NICE National Institute for Health and Care Excellence

Public Health England

NICE guideline

Indoor air quality at home

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Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

Overview

This guideline covers indoor air quality in residential buildings. It aims to raise awareness of the importance of good air quality in people's homes and how to achieve this.

See a 2-page visual summary on actions to improve indoor air quality.

NICE has also produced a guideline on outdoor air pollution.

Who is it for?

- Environmental health practitioners
- Building control, housing and maintenance staff
- Healthcare professionals
- Public health professionals
- Planners and regulators involved with residential developments
- Architects, designers and builders
- Private property managers and private landlords
- Housing associations
- Voluntary sector
- Members of the public

Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in NICE's information on making decisions about your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

Box 1 People who may be particularly vulnerable and factors that increase the risk of ill health due to exposure to poor indoor air quality

People who may be vulnerable

People who may be particularly vulnerable to ill health as a result of exposure to poor indoor air quality include:

- people with a pre-existing health condition such as asthma, allergies, chronic obstructive pulmonary disease (COPD) and cardiovascular disease
- pregnant women and their unborn babies
- pre-school children
- older people
- people who live in poor-quality housing
- people exposed to tobacco smoke in their homes
- people who live in poverty.

Housing conditions

Housing conditions that put people at increased risk of exposure to poor indoor air quality include:

- location (external factors such as high levels of outdoor air pollution, or where noise or security risks mean residents do not open windows)
- physical infrastructure (such as small room size, inadequate ventilation and the building's layout and orientation)
- standard of housing (for example, with damp and mould or physical disrepair including flood damage or with unflued or poorly maintained fuel-burning appliances)
- overcrowding.

There are a number of activities that might contribute to poor indoor air quality (see the section on advice and information for the general population).

For the purposes of this guideline, the term 'local authorities' covers all types of local

authority in England; these are county councils, district councils, unitary authorities, metropolitan districts and London boroughs. Each local authority should decide which of the following recommendations are relevant to their local responsibilities.

1.1 Prioritising indoor air quality in local strategy or plans

These recommendations are for local authorities.

1.1.1 Embed a plan for improving indoor air quality in an existing strategy or plan to improve people's health. This could be a general air quality strategy if one exists. Otherwise, for example, include it in a strategy on housing, health and wellbeing, or inequalities.

1.1.2 Ensure the strategy or plan takes account of the housing conditions that put people at increased risk of exposure to poor indoor air quality and especially people who are particularly vulnerable to ill health as a result of such exposure (see box 1).

1.1.3 Emphasise the need for a balanced approach to ventilation, insulation and heating for good indoor air quality. (See the sections on raising awareness of poor indoor air quality in the home and advice and information for the general population, and NICE's guideline on winter deaths and illness and cold homes.)

1.1.4 Encourage joint working between local authority departments, across different local authorities, with local health and social care providers, and with voluntary, community and social enterprise organisations and other organisations with interest in indoor air quality, to improve air quality in people's homes (see the sections on raising awareness of poor indoor air quality in the home and advice and information for the general population).

1.1.5 Encourage the use of existing home visits to identify poor indoor air quality. For example, visits to people's homes by housing officers, environmental health practitioners, community health services, social workers, care workers, and fire and rescue services.

1.1.6 Encourage the use of local inspection protocols to identify poor indoor air quality during home visits. This may include visual inspections, checklists and the monitoring of pollutant levels. Use this information to identify other homes that may be at increased risk of poor indoor air quality.

1.1.7 Encourage joint working with external organisations to inform home improvement programmes and identify grants to combat poor indoor air quality.

1.1.8 Monitor progress against the goals of the strategy. Use audit data (see the recommendation on encouraging the use of existing home visits in this section) plus the lists in box 1 to identify people who may be vulnerable and properties that are at risk.

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on prioritising indoor air quality in local strategy or plans.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 4: effective strategies for raising awareness.

1.2 Referrals for a housing assessment

These recommendations are for local authorities.

1.2.1 Develop a structured process so that health and social care professionals and housing and local authority staff can use existing referral pathways to help people request a housing assessment if poor indoor air quality has been identified or is suspected, for example, by using the housing condition factors in box 1.

1.2.2 Advise health and social care professionals and housing and local authority staff on how to help people request a housing assessment if poor indoor air quality is identified or suspected, for example, by using the housing condition factors in box 1.

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on referrals for a housing assessment.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes.

1.3 Raising awareness of poor indoor air quality in the home

These recommendations are for local authorities.

1.3.1 Use existing communication strategies to ensure members of the public and relevant professionals (those involved in planning, designing, building, renovating and maintaining homes) are aware of:

- the causes of poor indoor air quality
- how residents' activities can affect indoor air quality
- how health is affected by poor indoor air quality
- who is particularly vulnerable (see box 1)
- how to prevent or reduce poor indoor air quality.

1.3.2 Use existing professional development opportunities to ensure local authority

staff who visit people in their homes (such as housing, healthcare and social care professionals):

- know about the sources of indoor air pollutants and how they can affect health
- can give general advice on how to avoid activities that increase the level of indoor air pollutants (see the sections on advice and information for the general population and healthcare professionals)
- can give general advice on how to improve ventilation if the source of the pollutant cannot be controlled (see the sections on advice and information for the general population and healthcare professionals)
- are aware that affordability may be a barrier to effective and efficient heating and ventilation
- know that tenants may not be allowed to repair or alter building fabric, fixtures or fittings
- know who can provide help with repairs and necessary improvements (for example, the local authority or a home improvement agency)
- can advise people on how to request a housing assessment (see the section on referrals for a housing assessment).

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on raising awareness of poor indoor air quality in the home.

Full details of the evidence and the committee's discussion are in evidence review 4: effective strategies for raising awareness.

1.4 Advice and information for the general population

These recommendations are for local authorities.

1.4.1 Advise people on how to reduce damp and condensation and prevent mould. For example, by:

- using background ventilation (such as trickle vents, or whole-house mechanical ventilation systems)
- using mechanical ventilation (such as extractor fans), and opening windows where possible and safe to provide temporary increased ventilation
- avoiding moisture-producing activities (such as air-drying clothes) indoors if possible, or improving ventilation if these cannot be avoided
- repairing sources of water damage and ensuring that residual moisture is removed.

1.4.2 Advise people on how to use trickle vents correctly.

1.4.3 Tell people that the following activities may lead to poor indoor air quality and that they should think about increasing ventilation (by using extractor fans in the bathroom or kitchen, or opening windows if possible and safe):

- using cookers, especially gas cookers
- using open solid-fuel fires
- using candles
- using free-standing gas heaters
- using cleaning products, household sprays or aerosols and paints
- having a bath or shower
- air-drying clothes in the home.

1.4.4 Advise private and social tenants to contact their landlord if:

- ventilation is not adequate (for example, if the ventilation system is not working, trickle vents are blocked or damaged, extractor fans in the kitchen or bathroom are not working, or if excessive noise from the fans discourages their use)

- repairs are needed to prevent water from entering their building
- improvements to heating or insulation are needed to prevent condensation.

1.4.5 Advise private and social tenants to contact their local authority if no action is taken to improve ventilation or carry out repairs (see the government guides on private renting and council housing, and the Guide for tenants: Homes [Fitness for Human Habitation] Act 2018).

1.4.6 Advise people not to use unflued paraffin heaters in the home.

1.4.7 Advise people to follow the product instructions when using, for example, candles, paints, glues and solvents, to minimise exposure to pollutants.

1.4.8 Advise people to choose low-emission materials (for example, products with a low volatile organic compound [VOC] or formaldehyde content and emissions) if furniture or flooring needs replacing.

1.4.9 Advise people installing a new cooker about the need for ventilation, especially for gas cookers.

1.4.10 Advise people not to use gas cookers to heat a room.

1.4.11 Encourage people not to smoke in the home (see NICE's guidelines on stop smoking interventions and services and smoking: stopping in pregnancy and after childbirth).

Also see the section on healthcare professionals' advice for women who are pregnant or who have given birth in the past 12 months (see the section on healthcare professionals) and the section on advice for property managers and landlords (see the section on rental properties).

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on advice and information for the general population.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions.

1.5 Healthcare professionals

People with asthma, other respiratory conditions or cardiovascular conditions

1.5.1 Explain that indoor air pollutants (including nitrogen dioxide, damp, mould, particulate matter and VOCs) can trigger or exacerbate asthma, other respiratory conditions or cardiovascular conditions.

1.5.2 If a person has repeated or worsening respiratory symptoms such as a cough or wheezing, ask about their housing conditions. If these are a concern, help them request a housing assessment from the local authority (see the section on referrals for a housing assessment).

1.5.3 Advise people whose asthma is triggered by household sprays, air fresheners or aerosols to:

- avoid using them
- use non-spray alternatives.

Also see the section on advice and information for recommendations about ventilation and controlling sources of pollution (see the section on advice and information for the general

population) and NICE's guideline on asthma.

People who are allergic to house dust mites

1.5.4 Advise people who are allergic to house dust mites how to reduce their exposure to them. This includes:

- avoiding second-hand mattresses if possible
- using allergen barriers such as mattress and pillow covers
- washing bedding regularly.

Also see the section on advice and information for recommendations about ventilation and controlling sources of pollution (see the section on advice and information for the general population) and NHS advice on allergen avoidance.

Women who are pregnant or who have given birth in the past 12 months and partners and people who live with them

1.5.5 Ask about the person's housing conditions. If housing factors are a health concern, for example, because of damp or lack of ventilation, help them request a housing assessment from the local authority (see the section on referrals for a housing assessment).

1.5.6 Advise women who are pregnant that they are at increased risk of ill health from exposure to poor indoor air quality. Advise people who care for babies under 12 months old that the baby is at increased risk. Both groups should:

- reduce their use of household sprays, air fresheners and other aerosols, and always follow product instructions
- if possible, avoid or reduce activities that produce particulate matter such as using open solid-fuel fires or candles
- always keep the room well ventilated during these activities.

See also recommendations 1.4.3, 1.4.4, 1.4.6 and 1.4.8.

1.5.7 Explain that other people's tobacco smoke is a risk to a woman who is pregnant and her baby, before and after birth. Advise not smoking in the home or around the woman and her baby. (Also see NICE's guideline on smoking: stopping in pregnancy and after childbirth.)

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on healthcare professionals.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.2: occupant behaviour interventions.

1.6 Regulators and building control teams

1.6.1 Update existing standards, for example building regulations, or develop new ones for indoor air quality. Base them on current safe limits set for pollutants in residential developments. See, for example, World Health Organization guidelines on selected pollutants (2010) and dampness and mould (2009), and the Public Health England indoor air quality guidelines for selected VOCs (2019).

1.6.2 Use existing building regulation enforcement activities to improve indoor air quality. Ensure enforcement takes place within the specified timelines. (See the government's Building Regulations 2010 and Housing health and safety rating system operating guidance, and the Planning Portal's failure to comply with the building regulations.)

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on regulators and building control teams.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes.

1.7 Architects and designers

Avoiding sources of pollutants

1.7.1 Consider specifying building materials and products that only emit a low level of formaldehyde and VOCs. Use existing labelling schemes or other available information on product emissions (for example, on product labels) to make these specifications.

1.7.2 Design or specify heating systems that minimise indoor exposure to particulate matter.

Heating and ventilation

1.7.3 Adopt a whole-building approach to heating and ventilation to ensure indoor air quality is maintained while achieving standards for energy use. (Also see NICE's guideline on winter deaths and illness and cold homes.)

1.7.4 Ensure design strategies include provision for removing indoor air pollutants, for example by:

- specifying kitchen extractor fans or cooker hoods that extract to the outside, and are easily accessible for cleaning or maintenance, with simple

instructions for residents

- when safe and appropriate to do so, specifying that all habitable rooms are provided with windows that are openable and that windows or openings meet the purge ventilation requirements (see the Ministry of Housing, Communities and Local Government's advice on ventilation).

1.7.5 Design ventilation systems to reduce or avoid exposure to outdoor air pollution. For example:

- ensure windows that open face away from sources of outdoor air pollution, such as busy roads
- fit mechanical systems with filtration to protect against outdoor pollutants. (Also see the government clean air strategy 2019.)

1.7.6 When building dwellings or refurbishing them to improve thermal performance, ensure there is permanent, effective ventilation.

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on architects and designers.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions
- evidence review 3.3: ventilation design and use.

1.8 Builders, contractors and developers

These recommendations apply both to building new homes and renovating or refurbishing

existing homes.

1.8.1 Ensure products and materials comply with building regulations, design specifications and the manufacturer's guidance on installation and commissioning.

1.8.2 Use materials that emit a low level of formaldehyde and VOCs as specified. If materials need to be substituted, only use products with the same or lower emission levels.

1.8.3 Ensure all heating and ventilation is installed and commissioned in accordance with the manufacturer's instructions and meets building regulation requirements.

1.8.4 Ensure all installed heating and ventilation systems are easily accessible for regular maintenance.

1.8.5 Ensure any variations to the heating and ventilation specification comply with design specifications and building regulations (see the Ministry of Housing, Communities and Local Government's advice on ventilation).

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on builders, contractors and developers.

Full details of the evidence and the committee's discussion are in evidence review 3.1: material and structural interventions.

1.9 Rental properties

These recommendations are for local authorities and cover both private and public rented housing.

Regulations

1.9.1 Use existing regulatory powers to:

- reduce people's exposure to pollutants in their homes by ensuring identified problems such as damp and mould are fixed promptly
- ensure homes have suitable and efficient heating and ventilation (see the Ministry of Housing, Communities and Local Government's advice on ventilation and housing health and safety rating system operating guidance, and NICE's guideline on winter deaths and illness and cold homes).

1.9.2 Where a housing assessment has identified problems in private or public rented housing that may contribute to poor indoor air quality, ensure the property has:

- heating appliances and ventilation systems that:
  - comply with design and performance requirements
  - are correctly installed and tested
  - keep properties warm and ventilated without excessive heat loss or draughts
- ventilation that prevents the build-up of pollutants, including:
  - trickle vents
  - working mechanical ventilation systems, such as extractor fans, in bathrooms and kitchens
  - windows that open (but not onto busy roads or other major sources of outdoor air pollution)
- cooking appliances that:
  - comply with design and performance requirements
  - are correctly installed and tested.

1.9.3 Where a housing assessment has identified water damage in private or public rented housing, ensure that any water damage is repaired as soon as possible and the property has properly dried out.

Property management

1.9.4 Advise property managers and landlords to:

- develop and undertake maintenance programmes for heating and ventilation systems
- provide clear, easy-to-understand instructions telling residents how to use the heating and ventilation systems effectively.

1.9.5 Advise property managers and landlords about:

- the health risks associated with poor indoor air quality
- methods to control and minimise identified sources of indoor air pollution (see the section for architects and designers)
- their responsibilities for maintaining the property.

1.9.6 Advise property managers and landlords to:

- use low-pollutant-emission items when replacing furniture or flooring (for example, furniture or flooring with a low formaldehyde content and emission)
- ensure rooms are well ventilated and that the manufacturer's guidelines for use of materials are followed
- ensure there is adequate ventilation provision before installing a new cooker (especially a gas cooker).

For a short explanation of why the committee made these recommendations and how they might affect practice,see the rationale and impact section on rental properties.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions
- evidence review 3.2: occupant behaviour interventions
- evidence review 4: effective strategies for raising awareness.

Terms used in this guideline

This section defines terms that have been used in a particular way for this guideline. For other definitions, see the NICE glossary or, for public health and social care terms, the Think Local, Act Personal Care and Support Jargon Buster.

Particulate matter

Particulate matter (also referred to as PM or particle pollution) is a complex mixture of solid or liquid particles suspended in air. These particles can vary in size, shape and composition. Indoor particulate matter can be generated through cooking, combustion (including candles, open solid-fuel fires, unvented space heaters or paraffin heaters) and smoking.

Purge ventilation

Manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants or water vapour, for example by opening a window or using a fan.

Recommendations for research

The guideline committee has made the following recommendations for research.

Key recommendations for research

1 Health impact of air pollutants at home

What is the health impact of exposure to individual air pollutants alone or combined with each other in the home?

For a short explanation of why the committee made the recommendation for research, see the rationale on raising awareness of poor indoor air quality in the home and advice and information for the general population.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions.
- evidence review 4: effective strategies for raising awareness.

2 Effective interventions to improve indoor air quality for people without pre-existing health conditions

What is the effectiveness and cost effectiveness of interventions to improve indoor air quality at home for people without pre-existing health conditions?

For a short explanation of why the committee made the recommendation for research, see the rationale on advice and information for the general population and healthcare professionals.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions
- evidence review 3.2: occupant behaviour interventions.

3 Air exchange rate and the quality of indoor air at home

What is the minimum air exchange rate to minimise the health effects of poor indoor air quality in the home?

For a short explanation of why the committee made the recommendation for research, see the rationale on architects and designers.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions
- evidence review 3.3: ventilation design and use.

4 Impact of building materials on indoor air quality

What are the emission profiles of indoor air pollutants released from building materials in a lived-in home environment?

For a short explanation of why the committee made the recommendation for research, see the rationale on architects and designers.

Full details of the evidence and the committee's discussion are in:

- evidence review 1: associations between individual or building characteristics and exposure levels
- evidence review 2: exposure to pollutants and health outcomes
- evidence review 3.1: material and structural interventions
- evidence review 3.3: ventilation design and use.

5 Raising awareness of the health risks of damp and mould at home

What interventions are effective and cost effective at raising awareness of the health risks of damp and mould in the home?

For a short explanation of why the committee made the recommendation for research, see the rationale on raising awareness of poor indoor air quality in the home.

Full details of the evidence and the committee's discussion are in evidence review 4: effective strategies for raising awareness.

Other recommendations for research

6 Damp and mould in the home

How can damp and mould in the home be prevented?

How is damp and mould in the home best identified?

How is damp and mould in the home best fixed?

How can tenants be best made aware of whose responsibility it is to make any changes needed as a result of damp and mould in the home?

To find out why the committee made the research recommendations about damp and mould, see evidence review 4: effective strategies for raising awareness.

Rationale and impact

These sections briefly explain why the committee made the recommendations and how they might affect practice. They link to details of the evidence and a full description of the committee's discussion.

Prioritising indoor air quality in local strategy or plans

Recommendations 1.1.1 to 1.1.8

Why the committee made the recommendations

Local authority strategies

The committee noted that local authorities have a duty of care to ensure both public sector and private homes are maintained to a 'decent' standard. The committee also noted that local authorities are responsible for ensuring people's health and wellbeing.

Limited evidence showed that exposure to poor indoor air quality is linked to a range of health problems. These include respiratory conditions such as a cough, wheezing or asthma, and allergic symptoms such as a runny nose or eye irritation.

Local authorities that have been declared an 'air quality management area' must have an air quality action plan (government clean air strategy 2019). The committee agreed that indoor air quality would fit within this plan, where it exists. Otherwise, they agreed it could be embedded within one of several existing, health-related local authority strategies.

Vulnerable groups and factors that affect indoor air quality

Poor indoor air quality is a risk to everyone's health. But evidence showed that some groups are more at risk than others (see box 1).

For example, people living in poor-quality housing – including housing with damp or with inadequate heating due to fuel poverty or housing that may need remedial work – are at

increased risk. They may not have the resources to carry out the necessary work or may have to wait a while for landlords or property managers to carry it out. This could leave them exposed to pollutants for longer.

Good evidence showed that homes with damp and those in need of repair are both linked to an increased risk of health problems. (Homes with serious damp and mould are likely to be classified as having a category 1 hazard by the Ministry of Housing, Communities and Local Government's housing health and safety rating system.)

There was no evidence on the effect of poor indoor air quality on older people. But the committee agreed, based on their experience, that older people may spend longer than average at home and so may be at increased risk of exposure. People with existing health problems such as asthma or chronic obstructive pulmonary disease (COPD) are also more likely to be affected by poor indoor air quality.

Pregnant women, those who have recently given birth, and pre-school children are also at increased risk from damp and other indoor pollutants. This is partly because pregnant women and those who have recently given birth may have compromised immune systems, and pre-school children are likely to spend more time at home.

The committee agreed that location is a risk factor because if the property is near a busy road, for example, then opening windows to improve ventilation may be counterproductive. It is also important to consider other pollutant sources associated with building location, such as nearby open fires, bonfire and firework events, agricultural sources, industrial sources or railway lines, as outlined in the government clean air strategy 2019.

Evidence also showed that overcrowding increases moisture in the air from everyday activities such as cooking and washing. This creates damp conditions. In addition, in properties where rooms are used for both living and sleeping (for example, in bedsits or studio flats), poor indoor air quality can have a greater impact. That is because residents are exposed to it for a greater proportion of time and smaller dwellings have less space in which to dilute pollutants. Local authorities should assess crowding and space using the housing health and safety rating system of the Housing Act 2004.

Heating and ventilation can help to maintain good air quality. The committee agreed to stress that the balance has to be right, and remedial or maintenance works for any property should be assessed individually. For example, insulating the home to prevent cold without thinking of ventilation might lead to increased humidity and condensation, which in

turn results in damp. But the committee concluded that because buildings vary so much (for example, in terms of age, type, location and state of repair), it wouldn't be practical to make any specific recommendations in this area.

Joint working, inspection protocols and home visits

There was evidence on the benefits of home visits by healthcare professionals to prevent or reduce indoor air pollution. The committee were also aware of examples of shared decision making on health and funding in England.

There was a lack of evidence on the benefits of joint working and local inspection protocols to prevent or reduce indoor air pollution. But the committee agreed to recommend these actions because:

- Staff who visit vulnerable people in their homes are ideally placed to report on poor housing conditions, particularly if there are inspection protocols in place.
- Sharing this information, subject to local data-sharing arrangements, would speed up the process of assessment and remedying the poor housing conditions.

Home improvements

Based on their knowledge of current practice in England, the committee agreed that local authorities would benefit from working with local home improvement agencies who provide home improvement grants to vulnerable groups. The committee also considered the benefits of working with professional organisations such as the Chartered Institution of Building Services Engineers, the Chartered Institute of Environmental Health, the Royal Institute of British Architects, the Chartered Institute of Architectural Technologists and the Royal Town Planning Institute. These organisations would be able to provide practical information to support home improvements, which may include information on grants available. Not only would it free up resources, but it would also allow them to work with local partners to emphasise the importance of maintaining good air quality in the home.

Collecting data and monitoring progress

Based on their experience, the committee agreed that it would be helpful if local authorities regularly checked existing and new strategies to ensure air quality in the home is being given priority.

This could include monitoring buildings for signs of poor indoor air quality and checking whether data collected during home visits and local inspections identify vulnerable people and other neighbouring or similar types of properties that may be at risk.

How the recommendations might affect practice

Local authorities regularly update their strategies. But additional resources (in terms of staff time and meetings) may be needed to include indoor air quality in an existing strategy and ensure it is implemented.

Because making indoor air quality a public health priority will improve people's health, this will lead to resource savings elsewhere. For example, by reducing the need for enforcement teams to intervene. There may also be additional economic benefits to the local economy and wider social benefits including improved educational outcomes and contributing to the achievement of government policies supporting policies such as Best Start in Life.

Local health and wellbeing boards are already in place to review current and future health and social care needs. So the costs of staff time and meetings associated with multi-agency working are expected to be minimal. Also, increased collaboration with home improvement agencies could mean that local authority resources set aside for issues related to indoor air quality could be reallocated.

Staff who visit people in their homes may need training to identify problems with indoor air quality and give advice on how to prevent or resolve such problems. Incorporating this training into existing continuous professional development could help minimise costs. But the visits may take longer if staff give advice and they may also result in additional enforcement activities.

Using building control or enforcement teams to collect and use performance data may have resource implications. For example, staff time, communication, and meetings for cross-team working. But improved health outcomes and resource savings elsewhere in the system (for example, by reducing the need for enforcement teams to intervene) might offset costs. The committee also considered the impact of not taking action. This may increase the risk of any future litigation arising from 'unhealthy' homes.

There were limited data on the link between someone who was at high risk and their level of exposure, so the committee had to estimate this.

Some benefits that were identified could not be quantified. So the overall benefits are likely to have been underestimated. The committee concluded that interventions could offer good value for money, but that this will depend on local factors.

Return to recommendations

Referrals for a housing assessment

Recommendations 1.2.1 and 1.2.2

Why the committee made the recommendations

There are several ways tenants can request a housing assessment:

- Tenants in local authority housing can follow their complaints procedure, take action themselves or go to the Housing Ombudsman.
- Tenants in housing association housing can follow their complaints procedure and can contact the Housing Ombudsman or Environmental Health.
- Tenants in private rented properties can contact Environmental Health or take action themselves.

Private homeowners can also contact the local authority for advice if they are worried about the condition of their home. In the committee's experience, many people – including professionals working in housing services – don't know about these processes.

The committee also agreed that health and social care staff who visit people in their homes, and healthcare professionals who have concerns, need to be able to help people request a housing assessment. This is especially important for people who may be particularly vulnerable to ill health as a result of exposure to poor indoor air quality due to their housing conditions (see box 1). There was no evidence on how effective this would be. But the committee agreed it would ensure staff can make every contact count and could improve people's health.

Based on their experience, the committee agreed that there might be barriers preventing tenants from requesting a housing assessment. For example, they might be concerned about eviction, or about a possible increase in rent due to maintenance and repairs of heating and ventilation systems.

How the recommendations might affect practice

Housing assessment pathways already cover some of the causes of poor indoor air quality. For example, professionals such as heating engineers are given instructions on how to identify signs of poor ventilation (see NICE's guideline on winter deaths and illness and cold homes).

Minimal additional resources would be needed to extend this to health and social care professionals and public service staff (for example, fire and rescue service professionals, ambulance service staff) who visit people in their homes. Healthcare professionals may need training on how poor air quality affects health, how to identify poor indoor air quality and how to take steps to mitigate its effects. This could be incorporated within existing training pathways, including professional training and accreditation examinations.

If more professionals are made aware of how to make referrals, this could lead to more housing assessments and more remedial work or legal actions. But local authorities have budgets for regular maintenance and upkeep of their properties. In addition, if legal action is taken to enforce standards in private properties, these costs will be recovered if the action is successful.

Return to recommendations

Raising awareness of poor indoor air quality in the home

Recommendations 1.3.1 and 1.3.2

Why the committee made the recommendations

Good evidence showed that exposure to poor indoor air quality is linked to a range of health problems. This includes respiratory conditions such as a cough, wheezing or asthma, and allergic symptoms such as a runny nose or eye irritation. Certain groups are more vulnerable, either because of their personal circumstances or because of where they live. Because poor indoor air quality is a hidden health threat, raising awareness is a first step in reducing the risk of long-term health issues, especially for vulnerable groups.

In the committee's experience, professionals such as care workers and health visitors, and

the public, are generally unaware of the factors affecting indoor air quality. The same applies to private and social landlords, and those who regulate them.

Similarly, the committee agreed that not all professionals who see people in their home know who is likely to be most vulnerable to poor indoor air quality. And they will not necessarily know how to get help for those who cannot afford repairs or modifications.

Evidence showed that advice given on sources of poor indoor air quality could reduce people's risk of exposure. This includes general advice on using ventilation systems, barriers to heating and ventilation, and more specific advice about particular situations and activities, including how to get a housing assessment.

The committee noted that people on a low income, particularly in poorly insulated homes, may not be able to afford effective heating and may try to make their homes airtight to keep heat in. This, in turn, can mean the ventilation is less effective. They also may not be able to afford to heat all rooms to a constant temperature, or may only use heating occasionally (for example, when expecting a home visit). Both approaches can cause damp and condensation.

The committee were also aware of the increased risk for those who cannot afford remedial work or have to rely on landlords or property managers to do the work. In both cases, this could leave them exposed to pollutants while they wait for it to be done. The committee pointed out that there are enforcement powers that local authorities can use to ensure compliance with regulations. (See the recommendation on using existing building regulation enforcement activities in the section on regulators and building control teams and also the Ministry of Housing, Communities and Local Government's Housing health and safety rating system operating guidance.)

Most of the evidence focused on homes where a problem had already been identified. The committee agreed that research is needed on how to give people information on identifying the sources of the problem in the first place. Also, the committee considered that further research on the health impact of pollutants, alone or in combination with each other, would help identify the pollutant or combination of pollutants that have the largest impact on people's health. This research would also provide useful information to help raise awareness around indoor air pollutants. (See the research recommendations on the health impact of air pollutants at home, effective interventions to improve indoor air quality in the healthy population, air exchange rate and good air quality, health impact of building materials, and effective strategies for raising awareness.)

How the recommendations might affect practice

The government clean air strategy 2019 already outlines how the government and local authorities need to raise awareness of poor indoor air quality. These recommendations support the strategy and should have minimal additional impact.

Resident satisfaction from improved health outcomes should result in resource savings elsewhere in the system and will offset costs. For social landlords, improved tenant satisfaction reduces both the time properties are left vacant and the likelihood of compensation claims.

It is not expected that any extra resources would be needed. Staff may need training on raising awareness of poor indoor air quality and in giving advice in a language the tenant understands. But incorporating this into existing general training and continuous professional development could minimise costs. Improved health outcomes leading to potentially fewer hospital visits, GP visits, or visits from community nurses should result in resource savings elsewhere in the system and will offset costs.

Return to recommendations

Advice and information for the general population

Recommendations 1.4.1 to 1.4.12

Why the committee made the recommendations

The committee looked at evidence for specific interventions such as air filtering systems or air purifiers. But they agreed that buildings vary so much that it wouldn't be practical to make any specific recommendations in this area.

Evidence showed that giving people advice on specific pollutants and their sources can help them reduce the pollution levels in their homes and improve their health. Evidence also showed that giving people advice on how to reduce or prevent indoor air pollution is cost effective for people who are already ill, because it can prevent their condition worsening. So this can lead to savings for the NHS.

The committee agreed that local authority staff are in a good position to give this advice because they are in contact with members of the public who use their services, including

social housing. (They also have a regulatory responsibility for privately rented properties.)

There is clear evidence of a link between gas cookers and increased levels of nitrogen dioxide, and between open solid-fuel fires and increased levels of particulate matter. Exposure to these is linked to poor health, especially if there isn't sufficient ventilation to prevent the build-up of pollutants.

Based on their experience, the committee agreed that rooms should be well ventilated when cooking to prevent moisture and condensation. The committee also agreed that gas cookers should not be used for heating rooms because this can result in the build-up of moisture and indoor air pollutants (for example, nitrogen dioxides).

Although there was no evidence on candles, the committee, based on their experience, extrapolated from the evidence on particulate matter from other combustion sources and from the Chief Medical Officer annual report 2017: health impacts of all pollution. This stated that candles were one of a number of large combustion sources of pollutants alongside heating, cooking and open solid fuel fires. The committee therefore agreed that candles should not be used unless the room is well ventilated.

There was insufficient evidence on the health effects of indoor air pollutants in the home. The committee agreed that research on the relative health impact of individual pollutants alone or combined with each other, would help give people better information to understand and avoid harms associated with indoor air pollution (see the research recommendation on the health impact of air pollutants at home).

Evidence showed that poor housing in need of repair (for example, houses with damp) puts people's health at risk. Again, the committee agreed it was important to emphasise the significance of ventilation not only when washing or cooking, but also during other moisture-producing activities, for example, air-drying clothes indoors. The committee agreed that it is important for the local authority to take action if landlords do not carry out repairs or improve ventilation.

Evidence shows that paraffin heaters are linked with respiratory symptoms such as wheezing. These appliances are not in widespread use in England. But the committee agreed, based on their experience, that it was important to avoid using them at all indoors. They also agreed that paraffin heaters are more harmful than open solid-fuel fires, for example, because the latter are flued so that any harmful fumes should, in theory, be extracted outdoors.

Based on their experience, the committee were aware that many people do not know how and when to use ventilation systems. Ensuring a room is adequately ventilated is usually a key part of reducing exposure to volatile organic compounds (VOCs) especially while painting, renovating or decorating and using household products such as cleaning sprays and aerosols. The committee noted that there is a labelling scheme for paints in the UK. Although newer paints have a lower VOC content than older paints, the product advice is still to ensure good ventilation when using these products. The committee also agreed that people should be reminded to read the manufacturer's instructions and increase ventilation during these activities.

The evidence showed that flooring and furniture are often sources of VOCs or formaldehyde. Based on the evidence, the committee agreed it was important to highlight these dangers, because both can damage people's health.

Smoking and environmental tobacco smoke are always a health risk. The committee agreed it was important to encourage people not to smoke in their homes, and so they referred to NICE's guidance on smoking.

The committee agreed that research is needed on ways to improve indoor air quality for people who do not have pre-existing health conditions that put them at risk from poor indoor air quality (see the research recommendation on effective interventions to improve indoor air quality in the healthy population).

How the recommendations might affect practice

Local authorities will need to develop or update existing practice to provide people with information on how to improve indoor air quality and where to go for help. Staff might need training but incorporating this into existing continuous professional development could help minimise costs.

Improved health outcomes leading to higher resident satisfaction should result in resource savings elsewhere in the system and will offset costs. For example, by reducing the need for enforcement teams to intervene if a problem develops.

Return to recommendations

Healthcare professionals

Recommendations 1.5.1 to 1.5.7

Why the committee made the recommendations

Healthcare professionals frequently see people with pre-existing health conditions and women who are pregnant or have young children. The committee agreed that this puts them in an ideal position to give advice on how indoor air pollutants, as well as damp and mould, can affect their health.

People with asthma, other respiratory conditions or cardiovascular conditions

Evidence showed that people with respiratory or cardiovascular conditions or allergies are particularly affected by poor indoor air quality, including pollutants from damp and from open solid-fuel fires.

Good evidence showed that exposure to poor indoor air quality is linked to a range of health problems. These include respiratory symptoms and conditions such as a cough, wheezing or asthma, and allergic symptoms such as a runny nose or eye irritation.

Based on the evidence, the committee agreed that if people keep getting these types of symptoms – or they are getting worse – then they might be linked to the home environment.

People who are allergic to house dust mites

Evidence showed that allergen barriers like mattress and pillow covers can reduce exposure to house dust mite allergens. Evidence also showed that second-hand mattresses were associated with increased levels of house dust mites.

Women who are pregnant or who have given birth in the past 12 months and partners and people who live with them

Good evidence showed that damp homes and those in need of repair are both linked to an increased risk of health problems. (Homes with serious damp and mould are likely to be classified as having a category 1 hazard by the Ministry of Housing, Communities and Local Government's housing health and safety rating system.)

Pregnant women, those who have recently given birth, and young children are at increased risk from damp and other indoor pollutants. This is partly because these groups may have compromised or undeveloped immune systems, and also because young children are likely to spend longer than average at home. So the committee agreed that it was important to make sure they are living in a 'healthy' home that is well ventilated.

Women who are pregnant and babies under 12 months may be particularly vulnerable to pollutants such as VOCs. In addition, evidence suggested that exposure to VOCs during pregnancy was linked with coughing, wheezing and other health issues in the first years of the child's life. VOCs are found in products like aerosol sprays and glue.

Women who are pregnant and babies under 12 months may also be particularly susceptible to the effects of particulate matter – released from, for example, open solid-fuel fires. Based on this evidence, the committee agreed that using proper ventilation to disperse these pollutants is very important – as is reducing use of such appliances when this is feasible.

The committee did not look at evidence on environmental tobacco smoke because any level is considered unsafe. Instead they agreed to adapt recommendations from and cross-refer to NICE's guidance on smoking during pregnancy.

People without pre-existing health conditions

There was a lack of evidence on how indoor air pollutants affect people without pre-existing health conditions and how to improve air quality in their homes. So the committee made a research recommendation on this group (see the research recommendation on effective interventions to improve indoor air quality in the healthy population).

How the recommendations might affect practice

Most healthcare professionals might need training on how poor indoor air quality affects health and how to mitigate it. Incorporating this training into existing general training and continuous professional development could help minimise costs.

Asking about housing conditions and helping people request a housing assessment may increase consultation times. But this will be offset by future healthcare savings.

Return to recommendations

Regulators and building control teams

Recommendations 1.6.1 and 1.6.2

Why the committee made the recommendations

There are no national regulations or guidelines to determine 'safe' levels of indoor air pollutants. But based on their experience, the committee agreed that standards such as the World Health Organization or Public Health England guidelines could be used.

Building regulations are generally used to enforce standards in new housing. Other local standards may be used for existing homes, for example, standards on repairs and property condition or room size. Using these regulations will ensure existing and new buildings meet air quality standards.

The committee noted that enforcement and prosecution practice may vary across local authorities. Reasons for this variation include capacity for follow-up visits and time taken to confirm non-compliance. They agreed to highlight the importance of meeting the government Building Regulations 2010 legislation and housing health and safety rating system operating guidance because this can improve people's health.

How the recommendations might affect practice

Increased use of building control or enforcement teams may have resource implications. For example, staff time for inspection, communication, follow-up and meetings. But improved health outcomes and resource savings elsewhere in the system (for example, by reducing the need for enforcement teams to intervene) might offset costs.

Using existing international guidelines will minimise the resource impact of developing new standards or updating existing ones.

Return to recommendations

Architects and designers

Recommendations 1.7.1 to 1.7.6

Why the committee made the recommendations

Avoiding sources of pollutants

Evidence showed that some building materials can emit high levels of pollutants. There was no evidence on building materials and products that emit a low level of VOCs and formaldehyde. The committee agreed that specifying low-emission materials could help protect people's health. But because of the lack of evidence, they could only suggest professionals consider their use on a case-by-case basis when drawing up specifications.

The committee also noted that there are no national labelling schemes for building materials or consumer products in England (apart from a scheme for paints). They also noted government plans to set up a voluntary labelling scheme in England, as outlined in the government's clean air strategy 2019.

The committee noted the Department for Education's Building bulletin BB101: ventilation, thermal comfort and indoor air quality 2018 and considered that its recommended performance levels could also be applied to homes.

Evidence showed that open solid-fuel fires emit particulate matter and are a major cause of poor indoor air quality. This evidence was limited, but the committee agreed that designing heating options that avoid them will help protect people's health.

Heating and ventilation

Ventilation affects indoor air quality, and its role in removing potential pollutants is critical.

Evidence showed a clear link between cooking with gas and pollutant levels – these are higher in the kitchen when cooking using gas than outdoor pollutant levels unless there is an air quality alert.

Evidence also showed that some causes of poor indoor air quality, such as condensation, are the result of poor thermal performance, high moisture levels combined with poor ventilation. The current focus on draught proofing and energy efficiency can add to the

problem.

Because buildings vary so much, the committee were unable to recommend specific types of ventilation or heating strategies. But they agreed it is important that design strategies achieve the correct balance between ventilation, energy efficiency and heating.

Outdoor pollutants entering through windows can contribute substantially to poor indoor air quality. This is particularly the case in deprived areas where housing is likely to be close to busy roads (see the government's clean air strategy 2019). The committee agreed that if opening windows is not safe or lets in more outdoor pollutants (for example, if the window faces a busy road) then other methods of ventilation or methods of preventing pollutant ingress without resorting to opening windows are needed. This includes mechanical systems with filtration to protect against outdoor pollutants including intelligent ventilation systems.

Building or refurbishing homes to improve heating without taking ventilation into consideration can affect the health of people who live in them. So the committee stressed the importance of balancing the need for heating and ventilation, and taking into account all factors affecting indoor air quality.

They noted that the British Standards Institute standards for domestic retrofits and energy efficiency could be a useful source of information for architects and designers.

The committee agreed that more research is needed about the benefits and harms of different air exchange rates, and the health risks associated with pollutants released from building materials over time in lived-in home environments. This would improve understanding of the minimum ventilation thresholds and appropriate building materials that designers and builders should use. (See the research recommendations on air exchange rate and good air quality and health impact of building materials.)

How the recommendations might affect practice

The recommendations will reinforce current best practice. Architects and building designers should already be aware of the potential risks of the products and materials that they specify.

Balancing ventilation, insulation and heating is already best practice to maintain good air quality so there should be no additional resource impact.

Return to recommendations

Builders, contractors and developers

Recommendations 1.8.1 to 1.8.5

Why the committee made the recommendations

In the UK, materials specified for use by builders, contractors and developers have to comply with existing building regulations and should be used according to the manufacturer's instructions. The same is true for heating and ventilation systems. Based on their collective experience, the committee felt that compliance with regulations and instructions can be variable, so they agreed it was important to highlight them.

There are regulations on pollutant threshold levels but information on the level of emissions from different materials is limited. Few regulations exist to guide the choice of materials according to their effect on indoor air quality.

In the committee's experience, it is common practice for builders to use substitute materials if the specified ones are not available. Members agreed that emission levels need to be taken into account in such cases, whether working on a new building or a refurbishment.

Evidence showed that people's health is affected if best practice and standards are not complied with during home renovations. This is most likely during works that do not require building regulation approval.

In the committee's experience, building regulation enforcement may vary across local authorities. The committee stressed the particular need for enforcing compliance with heating and ventilation regulations, because any imbalance can have a disproportionate effect on indoor air quality.

The committee also highlighted that heating and ventilation systems in the home should be installed by a recognised competent installer, so as to avoid issues of poor-quality installation, in ways that make them easily accessible for regular checks and maintenance.

How the recommendations might affect practice

The recommendations reinforce current best practice and will help local authorities meet their obligations to improve people's health and reduce health inequalities. Ensuring compliance will lead to cost savings in healthcare, because it will reduce the number of homes with poor indoor air quality and, in turn, improve residents' health.

Building regulations and standards already exist for enforcement teams. But building control teams may need to monitor their activities more closely, unless building work is under the control of an approved inspector. This may incur costs for local authorities and homeowners, particularly if issues are identified that need to be fixed. (Only local authorities have the power to enforce standards if things go wrong.)

Training on specifications and compliance will involve costs and time away from work. Incorporating this training into existing continuous professional development could help minimise costs. For small contractors and companies that do not run continuous professional development programmes, the cost will be offset by reducing the risk of future litigation that may arise from building 'unhealthy' homes.

Return to recommendations

Rental properties

Recommendations 1.9.1 to 1.9.6

Why the committee made the recommendations

Regulations

Local authorities have a responsibility for public health, improving wellbeing and reducing inequalities, and a duty of care to ensure public sector homes are maintained to a decent standard. This duty extends to private housing with hazards considered to be a serious and immediate risk to a person's health and safety (category 1 hazards). Homes with serious damp and mould, excess cold or excess heat are likely to be classified as having a category 1 hazard by the Ministry of Housing, Communities and Local Government's housing health and safety rating system. Local authorities can also take action for hazards that are less serious or less urgent (category 2 hazards).

Local authorities have a range of enforcement options (see Ministry of Housing, Communities and Local Government's housing health and safety rating system enforcement guidance: housing conditions). The most commonly used enforcement option is an improvement notice, which requires work to be carried out within a defined time period to remove a category 1 or category 2 hazard. If the works are not carried out, the local authority may prosecute for not complying with the notice, and/or carry out the works itself and charge the owner.

The committee were aware that it is best practice to have heating and ventilation systems that meet performance requirements and are regularly maintained, which should include checking the airflow rates of extractor fans. The committee emphasised that some pollutants (such and damp and mould) and some hazards associated with poor indoor air quality (such as excess cold and excess heat) can only be dealt with if a problem has been identified and by ensuring that appropriate heating and ventilation systems are in place. But they agreed that this does not always happen – and so this needs to be stressed to all landlords as part of local authority advice to the public (see the section on advice and information for the general population) and implemented, if a housing assessment has identified a problem that may contribute to poor indoor air quality.

The committee agreed that best practice also involves repairing any water damage and removing its cause as soon as possible, to prevent mould and damp developing. Local standards may be used for existing homes, for example, landlord legislation or standards on repairs and property conditions or room size.

The committee were also aware of the increased risk for tenants who cannot afford remedial work or have to wait for landlords or property managers to do repairs (including to heating and ventilation systems). This could leave them exposed to pollutants while they wait for the work to be done.

Property management

Based on their experience, the committee agreed that if properties are properly equipped and maintained, this will control and reduce sources of indoor air pollution.

But they were concerned that property managers and landlords might not be aware of how mould, damp and other indoor air pollutants affect people's health. So they made a recommendation to advise on this and their general responsibilities to safely maintain their properties.

The evidence showed that flooring and furniture that contain flame retardants are often sources of VOCs or formaldehyde. Based on the evidence, the committee agreed it was important that these dangers were highlighted to property managers and landlords, because both can damage people's health.

How the recommendations might affect practice

Regulations

The recommendations will reinforce current best practice and the need to use existing regulatory powers to ensure homes are safe (see the government's advice on renting out your property [England and Wales]) and the Ministry of Housing, Communities and Local Government's housing health and safety rating system operating guidance. Because many people on a low income live in rented accommodation, this will help address health inequalities. It will also help improve the health of other vulnerable groups and others who live in rented accommodation.

Property management

These recommendations will reinforce current best practice.

Property managers are legally obliged to carry out maintenance checks and the following have to be embedded in tenancy agreements:

- checks and maintenance of ventilation systems (including airflow rates of extractor fans)
- gas and electricity safety checks.

So, the impact on practice and resources should be minimal, although there may be costs for repair of any problems found during the checks.

Housing has an important effect on health and health inequalities, particularly when properties need repairs. These recommendations will help meet local authorities' obligations to tackle health inequalities.

Return to recommendations

Context

People spend up to 90% of their lives indoors and 60% of that time at home.

Indoor air pollutants come from many sources, including:

- building materials (including fittings and flooring)
- furniture and furnishings
- consumer products, including household and personal care products
- activities such as cooking and smoking
- biological sources, including mould, house dust mites, bacteria, pests and pet dander.

Exposure to indoor air pollutants including, for example, nitrogen dioxide, carbon monoxide, particulates, biological agents and volatile organic compounds (VOCs), is widespread and can cause respiratory and other conditions, and premature death in some people. Asthma is a common respiratory condition, with over 5 million people receiving treatment for it in the UK. Indoor air pollutants such as dust mite allergens, nitrogen dioxide and particulate matter are small enough to get into the lungs, making the airways inflamed and swollen. This can exacerbate asthma symptoms and trigger asthma attacks.

It is best practice to reduce pollutant sources and reduce emissions as much as possible, especially for those who are more vulnerable to health problems caused by poor indoor air quality. This includes children and people with respiratory and cardiovascular conditions (Committee on the Medical Effects of Air Pollutants guidance on the health effects of air pollutants).

Usually the most effective way to deal with indoor pollutants is to either remove the source or reduce emissions from it. If these are not possible, the pollutant can be diluted by ventilation (for example, opening windows) to reduce exposure. But outdoor pollutants also enter through windows or gaps in the structure and are a significant contributor to indoor air quality, particularly in deprived areas (see the government's clean air strategy 2019). NICE has also produced a guideline on outdoor air pollution.

This guideline covers the whole population. But special consideration has been given to

those at increased risk of exposure to or adverse effects from poor indoor air quality.

Finding more information and resources

To find NICE guidance on related topics, including guidance in development, see the NICE topic page on environment.

For full details of the evidence and the guideline committee's discussions, see the evidence reviews. You can also find information about how the guideline was developed, including details of the committee.

NICE has produced tools and resources to help you put this guideline into practice. For general help and advice on putting NICE guidelines into practice, see resources to help you put guidance into practice.

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