Position Paper

Asthma and landscape fire smoke: A Thoracic Society of Australia and New Zealand position statement

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Abstract
Landscape fires are increasing in frequency and severity globally. In Australia, extreme bushfires cause a large and increasing health and socioeconomic burden for communities and governments. People with asthma are particularly vulnerable to the effects of landscape fire smoke (LFS) exposure. Here, we present a position statement from the Thoracic Society of Australia and New Zealand. Within this statement we provide a review of the impact of LFS on adults and children with asthma, highlighting the greater impact of LFS on vulnerable groups, particularly older people, pregnant women and Aboriginal and Torres Strait Islander peoples. We also highlight the development of asthma on the background of risk factors (smoking, occupation and atopy). Within this document we present advice for asthma management, smoke mitigation strategies and access to air quality information, that should be implemented during periods of LFS. We promote clinician awareness,
INTRODUCTION

The power and devastation of major landscape fire events have been vividly apparent with destructive megafires being experienced in many regions of the world and exemplified by the Australian bushfires of 2019–2020. While landscape fire smoke (LFS) events from bushfires and planned burns have always been a part of the Australian environment, further increases in the risk of catastrophic fires, are predicted in association with climate change acceleration. The anomalous Australian 2019–2020 bushfire season which exposed >10 million people to increased concentrations of particulate matter (PM) over 3 months was an example. This event was especially concerning for people with asthma, and with the high prevalence of asthma in Australia and New Zealand and increasing LFS events, clinicians, patients and carers need clear guidance on how to best manage these exposures. In response, the Thoracic Society of Australia and New Zealand (TSANZ) commissioned this position statement.

For this statement, landscape fires include vegetation fires (bushfires, prescribed and cultural burns, forest, savanna, grassland and shrubland fires, agricultural burning), open coal mine and peat fires. The main air pollutants in LFS include PM_{2.5} (<2.5 \mu m in diameter), PM_{10} (<10 \mu m), carbon monoxide, oxides of nitrogen, volatile organic compounds and polycyclic aromatic hydrocarbons. Most of these compounds have well-documented health risks. Ozone is a major component of photochemical smog in cities, and regional concentrations may be increased following injection of precursors from LFS, but will not be considered in this document.

LFS has a wide range of adverse effects on human health, with organ systems adversely affected by air pollution. For example, the 2019/2020 Australian bushfires directly caused 33 deaths, including 9 fire fighters and more than 400 deaths attributable to the associated smoke. Exposure to LFS during the period of October 2019 and March 2020 was associated with an estimated 1523 emergency department (ED) asthma presentations. There were increased dispensing and sales of asthma medications including reliever (short-acting \beta-agonists) and combination controller (inhaled corticosteroids and long-acting \beta-agonists) inhalers and increased medical benefits scheme (MBS) claims for respiratory services. There was also increased use of mental health services such as Lifeline. Furthermore, the longer-term impacts of such crises, for example, post-traumatic stress disorder and substance abuse can be delayed, so the true impact is not yet known. A survey by Asthma Australia demonstrated that people with asthma were also more likely to experience financial impacts, anxiety and depression compared to those without asthma.

Until recently each jurisdiction in Australia had its own public health advice for smoke events, which varied slightly between states and territories. In 2020, the Royal Commission into National Natural Disaster Arrangements, recommended a nationally consistent approach for air quality information, health advice and interventions. Therefore, the Environmental Health Standing Committee (enHealth) published national guidelines for managing prolonged exposure to LFS. This included air quality categories and accompanying public health advice for 1- and 24-h average PM_{2.5} concentrations.

This position statement communicates the impacts of LFS, highlights strategies to mitigate the risks, and provides clinicians with appropriate advice to communicate to people with asthma in future events.

METHODS

The writing group was convened by TSANZ following a call to members, and external experts were identified and invited. Applications were reviewed based on TSANZ policy, and multidisciplinary members and a consumer representative were selected based on experience and complementary skills. A range of professions and disciplines with relevant expertise across four Australian states were included: respiratory medicine and research, environmental science, paediatrics, nursing, epidemiology and a community representative with asthma. Conflict of interest declarations were made by all members and reviewed by TSANZ. The group was chaired by VMMcD and MJA.

An outline of the position statement was prepared by the Chairs and circulated. All members gave input and changes were made after discussion. Based on their areas of expertise, members were assigned specific writing tasks. The group held regular videoconferences to discuss the articles and prepare the position statement.

TAKE HOME MESSAGE

We provide a position statement from the TSANZ on the impacts of landscape fire smoke exposure on people with asthma, and risk mitigation, exposure management and interventions promoting clinician awareness, public health messaging and further research.
Search terms were developed by two members (TB, BB) and approved by the working group. Search terms are presented in Box 1. Medline was used to identify relevant research articles for relevant sections. ‘Grey’ literature was searched for articles pertaining to existing asthma management guidelines. The inclusion of articles was determined as being the most relevant to the position statement. Members revised the drafted sections using a shared drive. The final draft was compiled and edited by the chairs and circulated. Peer review was conducted jointly by TSANZ and Respirology and the final position statement was approved by the TSANZ Board and Editors of Respirology.

IMPACT OF LFS

Impact on adults with asthma, including vulnerable groups

There is mounting evidence reporting the association between LFS and asthma symptoms and healthcare service utilization. A study of the impact of the 2019–2020 Australian bushfires found that people with asthma reported significantly higher rates of respiratory symptoms and poor asthma outcomes (ED visits, hospitalization and oral corticosteroid use) during the fire period compared to those without asthma. Gan et al. found that the risk of asthma diagnosis at EDs, asthma-related primary care visits, outpatient hospital admissions and asthma rescue inhaler medication dispensing was significantly associated with increases in LFS-related PM$_{2.5}$. Vertigan et al. also demonstrated that adults with laryngeal hypersensitivity had a greater symptom burden during the 2019/2020 Australian bushfire period. Furthermore, these symptoms persisted in the months following exposure and were associated with worse asthma control.

These findings suggest that LFS increased the risk of asthma morbidity and healthcare service utilization, which warrants the need for public health intervention.

A systematic review and meta-analysis of 20 studies that examined the association between LFS-related PM$_{2.5}$ and asthma-related outcomes, found that older people (>65 years) were particularly vulnerable with a higher risk of asthma-related outcomes when exposed to LFS PM$_{2.5}$ compared to younger adults and children. Similarly, other studies found a greater impact of LFS on ED visits and hospitalization for asthma among older people. A study of the 2003 catastrophic fires in Southern California found that asthma admissions were increased during the LFS period compared to periods before or after among all age groups. However, the greatest increase in asthma admissions was observed in the older age group (aged 65–99 years, 10.1%), followed by children (0–4 years, 8.3%) and adults (20–64 years, 4.1%). A study of the health outcomes of smoke exposure during the 2011 landscape fire in New Mexico reported that the risk of asthma exacerbations increased for all ages by 8% during the fire smoke period, while the risk increased by 73% in the older population (≥65 years). Collectively, these studies indicate that older people are more susceptible to the effects of LFS. Reduced health literacy and the higher prevalence of comorbidities in older people makes this group particularly vulnerable.

Pregnant women with asthma are another vulnerable group. Normal physiological changes during pregnancy increase their vulnerability to exacerbations generally, and LFS in particular. Exposure to LFS in pregnant women may have a direct impact on asthma, increasing airway inflammation and reducing lung function causing asthma exacerbations, which may increase the risk of adverse pregnancy outcomes including low-birth weight and preterm birth. A study of the health impact of the 2019–20 Australian bushfire period found that pregnant women with asthma were more likely to report respiratory and non-respiratory symptoms during compared to after this period. Moreover, pregnant women with asthma also had higher anxiety scores during compared to after the fires. This indicates that LFS has significant effects on the health of pregnant women and identifies the need for adequate preparation, clear messaging and avoidance of LFS exposures during these events.

Impact of LFS on children with asthma

Children are also at increased risk of the harmful effects of LFS exposure compared to adults, due to smaller airways, higher metabolic rate and ongoing development. A systematic literature review of LFS exposure and respiratory-related healthcare visits in children included studies up to December 2020. Of the limited number of suitable studies, published between 2006 and 2020 in North America and Australia, five used a pre-post design and 11 were cross-sectional. Data were included on >500,000 children under the age of 20 years. This review demonstrated increased risks between LFS exposure and outpatient clinic visits for any respiratory problem (increased risk in all 3 studies; total 9777 participants), ED visits for any respiratory cause (5/8 studies; 557,454 participants) and hospitalization for any respiratory cause (3/4 studies; 13,258 participants). However, results for asthma-related healthcare visits were unclear: asthma-related clinic visits (increased risk in only 1/3 studies, 9777 participants), ED visits (3/8 studies,
577,454 participants) and hospitalization (2/4 studies, 9777 participants). Any observed effects occurred within the first 3 days of smoke exposure. Hutchinson et al. reported dose-effects and increased impact by LFS exposure on participants with existing asthma or rhinitis.

Following the systematic review, several notable studies have been published. AgUILERA et al. studying the wildfires of 2011–2017 in San Diego county California, observed that young children (<5 years) were more at risk of a hospital respiratory visit during LFS periods, with visit rates up to 10 times higher than a comparable 10 μg/m³ increase in non-wildfire smoke PM2.5.29 The main symptoms were cough, and visits for asthma were not significantly higher. Whether this failure to show a difference specific to asthma visits reflects a greater preference to stay indoors, increase their asthma medication in response to the change in the environmental conditions, or preferential evacuation of higher-risk people is unclear.

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**TABLE 1** Quotes from people exposed to the 2019/2020 Australian landscape fire smoke period.28

| Negative feelings/experiences from smoke exposure—‘It’s also been awful for my mental health. I have had to increase my dose of sertraline to manage the anxiety’. |
| Challenges in avoiding exposure to smoke—‘Even working inside a shopping centre gave no relief as the smoke could still be smelt inside. It has been near impossible to avoid’. ‘Staying indoors for a 3-year-old is hard. He wants to go out to play. Restricted time at friends [sic] birthday party due to outdoors’. |
| Costs and future resilience landscape fire events—‘Financial support would be huge for me, offering free P2 masks, offering discounted Ventolin, an air quality update app, discounted air cleaners…’ |

**Impact of short- and long-exposures to LFS including new onset of asthma and risk-factors**

There is growing evidence that exposure to urban air pollution, which is relatively constant, increases the risk of new-onset asthma in both children34,35 and adults.36,37 However, the risk of intermittent and transient LFS exposure on asthma is unknown. Firefighters are regularly exposed to LFS, but there is no consistent evidence of increased adult-onset asthma in this group.38,39 However, a study of firefighters with prolonged...
**TABLE 2** Benefits and drawbacks of personal risk reduction measures during landscape fire smoke events Adapted with permission.\(^6\)

<table>
<thead>
<tr>
<th>Risk reduction measure</th>
<th>Benefits</th>
<th>Drawbacks</th>
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<tbody>
<tr>
<td>Staying indoors (at home, workplace or school)(^6^7)</td>
<td>• Effective in reducing personal exposure to PM(_{2.5}) in relative well-sealed rooms with(^6^8), air conditioning (on recirculating mode), air filtration (with HEPA filters) no indoor pollution sources (e.g., cigarette smoking)(^6^7)</td>
<td>• Building overheating and low air exchange rates resulting in high indoor temperatures and carbon dioxide levels(^a) • Significant upfront cost for installation of air conditioning/filtration systems(^6^9) • Ineffective over longer periods of time (i.e., several days) without additional air filtration(^6^9)</td>
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<td>Reducing strenuous physical exercise outdoors(^6^7)</td>
<td>• Effective in reducing personal exposure to bushfire smoke(^a) • Limiting exertion in children may be especially important for reducing their exposure to particles(^6^7)</td>
<td>• Could be detrimental to cardiovascular and mental health if air pollution persists over longer periods, unless other opportunities for exercising are provided (e.g., indoor sports centres)(^6^7)</td>
</tr>
<tr>
<td>Using a clean air facility or public building with good indoor air quality (e.g., air-conditioned shopping centre, public library, community centre and sports centre)(^6^7)</td>
<td>• Effective in reducing exposure to outdoor air pollution over short periods (i.e., hours)(^7^0)</td>
<td>• Impractical over longer periods of time (i.e., several hours) • At-risk individuals may need onsite medical assistance or ambulance transport • Large numbers of facilities will be required in cities(^a) • Facilities may need retrofits for airtightness or installation of HEPA filters for air intake(^a)</td>
</tr>
<tr>
<td>Portable air cleaners (air purifiers)(^9^7)</td>
<td>• Effective in reducing indoor air pollution levels if fitted with HEPA filters(^6^7,6^9,7^1) • Highly effective in well-sealed rooms of certain size as recommended by manufacturer(^6^7,6^9,7^1)</td>
<td>• Less effective in less airtight houses, which are common in Australia(^a) • PM(_{2.5}) removal rate dependent on flow rate of air cleaner(^6^7,7^2) • Significant upfront purchase cost • Availability may be limited in areas heavily affected by bushfire smoke</td>
</tr>
<tr>
<td>Face masks, including professional masks and surgical masks(^2^2–2^5)</td>
<td>• Well-fitted professional (e.g., P2/N95) masks offer effective protection from PM(_{2.5}) exposure(^2^2) • Professional masks are generally suitable for outdoor workers(^a) • Exhalation valves can reduce build-up of humidity and carbon dioxide within masks(^a)</td>
<td>• Difficult to achieve good facial fit with professional masks (e.g., due to small face, facial hair etc.)(^3^3) • No professional masks are made for children • Surgical masks offer only moderate protections(^7^3) • Improvised cloth masks, bandanas or T-shirts offer no protection(^7^3) • Face masks may give false sense of security(^7^5) • Uncomfortable to wear over longer periods(^7^6)</td>
</tr>
<tr>
<td>Antioxidant supplements, fish oils (omega-3 fatty acids) and other dietary advice(^6^7,7^6)</td>
<td>• A healthy diet, rich in fruits and vegetables, is generally beneficial. However, there is no direct evidence of protective effects of diet against air pollution(^7^7)</td>
<td>• Dietary supplements can provide long term and potentially short-term health benefits, but may be costly(^a) • Supplements should not be used as substitute for a healthy and balanced diet • More research is needed to prove effectiveness of supplementation in reducing health risks from air pollution exposure</td>
</tr>
<tr>
<td>Asthma medication</td>
<td>• Asthma preventive medication can attenuate exacerbations of the condition</td>
<td>Patients require knowledge that they have asthma and/or are at risk of exacerbation during exposure. Therefore, adherence to prescribed controllers is necessary</td>
</tr>
<tr>
<td>Aspirin, statins and other medications(^6^7)</td>
<td>• There is very little evidence that aspirin, statins or any other medication have direct protective effects against air pollution(^6^7)</td>
<td></td>
</tr>
<tr>
<td>Smoke forecasts, near real-time air quality data (PM(_{2.5})), air pollution and health alerts(^6^9)</td>
<td>• Mostly free to use and can enable individuals to develop personal smoke exposure reduction plans(^7^9) • Localized hourly air quality information more useful than 24-h rolling averages or spatially averaged data(^a)</td>
<td>• Use information services that have been validated for Australian conditions such as jurisdictional environment agency websites or the Australian app AirRater • Information in electronic media may not reach some sensitive groups (e.g., older people)</td>
</tr>
<tr>
<td>Temporary relocation(^8^0)</td>
<td>Can provide health protection to at-risk groups, such as pregnant women, or people with serious lung or heart disease, affected by localized but persistent smoke episodes(^8^0)</td>
<td>• Impractical when large population centres are affected • Difficult and expensive to relocate many people(^2) • Socio-economically deprived individuals, older people and those who are very ill have lower ability to relocate safely(^8^0) • Cognitive impairment and restricted mobility could compound the stress of relocation(^8^0)</td>
</tr>
</tbody>
</table>

Abbreviations: HEPA, high-efficiency particulate air; PM\(_{2.5}\), atmospheric particulate matter with a diameter <2.5 μm.

\(^a\)Based on the authors’ expert opinion.
Studies of the Negative outcomes and Still, understanding highlights illustrative quotes from these studies. In a These observations suggest that LFS may have children born just prior to the fire, increased parent-reported and doctor-diagnosed respiratory infections in children exposed in utero, and increased use of asthma inhalers in children exposed post-natally. These observations suggest that LFS may have direct effects on dysregulation of immune responses and lung development in post-natally exposed children, and through maternal systemic effects in in utero exposed children.

Combinations of in vitro/ex vivo human cell studies with in vivo mouse and other animal models are valuable in defining the impact of short and long-LFS exposures on asthma onset. Studies in mice and rats showed that acute and chronic LFS exposures promote allergic sensitization, increase asthma-like severity and reduce responses to pathogens through increasing innate (uric acid, inflammasomes and oxidative stress) and adaptive (Th1 and Th2 cytokine) immune responses. In a natural experiment, rhesus macaques exposed to LFS smoke during the first months of life in the California fires of 2008 developed asthma-like symptoms, and reduced lung volume and function and peripheral IL-6 and IL-8 responses compared to macaques born after the fires.

These data suggest that early life exposure to LFS may impair immune responses and lung function in childhood and increase the risk of developing asthma. Furthermore, longer-duration fires, expected in the future, may be a greater risk for asthma development than repeat short-term exposures. However, research remains sparse. An American Thoracic Society Workshop Report outlined the future challenges and policy opportunities for the respiratory impacts of LFS. It highlighted the importance of future research on the effects of long-term and repeated LFS pollution on respiratory, cardiovascular, neurological and psychological health across life stages, including developing foetuses and children.

CONSUMER EXPERIENCE

There is substantial literature on the environmental, economic and health burden of landscape fires. Still, understanding patients’ experiences is important. Studies reporting on psychological impacts of LFS exposures have consistently found negative impacts on mental health. Negative outcomes in pregnancy due to pre-natal stress from LFS exposure are reported. A study from Broder et al. demonstrated distress caused to residents of Latrobe Valley, after the Hazelwood mine fire caused substantial PM release. Using self-reported data from health surveys they demonstrated psychological distress in people with self-reported respiratory symptoms.

The 2019–2020 Australian bushfires prompted Asthma Australia to undertake an online survey during December and January; a period of high smoke impacts. There were 12,152 responses received of whom 7285 (61%) reported a prior doctor diagnosis of asthma. Overall people with asthma reported substantial increases in the requirement for asthma treatment, a deterioration in symptoms and quality-of-life, including an increase in anxiety and depression, and greater healthcare utilization. The need for increased medication and protective equipment, time off work and increased doctor visits led to greater financial burden in those with asthma.

In another survey of 240 people with asthma who were enrolled in the Severe Asthma Web-based Database, conducted after the 2019/2020 Australian bushfires, adults with severe asthma experienced substantial health impacts from the intense and prolonged exposure. These data indicate a clear need to improve the messaging for people with asthma. Table 1 highlights illustrative quotes from these studies.

These Australian surveys demonstrate that beyond the well-documented health impacts of LFS from various international studies, people with asthma experience a range of impacts on their wellbeing and relationships from LFS exposure and desire further support and information. More research should be undertaken to further understand the needs of people with asthma to reduce the impacts of LFS. The Australian Commonwealth Royal Commission into National Natural Disaster Arrangements further highlighted this need calling for more support to vulnerable groups and a prioritization of mental health assistance.
These data and experiences of people with asthma also highlight the need for effective communication and partnership between people with asthma and their health care team. Shared decision-making is known to improve adherence and asthma outcomes among people with asthma.\textsuperscript{60,61} During periods of increased stress and environmental trigger exposure effective therapeutic alliances, and planning may lead to better outcomes.

**MITIGATION STRATEGIES AND EXPOSURE REDUCTION**

Reducing exposure to LFS can be achieved at varying levels of effectiveness by implementing personal mitigation strategies. A theoretically effective strategy, but one that is often not feasible is relocation.\textsuperscript{5} In a survey of people with asthma following the 2019–2020 Australian bushfire period, only 11/240 (4.6%) of participants indicated that they relocated elsewhere.\textsuperscript{59} Engineering controls such as setting air-conditioners to recirculation mode, closing windows and doors and using air-purifiers with high-efficiency particle air (HEPA) filters, potentially achieves 20%–90% exposure reduction. The most effective of these options is use of a HEPA filter that is sized appropriately for the room.\textsuperscript{62,63} In a cross-sectional survey of people with asthma, some of these strategies were frequently implemented, 83% of participants reported staying indoors, 92.9% kept their windows closed and 72.1% used home air-conditioners.\textsuperscript{59} However, Australian houses are more leaky (less airtight with poorer...
TABLE 3 Summary of guidelines/recommendations and resources from reputable sources.

<table>
<thead>
<tr>
<th>Authority</th>
<th>Recommendation/resource</th>
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<tr>
<td>The Commonwealth Department of Health</td>
<td>Fact sheets recommend staying indoors when there is visible smoke haze. In particular, they recommend avoiding exercise outdoors and monitoring air quality information via the state-based network of agencies and provide general information about N95/P2 masks and air purifiers. The Department also provides a document advising action for vulnerable groups.</td>
</tr>
<tr>
<td>The Australian Institute of Sport</td>
<td>A position paper on exercise and smoke that, while not specific to asthma, mentions asthma and respiratory infection as risk factors. This is useful as a practical guide to activity.</td>
</tr>
<tr>
<td>Asthma Australia</td>
<td>Provides web-based advice in a user-friendly format emphasizing avoidance of LFS, checking landscape fire and prescribed burn information, N95/P2 mask protection when outdoors for people with asthma and a personal asthma action plan. There are very clear, concise and downloadable documents for both patients and healthcare providers and numerous relevant links to government agency and monitoring websites.</td>
</tr>
<tr>
<td>NHMRC Centres of Research Excellence in Severe Asthma</td>
<td>Infographics on asthma management and LFS.</td>
</tr>
<tr>
<td>NHMRC Centre of Research Excellence for Air Pollution, Energy and Health Research</td>
<td>Fact sheet on the health impacts of bushfires.</td>
</tr>
</tbody>
</table>

insulation) compared to other countries including the USA, the UK and Canada, allowing smoke to permeate reducing the effectiveness of mitigation strategies. Smoke can remain trapped indoors for many hours after outside conditions have improved. For this reason, tracking of smoke impacts and ventilating homes when conditions are good is an important environmental intervention. We recommend that HEPA filter air-purifiers be subsidized for at risk people with asthma.

N95/P2 or P100 face masks can reduce exposure significantly, but fit-testing for these masks can be limited for community members, and effectiveness depends on well-fitting masks. N95 is a NIOSH (US) standard whereas P2 is the Australian standard. After the 2019–2020 Australian bushfires only 20.4% of people with asthma indicated they wore a mask, and the type was not specified. We anticipate that the rate of mask-wearing would be higher in future events following the experience of the COVID-19 pandemic. Real-time monitoring of air quality for Australian conditions is also recommended and can be achieved using mobile applications such as AirRater. Figure 1 and Table 2 present the personal mitigation strategies that are recommended, their effectiveness, as well as limitations and concerns.

**ASTHMA MANAGEMENT**

In addition to LFS exposure reduction strategies, optimal asthma management is critical. To achieve this the areas that need to be addressed are optimizing self-management skills, ensuring appropriate management with asthma medication, effective avoidance and management of triggers and effective planning. The core asthma management skills required are asthma knowledge, proficient inhaler device technique and delivery, good adherence to asthma treatments and possession of a written asthma action plan with education on when to implement it, how to implement it, when to go back to maintenance treatment, and when to seek emergency assistance (Figure 2). Written asthma action plans should be prescribed by the general practitioner in a shared decision partnership with the patient or parent. Using relievers to manage symptoms of asthma is necessary and international guidelines have recently evolved to promote the concurrent use of SABA and anti-inflammatory reliever therapy in appropriate age-groups where evidence of benefit exists (www.ginasthma.org).

Adherence in asthma is frequently sub-optimal, but a critical self-management skill. Strategies for improving adherence to therapy are reviewed in McLoughlin et al. In brief these include asthma education, electronic trackers/reminders and simplification to treatment regimens. Planning response to LFS exposure is also necessary and can include ensuring that patients have up-to-date written asthma action plans and sufficient supply of medications for optimal asthma management. A landscape fire checklist has been developed to guide patients with asthma (Figure 3). These and other useful strategies for people with asthma are listed in Figures 1 and 2, and are available for download.

Ensuring patients achieve good asthma control, optimal adherence to their treatment and have satisfactory asthma management skills are key goals in the treatment of asthma at any time and may lead to fewer impacts during periods of LFS exposure.

**LFS guidelines**

Whilst we were unable to source any clinical practice guidelines specifically for the management of asthma during landscape fires, there are several generic recommendations available from government health authorities around Australia, these are summarized in Table 3.
SUMMARY

We have summarized the health impacts of LFS exposure for people with asthma and identified the vulnerable populations most at risk of adverse outcomes (Figure 4). We have highlighted key points, recommendations and strategies that should be implemented during landscape fire periods and in planning for such events, and identified important future areas for research. The recommendations are summarized in Figures 1 and 3 and future research needs in Figure 5.

Landscape fires affect all continents except Antarctica and due to climate change, their size, duration and frequency are increasing, with more severe impacts. LFS has...
many adverse physical and mental health effects, as well as economic and health system consequences. In this position statement, we have summarized the impacts to draw clinician awareness and to prepare them and other interested people for future events. The challenge is to ensure public health messages are implemented into clinical practice and are accessible to patients via reputable online and printed sources. We draw attention to the impact of LFS on people with asthma and promote better communication and preparation for future events.

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CONFLICT OF INTEREST STATEMENT
Vanessa M. McDonald, Philip M. Hansbro and Michael J. Abramson are Editorial Board members of Respirology and co-authors of this article. They were excluded from all editorial decision-making related to the acceptance of this article for publication. Vanessa M. McDonald reports unrelated advisory board and speaker fees from AstraZeneca, GlaxoSmithKline and Novartis. Vanessa M. McDonald is a board member of the Thoracic Society of Australia and New Zealand. Michael J Abramson holds investigator-initiated grants from Pfizer, Boehringer-Ingelheim, Sanofi and GSK for unrelated research. He has undertaken an unrelated consultancy for Sanofi. He has also received a speaker’s fee from GSK. Peter G. Gibson reports speaker fees from AstraZeneca, GlaxoSmithKline and Novartis. John Harrington reports speaker fees from AstraZeneca, GlaxoSmithKline and Novartis. Fay H. Johnston led the development of the air quality service AirRater. Peter Franklin works for WA Department of Health and prepares advice around public health messaging for air pollution events such as landscape fires. The other authors have nothing to disclose.

DATA AVAILABILITY STATEMENT
Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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SUPPORTING INFORMATION
Additional supporting information can be found online in the Supporting Information section at the end of this article.