

Community cleaner air spaces during landscape fire events: What do we know?

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Overview

This commentary summarises current evidence, guidelines, and research and policy gaps in relation to the implementation and use of community cleaner air spaces (CCASs). CCASs may be established by jurisdictional health authorities or local governments during periods of severe and prolonged poor air quality, usually as a result of landscape fire smoke, with the aim of reducing smoke exposure across communities. We found very limited published evidence evaluating their establishment, use, effectiveness (both for reducing exposures and improving health outcomes) and their reach into higher-risk populations. Few guidelines exist to assist government agencies to set up a CCAS and effectively communicate their benefits to the community. In a warming world, with increasing risks of landscape fires, urgent research is needed to evaluate this potentially useful climate adaptation response and translate this evidence into policy and action.

Introduction

Globally, landscape fire smoke (LFS) episodes are projected to increase in frequency and intensity in a warming climate, as a result of increased landscape fire risk.¹ Recent episodes of widespread LFS have occurred in eastern Australia, Brazil and the Pacific Northwest.² Exposure to LFS has a detrimental impact on human health, primarily through pathways affecting respiratory and cardiovascular systems.³ Specific populations at greater risk of health impacts include the elderly, the very young, those with existing chronic health conditions and pregnant women.² Homeless people and low-income households are also at higher risk. Reducing the health burden on

these priority populations during severe LFS episodes remains central to the efforts of public health advisors and policy makers.⁴

While various recommendations to reduce exposure are available for households and individuals,⁴ another option available to health authorities in severe smoke events is the establishment of 'community cleaner air spaces' (CCASs), alternatively known as 'cleaner air shelters', 'safer air havens' or 'smoke relief centres'. A CCAS is an existing building or structure where indoor air quality can be improved by using a filtration system to reduce airborne particulate matter (PM) below that of the corresponding outdoor air levels.⁵ Structures may include community-accessible buildings such as libraries, shopping centres, sports facilities, schools or community halls, or specific rooms in evacuation centres established during a landscape fire event. These buildings may overlap with community cool spaces, typically established during extreme heat events to give community members respite from hot conditions. In Australia, the Australian Capital Territory (ACT) Government recently announced a new framework that will allow community clubs to operate as heat and smoke refuges during emergencies.⁶

To ascertain the current evidence, guidelines and research and policy gaps outlined here, we performed a web-based search using Google Scholar (for research literature) and Google Search (for grey literature). Keywords used were 'clean air centre', 'clean air shelter', 'clean air space', 'community resilience centre' or 'safe air haven'. We restricted the search to English-language publications from 2010 to the first quarter of 2024. Citations of the most relevant articles were checked to capture any missing publications. We also contacted researchers and policymakers to locate any relevant work in progress. From this

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review, we identified clear gaps in knowledge, which we translated into either research or policy priority recommendations.

Current evidence

In regions affected by prolonged LFS events, the use of CCASs is generally recommended by health authorities^{7,8} and researchers.^{9,10} However, establishing CCASs can be challenging,⁵ and research on their implementation, use and effectiveness, including an understanding of barriers and enablers, is very limited.

Wheeler et al.¹¹ evaluated the effectiveness of a local public library as a CCAS over a five-month period during a prolonged smoke event in Port Macquarie, NSW. This period covered a peat fire beginning in July 2019 and continuing to February 2020, and major landscape fires in November 2019. Measurements of PM_{2.5} (fine PM with a diameter of 2.5 micrometres or less) were made at two locations inside the library – one in the main air-conditioned space with no air filter and another in a smaller room containing a high-efficiency particulate air (HEPA) cleaner. Results demonstrated that when compared to outdoors, concentrations of PM_{2.5} were reduced by 70% and 87% in these indoor spaces respectively. The study also found that during periods of more severe smoke pollution, indoor concentrations of PM_{2.5} were reduced more than during periods of less severe smoke pollution. This observation may reflect behaviour change (for example, since residents were more likely to avoid outdoor excursions during periods of severe smoke, the library had fewer periods when the main doors were opened and closed). Although no information on the local community's use of the facility as a CCAS was captured in this study, it demonstrates that large public buildings with central air-conditioning could provide suitable spaces for a CCAS, at least in terms of hazard exposure reduction.

In California, USA, Treves et al.¹² interviewed health practitioners with experience implementing CCASs, along with members of the public previously exposed to LFS. Practitioners reported consistent underuse of CCASs, despite efforts to establish and communicate their presence to the public. Reasons for underuse included a lack of amenities (such as activities or children's entertainment) and individuals' strong attachment to their home. Practitioners also faced challenges with identifying a suitable facility, including difficulties finding facilities with appropriate air filtration systems, and adequate staffing provision. Other barriers cited included transportation to CCASs and difficulties engaging with specific at-risk groups (for example, those who are homeless or do not speak English). Community members expressed interest in using a CCAS during times of LFS, but noted transport to the facility and opening hours as possible barriers to use. They also emphasised the importance of communicating about the CCAS through multiple media outlets, including traditional and social media. This study highlights that effective use of CCASs requires improved alignment between community member needs and practitioner intentions and expectations.

Current policy guidelines

National guidelines for Australian public health agencies managing LFS events contain only limited references to CCASs.¹³ These include, for example, that “public buildings like libraries or shopping centres have air-conditioning systems that filter air pollution particles” and that “spending time in air-conditioned places will help reduce the amount of smoky air”.¹³ Local governments are also encouraged to

“identify and maintain a list of suitable facilities that could provide cleaner air spaces if needed and develop plans for communicating and activating their use in periods of poor air quality”.¹³ At PM_{2.5} concentrations >50 µg/m³ (rated as ‘very poor’), Australian national guidelines suggest considering going to “a place with cleaner air (such as an air-conditioned building like a library or shopping centre)”.¹⁴ The guidelines also encourage aged care facilities, schools and hospitals to establish cleaner air spaces within their facilities, given individuals at greater risk of poor health outcomes are likely to be present. However, the guidelines do not contain recommendations for establishing a CCAS, nor advice for communicating about the location or operation of a CCAS, both factors of high importance to practitioners and community users.¹²

At a jurisdictional level, Victorian State Government guidelines supply local councils with advice regarding the establishment of CCASs.¹⁵ This includes guidance on the buildings' air change rate, location (including proximity to health and community services), capacity, amenities, accessibility and backup power supplies. Furthermore, the Victorian guidelines provide advice on building ventilation and filtration systems. Advice is also provided on setting up a cleaner air space within a local facility such as a hall or church, which is of most relevance to regional towns that may not have access to a dedicated building. However, there are limited recommendations on the selection of buildings and spaces, community messaging regarding CCASs and transport to and from the centres. Issues such as capacity and resourcing for local councils to implement CCASs are not addressed.

International sources for CCAS policy and guidance include the California Department of Health,¹⁶ Health Canada,⁸ and the National Collaborating Centre for Environmental Health.⁵ Key recommendations found in international guidelines include identification of at-risk populations, criteria for identifying suitable community buildings and considerations in setting up a CCAS, including outdoor conditions and monitoring guidelines for indoor air quality.

Research gaps and recommendations

To be effective and sustainable as a robust intervention, research on CCASs is needed across several domains. Firstly, an evaluation of their effectiveness in reducing exposure to air pollution, and the potential associated health benefits to people who use them, is critical to establish the usefulness of CCASs and increase their adoption on a wider scale. Furthermore, research to characterise which building filtration systems are most effective will be critical to assist practitioners in identifying suitable structures and contribute to evidence-based policy guidelines for CCAS implementation. Helping public health practitioners develop effective communication strategies for CCASs is also key for their successful implementation and use, ensuring potential users are aware of LFS risks, and the existence and benefits of CCASs. Evidence and examples of beneficial community outreach and constructive partnerships are urgently needed, along with evidence that access to these facilities can protect the health of higher-risk members of the community. Timing and content of messaging, as well as methods to reach at-risk populations and culturally, ethnically and linguistically diverse groups, are important considerations.¹⁷ Furthermore, the requirements of at-risk groups must be identified and prioritised, as should the specific needs

of people with diverse abilities and First Nations communities.¹⁷ This would help health authorities to assist in setting up a CCAS targeting those at greatest risk from LFS exposure.

Research to provide a greater understanding of how community members utilise CCASs is also needed, including an understanding of user demographics, user experience and user expectations. Moreover, understanding local differences in the uptake of CCASs across urban, peri-urban and regional locations is needed to identify barriers and enablers across regions and socio-economic groups. For example, communities with existing high levels of social resilience and cohesion, or communities with previous experience of bushfire events, may respond differently to CCAS implementation in their local region, compared to communities without these factors.

Policy gaps and recommendations

For Australian health practitioners and policymakers, robust and evidence-based guidelines are urgently needed to aid the establishment and communication of local CCASs. These guidelines should include (i) a checklist with criteria to help identify suitable public buildings, (ii) minimum effective filtration standards and (iii) strategies to maximise outreach to high-risk populations. In addition, alternative approaches for areas without suitable facilities could be included⁵ (for example, the establishment of a smaller cleaner air space within an existing public building may be more practical than managing smoke ingress into an entire building).

Conclusion

Smoke from landscape fires has a substantial health burden globally, a risk projected to increase in a warming climate. Evidenced-based public health interventions are urgently needed to protect those at greater risk. CCASs offer one such option; however, a comprehensive understanding of the implementation, effectiveness and use of these facilities is currently lacking. To address this, clear prioritisation of further research on CCASs and the establishment of a research translation partnership between researchers and public health professionals will help determine whether these facilities are a practical and effective response, and scalable and sustainable in the long-term.

Conflicts of interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Sotiris Vardoulakis reports financial support was provided by CRE Centre for Safe Air. Sotiris Vardoulakis reports a relationship with Australian Government Department of Health and Aged Care that includes: funding grants. Sotiris Vardoulakis reports a relationship with University of Canberra that includes: employment. Sotiris Vardoulakis reports a relationship with National Health and Medical Research Council that includes: funding grants. Sotiris Vardoulakis reports a relationship with ARC that includes: funding grants. Sotiris Vardoulakis reports a relationship with Australian Government Department of Foreign Affairs and Trade that includes: funding grants and travel reimbursement. Sotiris Vardoulakis reports a relationship with Australian Government Department of Climate Change Energy the Environment and Water that includes: funding grants. Sotiris

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If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Ethical approval

Ethics approval for this work was not required.

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