



# AN OVERLOOKED ISSUE FOR HEALTHIER HOMES

New research explores the links between cooking practices, ventilation and indoor air quality in homes. Satish BK and the project team report and offer some practical solutions

## INTRODUCTION

Indoor air quality (IAQ) has a profound impact on health and well-being, yet it remains an overlooked issue in many homes, particularly in ethnic minority communities. Cooking practices, household ventilation, and building design all significantly influence IAQ, affecting the overall health of occupants. This study explores the relationship between user behaviour, cultural cooking practices, and the indoor environment, highlighting the critical role of lifestyle and home design in managing air quality.

While airtight, energy-efficient homes are designed to meet sustainability goals, they can inadvertently trap pollutants indoors, exacerbating respiratory conditions and reducing thermal comfort. Addressing these challenges requires a combination of improved ventilation, resident awareness, and informed policy decisions.

## THE IMPACT OF COOKING ON INDOOR AIR QUALITY

Cooking is one of the most significant contributors to indoor air pollution, primarily due to the release of various airborne contaminants. The pollutants generated during cooking include particulate matter (PM), volatile organic compounds (VOCs), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), and nitrogen oxides (NOx). These emissions arise from multiple sources, such as combustion, heating oils, and reactions between cooking ingredients at high temperatures.

Different cooking methods and fuel types can significantly impact pollutant levels. For example, frying, grilling, and roasting at high temperatures tend to generate higher levels of fine particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>) compared to



boiling or steaming. Research has shown that gas stoves, commonly used in many households, produce higher concentrations of nitrogen dioxide and carbon monoxide, both of which can contribute to respiratory illnesses. Cooking with solid fuels such as wood or charcoal—still prevalent in some cultural traditions—exacerbates these issues, leading to higher emissions of soot and black carbon, which have been linked to long-term cardiovascular and respiratory conditions. Studies have demonstrated that prolonged exposure to cooking-related pollutants can be as harmful as exposure to outdoor urban air pollution, particularly in poorly ventilated environments.

While these homes contribute to sustainability efforts, their reduced air exchange rates mean that cooking-generated pollutants accumulate more quickly, increasing indoor exposure levels. Without adequate ventilation, these contaminants can remain suspended in the air for prolonged periods, significantly impacting occupant health. Further compounding the issue is the fact that many residents in social housing are either unaware of

or unable to access proper ventilation strategies.

The impact of poor indoor air quality is particularly significant for vulnerable populations, including children, the elderly, and individuals with pre-existing health conditions. Studies have shown that children living in households with high indoor pollution levels have an increased risk of developing asthma and other respiratory conditions. Likewise, prolonged exposure to indoor air pollution in adults has been linked to a higher prevalence of cardiovascular diseases, lung disorders, and cognitive decline. Given these risks, improving IAQ in social housing is a pressing public health issue that requires a coordinated effort between residents, housing providers, and policymakers.

The findings from our previous study revealed that in many homes, carbon dioxide levels frequently exceeded recommended thresholds, particularly in households with limited ventilation. High levels of carbon dioxide not only indicate poor air circulation but also contribute to occupant discomfort, fatigue, and impaired cognitive function. Data collected from air quality monitors installed in

participants' kitchens showed that peak pollutant levels occurred during cooking sessions, with prolonged exposure when ventilation was inadequate.

To address these concerns, our project combined scientific air quality monitoring with behavioural interventions. By engaging residents through workshops and monitoring studies, we highlighted the direct correlation between cooking activities and IAQ deterioration.

The Good Practice Guide developed through this project offers practical, culturally sensitive recommendations to mitigate IAQ issues. The guide provides actionable steps for both residents and decision-makers, emphasising the need for improved ventilation infrastructure, resident education, and policy interventions. By ensuring that kitchens are equipped with efficient extractor fans, encouraging behavioural changes in cooking habits and promoting regular maintenance of ventilation systems, significant progress can be made in reducing indoor air pollution and enhancing overall well-being.

Through engagement with ethnic minority households, this project builds on earlier findings that demonstrate the necessity of balancing cultural identity with sustainable design and indoor environmental quality. To raise the awareness of indoor air quality and promote healthy indoor environment, a 'good practice guide' developed co-designed by the housing association (Cardiff Council) and residents.

### DEVELOPING THE GOOD PRACTICE GUIDE

The study employed a multi-step methodology integrating qualitative and quantitative data with academic research to develop a Good Practice Guide for improving indoor air quality. It began with two workshops to gather tenants' experiences and concerns, complemented by monitoring data from diary logs and air quality monitors. This data was then analysed alongside academic literature to create preliminary guide information, which is further refined through a

third workshop. The final output was a comprehensive Good Practice Guide that balances cultural traditions with practical solutions for healthier indoor environments targeting residents and landlords (Figure 1).

housing conditions in Wales.

Each workshop systematically advanced participants' understanding and engagement with indoor air quality issues, resulting in practical guidance tailored to their needs. The collaborative

design of the guide was a key achievement, driven by the insights and behavioural patterns identified during the workshops.

The first workshop introduced the concept of IAQ, assessed participants' knowledge by sharing the findings of recently completed research through film and comparative analysis of kitchens in White British and Ethnic minority homes, and explored their cooking habits through diaries. Participants were shown how to log daily behaviours that could influence air quality in their homes.

The chart below shows an analysis focused on monitoring

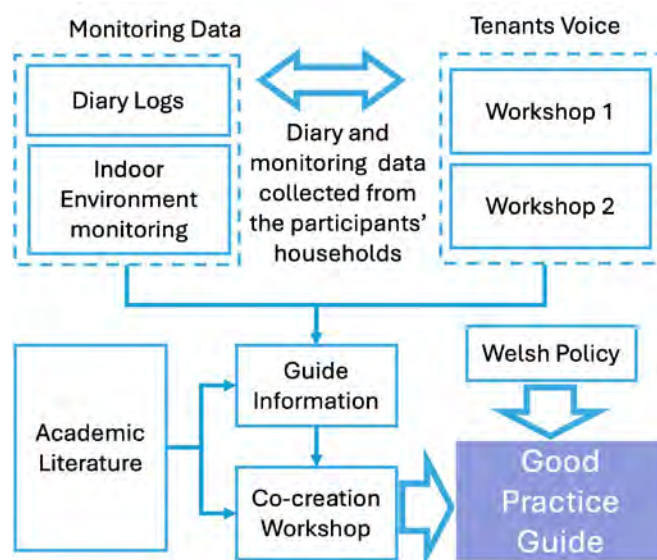


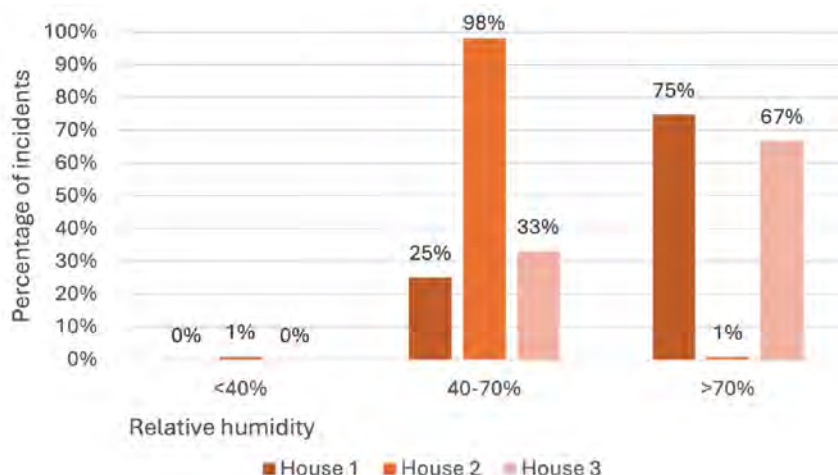
Figure 1

### ENGAGEMENT WORKSHOPS

A series of workshops was developed in collaboration with EYST Wales and Cardiff Council to raise awareness about the impact of indoor air quality on the well-being of ethnic minority households. These workshops, using a co-design, bottom-up approach, created a safe space for participants to share their experiences through roundtable discussions, contributing to the development of the guide. This provides practical recommendations tailored to various stakeholders, including residents and landlords, ensuring that community voices and needs are central to improving

relative humidity in the participants' kitchens within the previously agreed occupancy hours (6am to 12am) to assess thermal comfort following CIBSE (the Chartered Institution of Building Services Engineers) guidelines. The findings showed that humidity levels below 40 per cent were almost non-existent. In comparison, humidity within the optimal range of 40-70 per cent occurred 21-98 per cent of the time. However, humidity levels above 70 per cent were observed most of the time in the majority of the monitored houses. This suggests that maintaining ideal humidity levels is challenging, potentially affecting thermal comfort and well-being in the kitchens (Figure 2).

Figure 2



## INDOOR AIR QUALITY

The second workshop reviewed the diary logs and discussed the relationship between cooking behaviours and IAQ. This process empowered participants to identify changes to improve ventilation, cleanliness, and cooking practices, enhancing their air quality and overall well-being.

### INTEGRATING BEHAVIOURAL PATTERNS WITH MONITORING DATA

The following chart (Figure 3) shows carbon dioxide levels over time, with the red rectangle indicating poor air quality when windows are closed and fans are off, causing a sharp rise. The amber rectangle presents improvement as opening the windows reduces carbon dioxide levels. The yellow rectangle shows further reduction when both windows are open, and extractor fans are switched on, effectively lowering carbon dioxide levels and improving indoor air quality. This highlights the importance of ventilation and fan use for improving air quality.

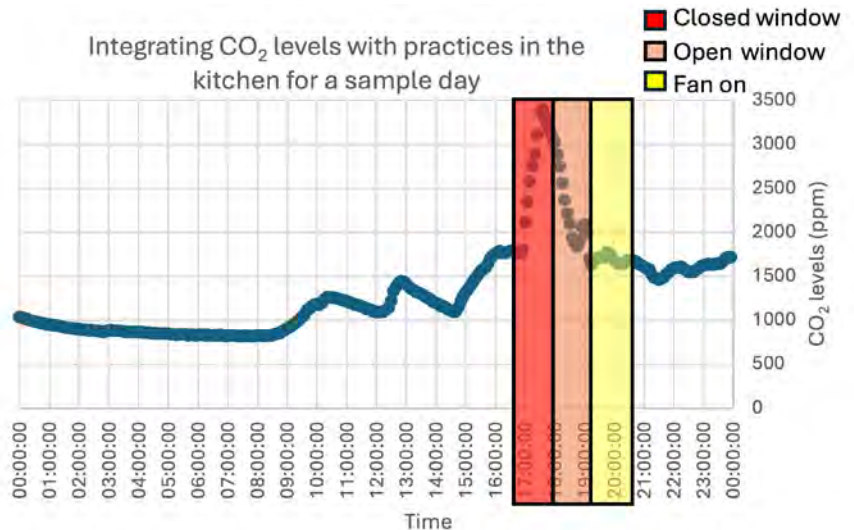


Figure 3

to implement ventilation strategies. Providers could offer clear guidance on using extractor fans and opening windows at strategic times, promote low-emission cooking methods, and encourage non-chemical cleaning products to reduce indoor exposure to volatile organic compounds (VOCs) from household cleaners.

By integrating these measures into housing policies and tenant support programmes, providers can significantly improve public health. These efforts align with sustainability goals while fostering safer, more resilient communities. Collaboration with policymakers, researchers, and local organisations will be key to creating long-term solutions for better indoor air quality in social housing.

### ALIGNING WITH WELSH HOUSING POLICY

The Welsh Housing Quality Standard (WHQS) 2023 mandates modern kitchens

with appropriate ventilation to prevent damp, mould, and harmful emissions. This project supports WHQS by demonstrating how effective ventilation—whether mechanical extractors or improved airflow—enhances residents' health and comfort.

Additionally, the research aligns with the Well-being of Future Generations (Wales) Act, which envisions a healthier Wales and a more equal Wales. Ensuring all communities benefit from sustainable, safe living environments requires action from housing providers, policymakers and residents alike.

### A COMMUNITY-DRIVEN APPROACH

A key strength of this project was its participatory approach, ensuring that residents' voices shaped the final recommendations. The research was conducted through a combination of workshops, case studies, and real-time air quality monitoring using data loggers.



The final workshop focused on validating the content and design of the Good Practice Guide. Participants emphasised the importance of practical, easy-to-follow guidance and preferred concise visual formats, such as a leaflet, with a more detailed booklet available for reference.

### IMPLICATIONS FOR HOUSING PROVIDERS

Housing providers play a crucial role in ensuring acceptable indoor air quality in social housing. Key strategies include investing in energy-efficient extractor fans to effectively remove cooking pollutants and ensuring operable windows in all homes to promote proper ventilation and cross-airflow, reducing the buildup of harmful pollutants. These measures are particularly important in airtight, energy-efficient homes where poor ventilation can lead to higher concentrations of airborne contaminants.

Beyond infrastructure improvements, tenant education is essential. Many residents lack awareness or resources



The study began with a series of engagement workshops designed to introduce participants to the significance of IAQ and its direct impact on health. Residents from social housing, particularly from ethnic minority backgrounds, were invited to share their daily cooking habits and ventilation practices. These sessions provided valuable insights into common challenges such as limited ventilation and the cultural importance of traditional cooking methods.

One participant reflected on the experience: *'Before this project, I hadn't realised how much cooking fumes could negatively impact my health. Now, I make sure to use ventilation whenever I cook.'* This testimony underscores the value of combining scientific data with lived experiences, bridging the gap between research and practical application.

By placing community engagement at the heart of this research, the project successfully empowered residents to take control of their indoor air quality while informing housing providers and policymakers about the critical need for IAQ considerations in social housing developments.

**CONCLUSION**

The Cooking Up Good Air Quality project demonstrates that small changes in cooking behaviours and ventilation practices can significantly improve IAQ and overall well-being. By aligning research with policy frameworks such as the WHQS and Future Generations Act, this work highlights the importance of community-led, evidence-based strategies for healthier homes.

**Dr Satish BK is senior lecturer at Welsh School of Architecture, Cardiff University and was part of the project team with Kamal Haddad, Rawan Jafar and Simon Lannon. This article is part of the outcome of the EPSRC IAA project Good practice guide to raise awareness of indoor air quality on the health and well-being of ethnic minorities. The project team would like to express their gratitude to all participants who helped shape this project and to the stakeholders, particularly EYST, Cardiff Council and the Welsh Government. For further information, visit [orca.cardiff.ac.uk/id/eprint/171965](https://orca.cardiff.ac.uk/id/eprint/171965)**

**Guidelines for residents**

**BEFORE COOKING**

Cooking increases gases such as carbon dioxide and nitrogen dioxide in kitchens, which can affect indoor air quality. However, well-maintained extraction systems, such as cooker hoods, help reduce these pollutants.

To improve airflow, open windows and external doors, turn on extractor fans if available, and ventilate the kitchen daily, even if not cooking.

A strong correlation exists between home cleanliness and indoor air quality. Homes that are not regularly cleaned tend to have higher levels of particulate pollution, negatively impacting health. Keeping the cooking area clean and free from clutter, removing food waste before cooking, and washing hands thoroughly before handling food are essential practices.

Reducing exposure to cooking fumes benefits long-term health and well-being. Preparing all ingredients in advance, such as chopping vegetables, washing rice, and marinating meat, as well as taking out necessary cooking equipment beforehand, can make cooking more efficient and reduce overall exposure time.

**WHILE COOKING**

The kitchen door plays a crucial role in limiting the spread of particulate matter. Keeping windows open and extractor fans on helps manage steam and odors, while keeping the internal kitchen door closed can prevent pollutants from spreading to other rooms. In open-plan kitchens, opening windows in adjoining rooms or the garden door can promote cross-ventilation.

Regular cleaning while cooking can significantly improve indoor air quality by reducing airborne dust, bacteria, and fungi. Cleaning as you go, washing dishes promptly, and reusing cooking equipment where possible can help maintain a healthier environment.

To reduce exposure to cooking fumes and save time, consider batch cooking and refrigerating sauces for future use. Additionally, using the correct pan size for the gas burner improves efficiency and reduces unnecessary emissions.

**AFTER COOKING**

Proper ventilation after cooking helps remove pollutants more quickly, with studies showing extractor fans can remove up to 63 per cent of particulate matter. Leaving extractor fans on for at least 10 minutes after cooking and keeping windows open for at least 30 minutes allows fresh air circulation and helps prevent condensation. Using dehumidifiers where necessary can also help control moisture levels.

Thorough cleaning after cooking is essential for maintaining indoor air quality. Washing all dishes, wiping down surfaces, and removing any remaining condensation from windows are simple yet effective ways to ensure a clean and safe kitchen environment.

Incorporating indoor plants in the kitchen can help filter pollutants and release oxygen, improving air quality. Taking breaks from the kitchen, reading a book, having a cup of tea, or engaging in light activities like gardening can contribute to overall well-being.