and little specialized training available for medical practitioners in this area. An educational programme has been shown to increase reporting in occupational disease [24] and information, education and practical tools can be developed [25]. In Australia, there is little difference in undergraduate training between states but there are few specialized university-based courses in occupational medicine, with more in Victoria than NSW. However, the main causal agents to which disease was attributed were similar for NSW as those commonly reported elsewhere [11,18], suggesting that the pattern of exposure for these diseases (i.e. high-risk industries and occupations) is similar. Only one population-based study to date has assessed the prevalence of OA in NSW [26]. The population attributable risk of adult-onset asthma for either a high-risk job or an exposure was found to be 9.5%, similar to other international reports. Thus, we believe that our estimates of OA incidence represent significant under-reporting rather than lack of occurrence of disease. Even allowing for a substantial degree of imprecision in existing estimates, the potential problem of OA throughout the world is large [27] and it is unlikely that NSW has been spared in this regard.

SABRE NSW is the first notification scheme to provide detailed data on occupational lung disease within NSW. Use of all types of asbestos is now prohibited in Australia, but potential exposures still continue, particularly in workers in asbestos removal or individuals renovating older homes containing asbestos-based products. Exposure to other agents, including new respiratory-sensitizing agents in industrial settings [28] and in rural NSW, still occurs [29]. Surveillance schemes play an important role in the development of exposure control strategies and may identifying causal agents and occupations and industries where workers are at risk. A recent enquiry by the Community Affairs Committee of the Australian Senate suggested that the SABRE scheme be implemented on a national level as a mandatory notification scheme [30]. With any such scheme, the cost-effectiveness must be assessed in terms of expenditure balanced against the potential benefit of prevention of exposures in the workplace. As a voluntary web-based scheme requiring the employment of a single research officer, SABRE NSW is relatively cheap to run and could easily be implemented more widely. Given the preventable nature of occupational lung disease and the considerable morbidity and mortality associated with its development, we believe that a national programme in Australia is warranted.
Key points

- The New South Wales Survey of Australian workplace Based Respiratory Events currently provides the only available information on occupational respiratory disease in New South Wales.
- Asbestos-related diseases are the most frequently reported conditions, and the very low incidence of occupational asthma most likely reflects under-diagnosis as well as under-reporting.
- Occupational lung disease still occurs in New South Wales despite current preventive strategies and reporting schemes are vital to estimate incidence and prevent future morbidity and mortality from occupational causes.

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Conflicts of interest

None declared.

References


