Bushfires, air pollution and asthma

We need more research on the health effects of air pollution caused by bushfires

THE IMMEDIATE HEALTH effects of bushfire smoke are well known to Australia's volunteer firefighters, who willingly fight bushfires each summer with no remuneration and at considerable personal risk. However, the population health impacts of pollution associated with large bushfires or "backburning" operations (prescribed burning to reduce the fuel load and the intensity of future bushfires) are less well defined, but are a matter of concern for emergency, environmental and public health agencies. A study from Darwin, published in this issue of the Journal by Johnston et al (*page 535*),[1] is a welcome addition to this area of research.

Johnston and colleagues[1] analysed emergency department presentations for asthma in the Darwin region during the "dry" season, April – October (2000), when bushfire activity is high. The authors found that asthma presentations increased significantly (by nearly 2.4 times) on days when PM_{10} levels (ie, the concentration of respirable particulate matter with an aerodynamic diameter of 10 microns or less) were above 40 $\mu g/m^3$, compared with days when PM_{10} levels were less than 10 $\mu g/m^3$.

The Australian National Environment Protection Council's target for maximum mean PM_{10} concentration is set at 50 $\mu g/m^3$ in a 24-hour period.[2] This level was exceeded on six days, with the maximum being 70 $\mu g/m^3$. In fact, this value is relatively low in the international context. The Indonesian forest fires in 1997[3] produced maximum daily PM_{10} averages of over 1500 $\mu g/m^3$. During Sydney's Christmas 2001 bushfires, PM_{10} levels above 150 $\mu g/m^3$ were sustained for 10 days. In Sydney's 1994 bushfires,[4] the peak PM_{10} was 210 $\mu g/m^3$, compared with background levels of about 30 $\mu g/m^3$.

Previous Australian studies examined the effects of pollution in Sydney from backburning in May 1991[5] and bushfires in January 1994.[6] Both studies analysed daily numbers of asthma presentations at several metropolitan hospitals for up to a month. The first study provided weak support for a link between particulate air pollution and asthma attendances, but the second found no difference in asthma presentations in the periods before, during and after the high-pollution event.

There have been two more detailed studies of the health impacts of the 1994 Sydney bushfires. The first[7] extended the period of analysis to six to seven weeks and compared asthma attendances with those in the same period the previous year. The researchers used a more complex analysis strategy, incorporating lag periods of one and two days for independent variables. They found that bushfire-generated particulate air pollution did not result in an increase in asthma presentations to emergency departments in western Sydney.

The second study[4] measured changes in evening peak expiratory flow rates (PEFR) during the bushfire period in children with wheeze, and used a direct measure of PM_{10}, including pollen and alternaria counts, and meteorological factors (temperature and humidity). Thirty-two children were recruited to the study over a period of one week. Peaks in PM_{10} levels occurred three days before recruitment and on Days 3 and 8 (PM_{10} levels of about 70 $\mu g/m^3$, 150 $\mu g/m^3$ and 210 $\mu g/m^3$, respectively, were recorded).

Overall, there was no association found between mean PM_{10} and PEFR. Subgroup analysis of 20 of the children without bronchial hyperreactivity recorded significant falls in PEFR with rising PM_{10} levels. The remaining 12 children with bronchial hyperreactivity showed no significant association between PM_{10} and PEFR. The relative timing of exposure and recruitment may have caused changes in respiratory function before the study period, thereby biasing the results.

All but one of the previous studies[5-7] used indirect measures of particulate pollution, did not account adequately for confounders and did not use appropriate time-series methods. Notwithstanding these shortcomings, the potential for bias is probably low, as most important confounders do not vary on a daily basis. Johnston and colleagues' study[1] has the advantage of running for a longer time period, with the episodes of pollution occurring during the study.

The findings of the Darwin study should stimulate further research on the health effects of bushfire smoke. Current public health approaches to bushfire or other pollution episodes are to invoke a tiered system of warnings, moving from advice for susceptible subgroups (people with asthma, other chronic respiratory disease, or cardiovascular disease) to whole-population warnings as pollution increases. Applying "backburning" as a fire control measure, in itself an effective public health tool, may be restricted, partly because of the perceived impact of the resultant particulate pollution on urban populations. Better information about these effects will result in more appropriate risk management.

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