Nelson Marlborough District Health Board

Position Statement on Warm Homes and Clean Heating

NELSON MARLBOROUGH DHB POSITION

The Nelson Marlborough District Health Board (NMDHB):

- Considers warm dry housing and good air quality to be important public health issues with significant ethnic and socioeconomic health inequalities in both access to quality housing and susceptibility to the health effects of cold homes and poor air quality.
- Recognises that New Zealand has well-established housing quality issues with cold, damp and hard to heat houses and that living in cold damp housing is associated with serious health impacts and conditions such as respiratory and cardiovascular diseases, sub-optimal mental health, fuel poverty[i] and household crowding[ii].
- Acknowledges that while a warm home is fundamental for comfort and good health, some forms of home heating are inefficient and contribute significantly to indoor and outdoor air pollution and health impacts such as asthma and other respiratory diseases.
- Considers good air quality should not be compromised at the expense of heating cold houses.
- Supports central and local government housing and air quality standards, policies and programmes that seek to improve the warmth and thermal efficiency of New Zealand housing alongside maintaining and improving local air quality.
- Is committed to highlighting the adverse health impacts of cold housing and air pollution.
- Advocates for the following evidence-based interventions to reduce the health impacts of cold homes and poor air quality associated with some forms of home heating:
    - public education on energy efficiency housing design principles for new builds and renovations;
    - programmes that support improving the thermal efficiency of existing homes;
    - education programmes that support appropriate home management practices (ventilation, moisture level management, warmth retention, wood burner operation);
    - the use of clean and efficient sources of heating (heat pump or other electric, flued gas, low emission wood and pellet burners);
    - regulation of wood burners;
    - rental property Warrant of Fitness assessments; and
    - ban on the sale and use of unflued gas heaters designed for indoor use (e.g. LPG cabinet heaters).

[i] Fuel poverty is where a household would need to spend more than 10% of its income on household energy in order to be adequately warm

[ii] For the purposes of this position statement, household crowding is where children and other household members sleep in the same room to keep warm

BACKGROUND

The adverse health impacts of living in a cold home are widely established and accepted, as are the health impacts from exposure to indoor and outdoor air pollution from some forms of home heating.

Conditions related to cold housing such as low indoor temperatures, fuel poverty and household crowding are associated with increased winter hospital admissions for respiratory and cardiovascular illnesses, increased rates of colds and flu and other infectious diseases,[1] and excess winter deaths (where more people die in the winter months than the remaining warmer months). [2]

Exposure to air pollution from open fires, wood burners and unflued gas heaters (e.g. LPG cabinet heaters) is also associated with increased winter hospital admissions for respiratory and cardiovascular illnesses, as well as increased respiratory symptoms such as coughing and wheezing[3], reduced life expectancy and death.[3,4,5]

Respiratory health of both adults and children is particularly affected.[4,6] Evidence shows that cold damp housing, and exposure to air pollutants from the use of unflued gas heaters and domestic fires are linked to increased respiratory symptoms[7,8] and are suggested to contribute to New Zealand having one of the highest asthma rates in the world.[7,9,10]

Demographic groups that are vulnerable to the health impacts of both cold homes and air pollution include older people, people with existing health issues (especially cardiovascular and respiratory illnesses), [2,8] and young children and infants in particular.[11,12] Pregnant woman and their unborn babies are especially vulnerable to the health impacts of air pollution.[13]

Health effects of cold homes and poor air quality also fall disproportionably on those of lower socio-economic status, and Maori and Pacific peoples due to a combination of greater exposure and susceptibility. [8,14,15]

COLD HOMES SUMMARY OF EVIDENCE

Cold homes - New Zealand setting

New Zealanders spend more than 70% of their lives indoors in the home environment with older people, the young and people with long-term illnesses spending more time at home.[16]

In ensuring thermal comfort and protecting health, the World Health Organisation recommends a minimum indoor temperature of 18°C, and a warmer minimum temperature of 20°C if the very young, the elderly or people with an illness live in the house.[17,18]

In New Zealand, most occupants only heat the living room and on occasion a bedroom[19] and 3% of households use no heating.[20] The average winter evening living room temperature is 17.9°C, with recorded temperatures as low as 10°C, and the average night time bedroom temperature is 13.6°C.[19]

Rental houses represent about a third of New Zealand's total housing stock and are generally in worse condition than owner-occupied houses with a higher incidence of dampness and mould, and a greater likelihood of exterior and interior components (e.g. windows, roof cladding, and kitchen and bathroom linings) to be in poor or serious condition.[21] The BRANZ 2010 House Condition Survey, which involved physical inspections of housing, found nearly twice as many rental houses to be in

poor condition than owner-occupied houses.[21] Renters are also more than twice as likely to report that their homes are always or often cold, and four times more likely to report a major dampness problem, than owner-occupiers.[22]

The number of households renting is rising – In 2013, 453,135 households lived in rental homes, being nearly 65,000 more households than in 2006.[20] Overall, around half of all New Zealanders live in rental homes. [23] Of those living in rental housing, Maori, Pacific peoples, older people and children are disproportionately represented.[24,25]

Cold homes and health effects

The reported health effects associated with cold housing include:

- increased risk of cardiovascular and respiratory disease[6]
- increased risk of stroke and heart attack[26], especially in older people[27]
- increased respiratory symptoms such as wheezing and asthma attacks[9]
- increased incidence and exacerbation of colds and influenza[1]
- negative mental health effects[1]
- exacerbation or complication of existing conditions such as arthritis, diabetes complications, osteoarthritis knee pain severity and hip fracture[1,28]
- increased risk of excess winter mortality, especially in the very young and the elderly, and mostly attributable to cardiovascular and respiratory diseases[29]
- increased risk of hypothermia, especially in the elderly[27]
- increased rates of hospital admissions, visits to general practitioners, and days off school or work.[30]

Of those listed, the key conditions associated with cold housing are cardiovascular disease, respiratory problems and sub-optimal mental wellbeing.[1]

Furthermore, houses that are cold are typically also damp.[7] Damp leads to the growth of moulds and the proliferation of house-dust mites, both of which have been linked with increased respiratory symptoms.[9]

Fuel poverty

Around a quarter of New Zealand households are thought to be in fuel poverty.[2] Fuel poverty is where a household cannot afford to heat their home to a satisfactorily warm environment, or to a World Health Organisation recommended temperature of at least 18°C, for a reasonable expenditure of household income.[2] Typically a reasonable expenditure is defined as no more than 10% of a households income on household energy requirements (excluding energy for transport). [2]

People living in fuel poverty are faced with the choice to 'heat or eat' whereby either less money can be spent on basic necessities such as food or alternatively, less money can be spent on heating their home to a reasonable temperature.[1] Studies have shown an association between colder temperatures and reduced food expenditure in poor families to offset heating costs.[31]

In New Zealand, factors which exacerbate fuel poverty include poor housing quality in terms of thermal efficiency, relatively high levels of income inequality, and rising electricity prices.[2]

Household crowding

Cold housing influences the way in which occupants live within a house. There is a strong association between crowding and fuel poverty. [32] In staying warm, New Zealanders tend to crowd together in one room, promoting the transmission of infections[7] and the generation of moisture and damp.[33]

Infectious and respiratory diseases strongly associated with crowding include meningococcal disease, tuberculosis, bronchiolitis, pneumonia [34], rheumatic fever[35], and asthma.[33] An estimated 10% of hospitalisations in New Zealand due to infectious diseases are attributable to household crowding.[34]

Maori and Pacific peoples experience markedly higher rates of both infectious diseases and crowding comparative to European/others.[34]

Additional to implications on physical health, household crowding can also impact on mental health.[36] Studies suggest that crowding is stressful for both children and adults, in particular women, and leads to poor social relationships, poor childcare, and aggressive or withdrawn behaviour.[37]

AIR QUALITY & HEATING SUMMARY OF EVIDENCE

Outdoor air quality – New Zealand and local setting

New Zealand generally has good air quality as a result of its relatively small population, low level of reliance on heavy industry in comparison to other developed countries, geographic position and climatic factors.[38]

The pollutant of most concern in New Zealand that can harm health is fine particulate matter (PM_{10} and $PM_{2.5}$[iii]).[38] These tiny airborne particles can be inhaled into the lungs and affect respiratory and cardiovascular health resulting in increased hospital admissions, increased number of sick days, and shorter lives for some New Zealanders.[38] The World Health Organisation states that the health effects of PM_{10} and $PM_{2.5}$ are well documented and that there is no safe level of exposure to which no adverse health effects occur.[39] Accordingly, World Health Organisation policies aim to achieve the lowest concentrations of particulate matter possible.[40]

The burning of wood or coal for home heating is the primary source of air pollution in New Zealand, contributing 58% of annual emissions of human-made particulate matter in our air.[38]

Since 2006, air quality has significantly improved nationally as well as locally, mainly as a result of the shift to cleaner home heating.[38,41,42,43]

Despite an overall improvement in local air quality the overall trend in the number of hospital admissions for respiratory disease in Nelson Marlborough has not decreased. [44] This may be explained by changing demographic and socio-economic factors such as an ageing population and

[iii] Particulate matter are generally measured in two size ranges – PM_{10} have a diameter of 10 microns or less (an average human hair is 50 microns in diameter) and $PM_{2.5}$, a subset of PM_{10}, have a diameter of 2.5 microns or less. The smaller particles of $PM_{2.5}$ pose a greater health risk given that they can penetrate deeper into the lungs and can enter into the bloodstream. Particles larger than 10 microns typically settle in the nose and mouth and are less likely to cause health effects.

lower use of primary care due to economic constraints (e.g. less likelihood of doctor's visits to intervene before hospitalisation is required), alongside other contributing environmental factors like housing quality and year to year variations in the incidence of circulating viruses such as influenza.[44] Notwithstanding this, there is a strong relationship between poor air quality, adverse health impacts and increased hospital admissions.[38] Accordingly, work to maintain and improve local air quality (amongst other activities such as addressing cold homes) needs to be ongoing.

Indoor air quality

Studies have shown that pollutants released indoors have around 1000 times greater chance of being inhaled than those emitted from nearby outdoor sources.[10] This is a result of the close proximity of occupants to indoor emissions and that small amounts of pollutants emitted can accumulate to higher concentrations than they would outdoors.[45]

The use of unflued gas heaters without adequate ventilation, regular maintenance, and large enough room area can degrade indoor air quality.[5] Residential wood burners are not only a significant source of outdoor air pollution but substantial indoor pollution as well through either direct exposure or infiltration from outside.[46]

Emissions from wood burners and health effects

Air pollutants produced by burning wood or other solid fuels include smoke made up of fine particulate matter (PM_{10}/$PM_{2.5}$ such as black carbon and organic carbon) and combustion gases (e.g. carbon monoxide and toxic substances such as benzene and formaldehyde).[46]

Several reviews have looked at the health effects of wood smoke from residential wood burners and that of wild fires/vegetation clearance (researchers have presumed the effects to be the same as for residential wood burners given the similar fuel sources). The reported health effects associated with wood smoke include:

- increased rates of respiratory hospital admissions and emergency department visits, especially for asthma and chronic obstructive pulmonary disease (COPD)[46,47]
- eye irritation, airway inflammation, and increased respiratory symptoms such as cough and wheezing[3,46]
- increased use of COPD medication and decreased lung function[46]
- all-cause mortality, cardiovascular mortality and cardiopulmonary hospitalisations[48]
- increased risk of cardiovascular disease and cancer.[3,46]

The Health and Air Pollution in New Zealand (HAPINZ) study[4] found domestic fires to be the largest contributor to health impacts associated with air pollution from human activities (with the exception of Auckland where health impacts from vehicle emissions dominate). The study estimates the social cost of air pollution from domestic fires to be $2.4 billion per year. [4]

Open fires and older wood burners produce more smoke than modern wood burners.[49] However, modern wood burners still need to be properly installed, maintained and operated to ensure more efficient heating and minimise air pollution.[49]

Emissions from unflued gas heaters and health effects

Without adequate ventilation, the use of unflued gas heaters (which produce heat without a flue or chimney to transfer the combustion products outdoors) can degrade indoor air quality and adversely impact health.[5] Ensuring adequate ventilation during the operation of an unflued gas heater as per manufactures instructions, for example through opening a window or door, may seem counter intuitive to people heating their home.[50] Studies of unflued gas heater use show that concentrations of carbon monoxide, nitrogen dioxide, and formaldehyde regularly exceed health-based standards indoors.[5]

The reported health effects associated with unflued gas heater use include:

- increased severity of respiratory conditions such as asthma, coughing, wheezing, and general nose, throat and lung irritation[10,51]
- increased rates of fevers, nausea, vomiting, headaches, sore throats, lung infections, skin conditions, constipation, back ache, aching joints, and fainting[51]
- reduced lung function in later life[3]
- increased risk of death or permanent disability from carbon monoxide poisoning[3]
- increased risk of cardiovascular disease and cancer[3]
- increased rates of hospital admissions, emergency department presentations, days off school or work, and mortality.[3,10]

Additionally, water vapour released by unflued gas heaters promotes dampness and mould, further exacerbating respiratory problems.[51]

Those particularly vulnerable to the adverse health effects of unflued gas heater use include infants, unborn babies, children, older people, asthmatics and people with respiratory illness.[50,52]

Further to the health risks from reduced indoor air quality, unflued gas heaters also pose a greater fire risk than other forms of home heating.[53]

EVIDENCE-BASED STRATEGIES TO REDUCE IMPACT

Energy efficiency and home management practices

Public education on energy efficient housing design for new builds and renovations

A common misconception is that compliance with the energy efficient requirements of the New Zealand Building Code will ensure best practice.[54] However, the Code sets minimum performance standards only and therefore to obtain better performance requires going beyond Code requirements.[54]

A more comfortable, healthy and energy efficient building can be achieved through passive design. Passive design uses the sun and wind to provide household heating, cooling, ventilation and lighting.[55] It can achieve consistent indoor temperatures, improve indoor air quality and make a home drier and more comfortable to live in.[55] The need for mechanical heating or cooling is decreased or removed, reducing energy use and environmental impacts such as greenhouse gas emissions.[55]

While the costs of building a passive house in New Zealand are currently 10% higher than conventional construction, a 80-90% reduction on energy bills can be achieved over the long term.[56]

New houses should be designed and built to the highest energy efficiency standard affordable.[57] To improve the uptake of energy efficient options information needs to be disseminated to those building or undertaking renovations.[58] Important mechanisms for providing information include information centres, demonstration buildings, information campaigns, websites and free energy adviser consultations.[58]

Thermal efficiency upgrades for existing homes

The Energy Efficiency and Conservation Authority (EECA) estimates New Zealanders are spending $300 million annually on unnecessary energy costs due to under-insulated homes.[59]

Increasing the thermal efficiency of homes is a long-term sustainable strategy as it allows people to use less energy to heat their homes adequately whilst having a positive impact on reducing greenhouse gas emissions.[1] In general, it has also been found to be the most cost effective way of addressing fuel poverty.[60] Importantly, it means that houses are warm and comfortable to live in and the health of occupants is improved.[7]

A UK study[61] showed significant improvements in cardiovascular health as a result of improvements in the thermal efficiency of housing.

The New Zealand Housing, Insulation and Health Study[62] found that retrofitting insulation into existing homes improved the health and wellbeing of occupants with respiratory disease as well as energy efficiency.[63] A cost-benefit analysis concluded that the benefits exceeded the costs of retrofitting insulation by almost two to one.[62]

EECA estimates $400 million is spent in New Zealand per year on unnecessary health costs that could be addressed by insulation alone.[59] EECA also reports that one night in hospital costs the same as insulating a whole house and realising the benefits for decades to come.[64]

In 2014/2015, the Warm Up Healthy Homes programme which retrofits insulation into the cold damp homes of households with high health needs benefited 150 households, or approximately 500 people, in the Nelson Tasman area.[65] From 2015/2016, the programme expanded to include Marlborough and up to 400 homes in total.[65]

Education on ventilation, managing moisture levels and retaining warmth

Moisture control and ventilation are two important practices in managing dampness and mould within a home.[66] Regular household activities such as cooking and clothes drying can create moisture inside the home as can leaks and damp ground beneath the house.[66] It is important to eliminate or reduce sources of moisture[66] along with ensuring sufficient ventilation to allow moisture and indoor air pollutants to escape outdoors.[67] Other important practices for keeping a home warm and dry include drawing curtains at dusk and stopping drafts.[68]

Evidence shows that ventilation is important for managing indoor mould in both new homes and thermal efficiency retrofits of older homes.[69,70] Studies have also shown that the removal of indoor mould and improvement of home ventilation results in improved asthma symptoms.[71,72]

It has been found that households receiving remedial measures to reduce housing-related health problems, such as retrofitted insulation, need guidance on how to maintain their improved homes as many have little knowledge of the most basic ways to keep their homes clean, dry and warm. [73] As such, approaches which incorporate both remediation and education are more effective in providing a healthier living environment and improving health outcomes than interventions that use either alone. [73,74,75,76]

Education on wood burner operation

Modern wood burners operated in accordance with manufactures' instructions release limited particulate matter and gaseous pollutants directly into indoor[46] and outdoor air.[77] However, when indoor wood burners are operated poorly, have poor ventilation or backdraft, elevated concentrations of combustion products (particulate matter and gaseous pollutants) may result inside the home[46] and can degrade outdoor air quality.[78]

Educational programmes can inform people how to operate their wood burners correctly to ensure more efficient heating and less pollution. This includes burning the right wood (dry, seasoned hardwood; no chemical treatment or rubbish) the right way (hot and not smouldering fire, not overloading the appliance).[46]

The World Health Organisation urges that education is undertaken given that improved efficiency of wood combustion in domestic wood burners greatly reduces emissions.[46] An Australian study[79] found that visible wood smoke emissions significantly decreased following an educational campaign. Unfortunately no air quality measurements were taken.

Clean and efficient sources of heating

The replacement of inefficient or polluting sources of heating (e.g. unflued gas heater, older wood burner) with more efficient and cleaner sources of heating (e.g. electric heaters, flued gas, low emission wood burners) can reduce indoor and outdoor air pollution, fuel poverty and greenhouse gas emissions and improve physical and mental health outcomes.[80]

New Zealand and Australian studies[10,63,81] found a significant reduction in nitrogen dioxide levels and asthma symptoms through the replacement of unflued gas heaters in the home and school classrooms with more effective forms of heating (e.g. flued gas heater, electric heater).

A US study[82] of wood burner change-out programmes, where older higher polluting wood burners were replaced with more efficient cleaner models, showed community level improvements in outdoor air quality, and improvements in indoor air quality and self-reported children's health.

Policy and regulation

Regulation of wood burners

In densely populated urban areas, particularly where metrological conditions and/or local topography are unfavourable for dispersing air pollution, it may be appropriate to not permit wood burner devices at all or at least limit wood burners to registered low emission models.[83]

In New Zealand, national regulations restricting the installation of higher emission wood burners on properties less than two hectares in area came into effect in 2005.[84] To progress towards meeting

new air quality standards many local authorities have also phased out, or are working towards phasing out, existing higher emission wood burners including in the Nelson and Richmond areas.[85,86] Furthermore, the installation of any new wood burner (except where specified criteria is met) is restricted in the urban areas of Nelson and Richmond as an additional measure.[85,86]

Rental property warrant of fitness

An effective housing quality assessment tool is pivotal to supporting improvements to existing housing stock at two levels.[87] At the individual property level it can assist property owners or managers to identify problems that require fixing, benefit renters and buyers at the time of choosing a house, and support local authorities to identify substandard properties that require remediation.[87] At a high-level it can provide a sound basis for policy and decision making, compliance monitoring and research about the impacts of housing quality.[87]

The Healthy Housing Index (HHI), developed in New Zealand, is such a tool that can measure the physical characteristics of a house in order to assess potential risks to the health and safety of occupants, as well as its energy efficiency.[7]

In 2012 the Children's Commissioner's Expert Advisory Group on Solutions to Child Poverty recommended "*that the government ensure all rental housing (both social and private sector) meets minimum health and safety standards, according to an agreed Warrant of Fitness, such as the Healthy Housing Index*".[88]

Since the release of this recommendation, two draft Warrant of Fitness (WOF) assessment tools have been trialled in New Zealand, one trial lead by University of Otago and the other Housing New Zealand (HNZ).[89,90]

The two draft WOF assessment tools largely assess the same criteria including water temperature, fixed heating, smoke alarms and insulation.[89,90] The trial led by University of Otago resulted in the majority of landlords surveyed stating they conditionally supported a WOF in New Zealand, and that they were going to undertake work as a result of the trial results.[91] An assessment of the HNZ trial found that the WOF inspection scheme "*is feasible and can be achieved at a reasonable cost, with results that will lead to improved health and safety outcomes for tenants*".[90]

Ban on the sale and use of unflued gas heaters designed for indoor use

Although they have relatively low purchase prices, unflued gas heaters are one of the most expensive forms of heating per unit of energy.[5] Some households may use unflued gas heaters as a means of budgeting given that they can refill the gas bottle as money allows.[53] However, changing to an electric heater provides greater energy efficiency, less health risks and lower heating costs.[53]

Unflued gas heaters pose a health risk to those using them through the emission of toxic gases into indoor air, the release of water vapour promoting damp and mould, and the risk of fire and explosion.[5]

Users of unflued gas heaters may not open a window for ventilation during their operation given this is counter intuitive to heating their home.[50] A consumer survey[92] found that while most users felt they are informed about unflued gas heater safety, nearly a third of all respondents did not ensure the heated area was ventilated on the last occasion of use and more than a third of respondents had

never had their gas heater checked by either someone in the household or a qualified tradesperson to make sure it was working correctly.

The principal cost of unflued gas heaters is the health effects on children with asthma.[5] One in four New Zealand children will experience symptoms of asthma at some point in their childhood.[93] Asthma is the most common cause of hospital admissions in children[94], costing about $1,200 per day to treat a child in hospital.[95] The economic cost of asthma in New Zealand is over $800 million per year.[94] As previously noted, New Zealand and Australian studies[10,81] have shown that the replacement of unflued gas heaters with more efficient and less polluting forms of heating significantly reduced asthma symptoms in children.

A 2010 review of unflued gas heaters[5] consulted a range of groups on their sale and use with those expressing a preference to banning including Community Energy Action, Plunket Society, Tenants Protection Association, Beacon Pathway, Consumer NZ, Ministry for the Environment and the Energy Efficiency and Conservation Authority. The review also reports others actively discouraging the use of unflued gas heaters or moving towards a ban as including the Ministry of Health, public health organisations and The Warehouse Group.[5] In addition, the Canterbury District Health Board recently adopted a position statement advocating the prohibition of unflued gas heaters.[96]

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