

Indoor Air Quality in Nursing Homes & Eldercare

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Addressing Poor Indoor Air Quality in Nursing Homes & Eldercare

While most untreated indoor spaces have high levels of air pollution, many eldercare and nursing home facilities have high concentrations of harmful airborne pathogens. These concentrations can — and often do — far exceed international standards for acceptability and safety¹. This can be caused, paradoxically, by the pursuit of the comfort of residents. Care homes feature crucial quality-of-life factors in layout, furniture, décor, and temperature control that can unfortunately exacerbate the build-up and persistence of indoor air pollutants^{2,3}.

Add to this the fact that many residents spend most of their time indoors⁴, and that by nature the elderly and infirm are particularly vulnerable to the risks associated with indoor air pollution, and you have a truly worrying combination: High pollution concentration, high exposure, and high vulnerability.

Respiratory Illness

Respiratory muscle strength decreases with age and a lack of physical activity can predispose senior citizens to respiratory illness.

Cardiovascular Disease

Changes in the heart and blood vessels due to ageing can put people over the age of 65 at risk of heart disease, while airborne pollutants increase this risk.

Spread of Airborne Viruses

Ultrafine particulate matter can be a vector for the spread of airborne viruses. Once inhaled, these particulates enter the bloodstream, allowing viral infections to develop in the respiratory tract.

Unpleasant Odors

Age-related hormone changes can lead to increased body odor, while incontinence and urinary tract infections (UTIs) are common among the elderly⁵.

Poor Quality of Sleep

High levels of indoor air pollution can cause fatigue and lead to poor quality of sleep, resulting in weakened immune systems and longer recovery periods.

Respiratory Illness

- Exposure to indoor air pollution is a major threat to the respiratory health of the elderly and infirm — far more so than it is to young and healthy individuals^{6,7,8}.
- These risks have been observed around the world, even in care facilities where the concentration of indoor air pollutants did not exceed international guidelines⁹.
- High concentrations of indoor air pollutants have been linked to higher rates of hospital admissions among the elderly¹⁰.

Outcome	Associated Pollutant(s)
Airway inflammation	O ₃
	PM
Allergies / Hay Fever	PM
Asthma	NO ₂ , O ₃
	PM
	Mold, Fungi
Breathlessness	VOCs (toluene, xylene)
Chronic obstructive pulmonary disease (COPD)	NO ₂ , formaldehyde
	PM
Coughing	VOCs
	PM
	Mold, Fungi
Decreased lung function	NO ₂ , formaldehyde
	PM
Emphysema	O ₃
Lung Infection	VOCs
	Mold, Fungi
Respiratory restriction (bronchoconstriction)	SO ₂

In 2017, the standardized death rate in the EU from respiratory diseases for people aged 65 and over was a staggering 38 times higher than those under 65¹¹.

Cardiovascular disease

- Exposure to indoor air pollution has a significant effect on increasing blood pressure — the primary cause of cardiovascular disease⁸.
- Cardiovascular disease is the leading cause of death and accounts for nearly one third of all deaths globally⁹.
- Vulnerable people, including the elderly, have been shown to be higher risk for adverse cardiovascular outcomes from exposure to air pollution¹⁰.

Outcome	Associated Pollutant(s)
High blood pressure	PM
Risk of stroke	PM
Coronary artery disease	CO

Studies show that an increase of 0.9ppm of carbon monoxide in air pollution causes a significant increase in cardiovascular hospital admissions in the elderly¹¹.

Spread of Airborne Viruses

Viruses as a threat

- Viruses are a major threat, but even more so in enclosed spaces where vulnerable people are gathered and can interact with each other.
- The largest proportion of deaths relating to viral illness and influenza is the aged and elderly residents who live in care facilities, which are subject to outbreaks¹².
- The coronavirus (SARS-CoV-2) pandemic saw record numbers of deaths, not only disproportionately in the elderly, but overwhelmingly and specifically in nursing homes and senior living facilities around the world^{13,14}.

Viruses as a precursor to pneumonia

- Pneumonia can be caused by several different pathogens, including airborne bacteria and respiratory viruses, such as influenza, coronaviruses, and rhinovirus¹⁵.
- Pneumonia is the most frequent cause of death in residents in eldercare facilities¹⁶.
- Pneumonia is more common among residents of eldercare facilities than among elderly persons living at home¹⁷.

Outcome	Associated Pollutant(s)
Infectious disease	Airborne viral cross-infection
	Respiratory viruses
Pneumonia	Bacteria
	Respiratory viruses
Respiratory tract infection	Respiratory viruses
Soft tissue infection	Respiratory viruses
Immunodeficiency	Fungi

Unpleasant Odors

While it may be a sensitive subject, odor control is simply one of the issues care facilities must deal with daily. The conditions in which we place our loved ones should be those that respect human dignity and mental health to create a welcoming space for all.

- Strong, unpleasant odors in nursing homes and care facilities are a major source of discomfort and embarrassment for residents, staff, and visitors^{18,19,20}.
- Odor is one of the factors that can influence staff workplace satisfaction and morale²¹.
- Odor is a significant measure of perceived indoor air quality and facility cleanliness²².

Outcome	Associated Pollutant(s)
'Ageing smell'	2-Nonenal
Body odors	Ammonia, volatile Sulphur compounds, trimethylamine
Urinary tract infection	Escherichia coli (E. coli)
Waste odors	Ethanol, sulphides, ammonia
Wound infections	Staphylococcus aureus

Poor Quality of Sleep

- Air pollution can cause nasal inflammation, which can be associated with sleep disorders due to airway obstruction²³.
- Degradation of building materials, poor maintenance of ventilation systems, and humidity can lead to dampness or the presence of indoor mold, exposure to which is related to poor quality of sleep²⁴.
- Short-term exposure to air pollutants has been linked to a higher risk of hospitalization among the elderly due to exacerbated sleep disorders²⁵.

Outcome	Associated Pollutant(s)
Sleep efficiency	PM
	VOCs, CO
Reduced sleep time	NO ₂
Sleep-disordered breathing	PM
Sleep apnea	PM
	NO ₂
Insomnia	PM, mold
Poor sleep quality	Allergens, dust, dust mites
Nasal and airway inflammation	Damp, mold
Snoring	Damp, mold
Daytime fatigue	Allergens, dust mites, mold

Spending up to 20 hours a day indoors, many elderly people are entirely without the health benefits of fresh, clean air²⁶.

Glossary

Term	Description
CO	Carbon monoxide
COPD	Chronic obstructive pulmonary disease
IAQ	Indoor air quality
NO	Nitric oxide
NO _x	Nitric oxides
NO ₂	Nitrogen dioxide
O ₃	Oxygen
PAHs	Polycyclic aromatic hydrocarbons
PM	Particulate matter
SO ₂	Sulphur dioxide
UTI	Urinary tract infection
VOCs	Volatile organic compounds. These include benzene, butadiene, carbon tetrachloride, ethylene glycol, formaldehyde, methylene chloride, tetrachloroethylene, toluene, and xylene.

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