Burnet
reach for the many

Delivering quality care more efficiently through improved indoor air quality

Executive Summary

The Productivity Commission's interim report *Delivering Quality Care More Efficiently* identifies prevention as a national priority, recommending the establishment of a National Prevention Investment Framework (NPIF) to improve outcomes and reduce demand for acute care services[1]. The Commission highlights that prevention must be supported by stable investment, rigorous evaluation and cross-portfolio accountability, recognising that the benefits accrue across sectors and levels of government over extended timeframes[1].

We recommend that indoor air quality be established as a priority investment area within the NPIF.

Australians spend approximately ninety per cent of their time indoors [2], where inadequate ventilation allows pollutants to accumulate and infectious diseases to spread. Poor air quality in schools, workplaces, health services and public buildings contributes to over 3,200 deaths annually from fine particulate matter ($PM_{2.5}$) exposure alone [3]. Evidence shows that mechanical ventilation and HEPA filtration can reduce respiratory infections significantly by diluting and removing infectious particles [4–7]. These interventions are cost effective, with economic benefits outweighing implementation costs [8,9]. The impact on Australia's 2 million-strong care workforce[1] is particularly heightened. These workers face a higher exposure risk to respiratory infections in hospitals, aged care and childcare facilities[10], leading to increased absenteeism and service disruption. Additionally, when poor air quality in schools and childcare centres causes frequent childhood illnesses, care workers must withdraw from work to care for sick children, reducing the sector's effective capacity. Beyond these ongoing impacts, poor indoor air quality leaves Australia vulnerable to the increasing risk of pandemics [11].

Indoor air quality exemplifies why prevention fails to scale despite proven benefits. Three key systemic barriers prevent action: fragmentation of responsibility across portfolios with no single government Minister, agency or department accountable; misaligned incentives where those who pay for upgrades cannot capture the benefits; and budget cycles that undervalue long-term prevention gains. These barriers disproportionately affect disadvantaged communities who face greater vulnerability to respiratory illness, higher exposure in poorly ventilated workplaces and homes, and inferior building infrastructure.

Indoor air quality is a textbook case for the NPIF.

It will provide the necessary mechanism to government to overcome fragmentation, address split incentives, and enable long-term investment. By embedding shared accountability and rigorous evaluation, the NPIF can drive programs that reduce preventable hospitalisations, maximise workforce availability and address inequities. In doing so, it delivers precisely what the Commission calls for: Better and more equitable outcomes for Australians while making the care sector more efficient by reducing future demand for costly acute services.

1. Indoor Air Quality as a Prevention Priority

Australians spend around 90 per cent of their lives indoors, yet pollutants inside homes, schools, workplaces, health services and public buildings can frequently exceed outdoor levels [2]. This hidden exposure drives preventable disease resulting in a significant burden on the health system, education sector, workforce and productivity.

2. Evidence of Harm and Solutions

Indoor air quality has direct impacts on both short- and long-term health outcomes. Poor ventilation and exposure to airborne pollutants increase the risk of respiratory infections, which translates into avoidable demand on health systems and lost productivity. A large cohort study in Italy demonstrated that classrooms with mechanical ventilation recorded a 74–80 per cent lower risk of clustered SARS-CoV-2 infections compared with naturally ventilated classrooms, with a clear dose–response effect[5]. More recently, a randomised crossover trial in Los Angeles schools showed that portable HEPA air cleaners significantly reduced indoor particulate concentrations, providing further evidence of effective intervention in educational settings[7].

Chronic exposure to fine particulate matter ($PM_{2.5}$) contributes substantially to disease burden. A systematic review and meta-analysis confirmed strong associations between long-term PM exposure and increased all-cause and cause-specific mortality[12] . In Australia, the AIHW estimated that in 2018 more than 3,200 deaths (2.0 per cent of all deaths) and 1.3 per cent of the total burden of disease were attributable to $PM_{2.5}$ air pollution [3].

Beyond day-to-day health impacts, poor indoor air quality significantly increases our vulnerability to pandemics and other respiratory events (such as a bad influenza season). Recent modelling estimates a 47–57 per cent probability of another COVID-scale pandemic within the next 25 years[11]. The COVID-19 pandemic demonstrated the economic impact of such events, with the Australian Government providing $291 billion in direct economic support during 2020–21[13] . Indoor air quality measures such as improved ventilation and filtration are among the few prevention interventions that can reduce both day-to-day transmission of respiratory illness and the severity of pandemic-scale disruptions, by keeping schools, workplaces, and care settings safer and more operational during airborne outbreaks.

Indoor air quality also influences education, learning and productivity. The U.S. Environmental Protection Agency maintains a synthesis of peer-reviewed studies showing

consistent links between improved classroom air quality and academic performance, including test scores and attendance[6]. The impact on the care economy warrants particular attention. The Commission's Interim Report emphasises that productivity gains in this sector rely on delivering better quality care and improving efficiency. Indoor air quality directly supports both objectives. Australia's care workforce of 2 million workers [1] faces high exposure to respiratory infections in hospitals, aged care and childcare facilities [10], leading to increased absenteeism and turnover. Beyond this direct impact, the care workforce is 79 per cent female[1], with many workers balancing paid employment and primary caregiving responsibilities. When poor air quality in schools and childcare centres leads to frequent childhood illnesses, these workers must withdraw from the workforce to care for sick children, reducing the effective capacity of the entire care sector.

These cascading impacts across health, education and workforce participation are avoidable. Evidence demonstrates that targeted IAQ interventions can effectively address these challenges. Interventions such as mechanical ventilation, portable HEPA filtration, and air cleaners in schools, day care centres, and aged care facilities consistently demonstrate reductions in exposure and infection risk [4–7]. Economic evaluations are beginning to show favourable results, with HEPA filtration during bushfire events identified as cost-effective in reducing asthma complications[14]. Ventilation upgrade modelling in offices indicates productivity gains that outweigh incremental energy costs in most scenarios [8]. Social cost–benefit analysis of infection-resilient buildings reports net benefits across public settings under plausible assumptions[9] .

3. Inequities in the Burden of Poor Indoor Air Quality

Poor indoor air quality disproportionately affects disadvantaged Australians across three key dimensions:

i. **Inequity of risk factors:** Poor IAQ carries disproportionate risks for people who are more susceptible to respiratory illness, including those who are immunocompromised, elderly or living with chronic conditions such as asthma[15] . Ensuring safer air in public buildings and workplaces is therefore an inclusion measure, allowing vulnerable populations to participate more fully in education, employment and community life.

ii. **Inequity of exposure**: Lower-income families more frequently live near industrial zones or major roads where outdoor pollution infiltrates homes, and in overcrowded housing where infections spread rapidly[16]. Workplace exposure compounds these residential disadvantages, with lower-wage workers concentrated in factories, warehouses, kitchens and crowded service settings where ventilation is often inadequate[17]. Meanwhile, professional workers occupy newer buildings with modern HVAC systems, regular maintenance schedules, and air quality monitoring.

iii. **Inequity of infrastructure quality:** Lower-income communities occupy older, poorly maintained buildings with inadequate ventilation, deferred maintenance, and dampness problems. Schools in disadvantaged areas often operate older facilities

with often inadequate or no mechanical ventilation systems. This infrastructure deficit means those with the least economic power experience the worst indoor air quality.

These overlapping inequities demonstrate that improving indoor air quality is fundamentally an equity intervention, aligning with the Commission's emphasis on prevention that reduces disadvantage.

4. Systemic Barriers to Indoor Air Quality Investment

Indoor air quality illustrates why prevention opportunities often fail to scale despite strong evidence of benefit. The barriers closely mirror those identified by the Commission.

i. Fragmentation of responsibility

Indoor air quality falls between institutional boundaries with no single government Minister, department or agency accountable for outcomes. Responsibility is scattered across Commonwealth and jurisdictional governments spanning several portfolios across health, education, environment, infrastructure and building regulation, each addressing only siloed fragments of the problem without coordination or shared objectives.

This fragmentation is further evident in the regulatory landscape. The National Construction Code sets ventilation requirements for new buildings and major refurbishments, but these standards were developed for odour and moisture control, not disease prevention or health outcomes [18]. Critically, once a building is occupied, no agency monitors whether ventilation systems continue to perform as designed, leaving decades of operational life without oversight.

Voluntary frameworks attempt to fill this gap but lack the reach or authority needed for systematic change. NABERS Indoor Environment Quality [19] offers a performance rating system including air quality metrics, yet remains optional, is updated infrequently, and was not designed to function as a health-based regulatory standard. The voluntary nature means uptake is often concentrated among large and well-resourced organisations already motivated to act, while buildings with vulnerable populations face the highest risks such as schools, aged care and community facilities.

The result is a governance vacuum where no government or portfolio owns the mandate to deliver safe indoor air as a public health outcome. This fragmentation means that despite compelling evidence of benefit, indoor air quality remains orphaned as a prevention measure: Everyone's problem in theory, no one's responsibility in practice.

ii. Misalignment of benefits and funding

A key economic barrier is the multi-layered split incentive between who pays and who benefits. In government facilities, the costs of indoor air quality upgrades fall on facility owners or managers (aged care providers, hospitals, or education departments) while the primary benefits flow to different budgets and sectors, particularly health portfolios and the broader economy.

This misalignment extends throughout the built environment. In commercial and residential properties, landlords bear upgrade costs, but tenants capture the health benefits and

reduced medical expenses, creating no incentive for owners to maintain good indoor air quality. Similarly, while employers may see some productivity gains from better air quality, the primary health benefits accrue to employees rather than on company balance sheets. These cascading split incentives create a systematic market failure where cost-effective interventions fail to be implemented, even when they would deliver net benefits at a societal level.

iii. Short-term thinking and long-time horizons

The benefits of indoor air quality investment accrue over extended timeframes, far exceeding standard budget cycles. Reducing chronic illness through lower $PM_{2.5}$ exposure may prevent hospitalisations years or decades later. Building resilience against future pandemics delivers returns only when the next outbreak occurs.

These prevention benefits are systematically undervalued by budget processes focused on immediate returns, particularly when no single portfolio can claim the long-term gains. This temporal disconnect reinforces the status quo, where proven interventions with strong benefit-cost ratios remain unfunded because their value cannot be captured within conventional planning horizons.

Improving indoor air quality is a measurable investment with tangible returns. Air quality parameters such as CO_2, $PM_{2.5}$ and ventilation rates can be monitored in real time, providing objective evidence of performance[20]. Moreover, there are quantifiable benefits to health and productivity: cleaner air reduces illness and absenteeism, enhances cognitive performance and productivity, and lowers pressure on the health system[6,20]. International studies consistently show that modest investments in ventilation and filtration deliver returns many times greater in avoided healthcare costs and economic gains, making indoor air quality a critical, evidence-based component of a National Prevention Investment Framework [9,14].

5. Why the National Prevention Investment Framework is the Mechanism

The Productivity Commission has recommended the creation of a National Prevention Investment Framework (Draft Rec 3.1) to overcome the systemic barriers that paralyse prevention investment. We recommend that indoor air quality be designated as a priority investment area within the NPIF.

Indoor air quality is a textbook case for the NPIF. The framework is specifically designed to support investments where benefits fall "across sectors and levels of government, and over extended timeframes". It provides the necessary mechanism to:

- **Address fragmentation and misalignment of incentives:** By facilitating shared accountability and cross-portfolio evaluation, the NPIF can recognise the health, education, and productivity benefits of indoor air quality, overcoming the split incentives and governance vacuum that prevent action.
- **Support long-term investment:** The NPIF's focus on long-term fiscal effects allows for the appropriate valuation of indoor air quality benefits like pandemic resilience and reduced chronic disease burden, overcoming the barrier of short-term thinking.

- **Build the evidence base:** The proposed independent advisory board can facilitate the rigorous evaluation needed to assess the cost-effectiveness of indoor air quality interventions in the Australian context, ensuring value for money.

Designating indoor air quality as an NPIF priority area would transform it from an orphaned issue to a nationally coordinated prevention strategy with clear governance, stable funding, and accountability for outcomes.

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