

Evidence base for a housing warrant of fitness

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Abstract

Substandard housing is a major public health issue in New Zealand. Approximately, two-thirds of the housing stock is uninsulated and many homes are inadequately heated, with an average indoor temperature of 14.5°C. Cold, damp, and mouldy housing results in poor health; each year, respiratory hospital admissions are 74% higher during winter, and excess winter mortality is 20% higher than other seasons. The relationship between injury and housing conditions is also well established. Each year, 500,000 New Zealanders suffer falls requiring medical treatment in their homes. As a step towards improving the quality of existing housing, an evidence-based warrant of fitness has been developed. This article outlines the evidence base to each criterion in the warrant of fitness. We conclude that introducing and properly enforcing a housing warrant of fitness will ensure that basic minimum standards are met, which could mitigate the disease burdens and injuries associated with, or caused, by poorer quality housing. In addition, there are potential fiscal and economic advantages of the scheme, including reduced hospitalisations and increased productivity.

Keywords

Housing, health, injury hazards, prevention, warrant of fitness, minimum standards, insulation, cold

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Introduction

Historically, there have been few government policies aimed at addressing the standard of New Zealand's existing housing, and for many people, living in a healthy home has become aspirational and, in some cases, unachievable. The Kainga Oranga/Housing and Health Research Programme has developed a housing warrant of fitness (WoF; the Housing Warrant of Fitness is referred to in New Zealand generally as the 'Rental Housing Warrant of Fitness' or the 'Rental Warrant of Fitness'). This tool is based on evidence, and it primarily aims to reduce unintentional injury in the home and improve occupant's health status. The WoF criteria have been adopted by some local councils, who provide a service of trained assessors to inspect homes. This article outlines the evidence base to each of the criteria in the WoF and argues that nationwide compulsory adoption of the WoF could result in significant health benefits and reduction in injuries in the home.

The WoF has been developed in order to provide a series of minimum standards that can be enforced before a dwelling is deemed suitable for occupancy.^{1,2} The WoF was developed

using a wider housing quality assessment tool, the Healthy Housing Index (HHI). The HHI is an evidence-based, quantitative, well-defined measure of unhealthy or unsafe housing,³ but is more suited to use in a research environment, due to the degree of detail collected and consequently the time required to conduct the assessment. The WoF is a practical tool that can be used across a broad range of homes, with a home inspection able to be completed by a trained assessor in less than 1 h to quickly and objectively determine if a property is safe and suitable for occupancy.¹ In the following sections, each WoF criteria (29) has been grouped into broader sections: insulation and heating; ventilation, mould, and dampness; home injury hazards; hygiene; security; and basic repair. These sections outline the WoF's evidence base for improved health effects and injury reductions.

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Insulation and heating

The WoF requires that dwellings meet the following criteria:

- Ceiling insulation is required to the 2008 Building Code⁴ (the current standard) for all houses where access to the roof space is feasible (item 18);
- Underfloor insulation is required to the 2008 Building Code for all houses where there is access to the sub-floor (item 19);
- Windows in bedrooms and living areas are required to be either double glazed or have effective curtains or blinds installed (item 16);
- The living room must contain an adequate form of safe and effective space heating (item 8).

A warm and dry home is essential for health. Insulation combined with effective space heating promotes positive health outcomes through reduction of cardiovascular and respiratory-related illness, hospitalisation, and mortality. The health consequences of inadequately warm homes are most significant during winter periods, when cold homes affect respiratory and circulatory health, especially in the elderly, children, and people who are unwell.⁵

The Healthy Homes Programme, a joint initiative between district health boards and Housing New Zealand, the organisation responsible for state-owned rental properties, included retrofitting insulation into Housing New Zealand properties. Data from this programme showed a reduction in hospitalisation rates following insulation intervention.⁶ An evaluation of the Warm Up New Zealand (WUNZ) government insulation subsidy programme, which was rolled out nationally to over 330,000 homes, found statistically significant changes in mortality and hospitalisations in households directly attributable to retrofitted insulation.⁷

A lack of home heating also creates an unnecessary disease burden. Low indoor temperatures have been shown to reduce lung function in children with asthma.⁸ In households with asthmatic children, installation of effective and non-polluting home heating has been shown to reduce school absences, improve wellbeing, and lead to a reduction in asthma symptoms.^{9–12} The WUNZ programme has resulted in the installation of safe and effective heating (either a heat pump, wood pellet burner, modern wood burner, or flued gas heater) to a subsection of approximately 40,000 New Zealand homes. Statistically, significant reductions in visits to a general practitioner (GP) and days off work/school as a result of receiving a heating retrofit were determined in a previous study.^{13,14} Where insulation cannot be installed (because of the building's structure), indoor temperatures can be similarly increased through installation of high-efficiency clean heating without substantial energy costs to tenants. In a conservative analysis contracted by the New Zealand government, the health and energy benefits outweighed any installation costs with a ratio of 1.51:1.¹⁵

Around 25% of New Zealand households are estimated to be in fuel poverty.¹⁶ Even when non-polluting effective heating is installed in the home, fuel poverty can deter tenants from using heating, instead keeping the house closed up from the cold, which can result in inadequate ventilation and dampness.¹⁷ Agencies in the United Kingdom found strong evidence that excess winter mortality is linked to suboptimal home heating, with people living in the coldest 25% of homes having a 20% increased risk of winter illness and death.¹⁸

Ventilation, mould, and dampness

To improve ventilation and reduce mould and dampness in dwellings, the WoF requires that houses meet these criteria:

- The bathroom(s), kitchen, bedroom(s), and living areas must have some form of ventilation to the outside (item 9);
- The house must be reasonably free of visible mould, having no more in total area of mould than an A4 sheet of paper (item 10);
- A ground vapour barrier is required for all houses where there is an accessible and fully enclosed sub-floor (item 20);
- The house must be weathertight with no obvious leaks or moisture stains on the walls, ceilings, or floors (item 21);
- The ground under the house should be free of ponding and surface water (item 24).

Multiple international studies have shown that there is a significant relationship between visible mould and dampness, and respiratory illness, specifically asthma. New Zealand studies have determined that between 35% and 46% of homes have mould, which is related to indoor dampness, poor house condition, crowding, lack of heating, and lack of insulation. Studies that have assessed the health effects of dampness and condensation on windows, as a consequence of inadequate ventilation, have found it to be a major risk factor for coughs, wheezing, asthma, and airway infections.^{19,20} Producers of allergens (mould, dust mites, and cockroaches) thrive in damp environments and are likely to be implicated in the aetiology of respiratory illness.^{20,21} These allergens and bioaerosols may then accumulate in stagnant zones of air where there is insufficient airflow to refresh the air.²² Mould growth is usually accompanied by bacterial growth which together can be causative for illness, primarily through toxic and inflammatory effects causing upper respiratory tract symptoms (such as cough and wheeze) and asthma symptoms.^{23,24}

Interventions to reduce household mould have been trialled, and these also suggest a causal link between the presence of mould/damp and asthma symptoms.^{25,26} This link has been accepted in Scotland to the extent that courts have awarded compensation for asthma aggravated by mould.²⁷ The association also affects the health of those without known

allergies.²⁰ A meta-analysis of research into this relationship determines that building dampness and mould are associated with approximately 30%–50% increase in respiratory and asthma-related health outcomes.²⁸ A World Health Organization (WHO) report produced a population-attributable fraction of home mould exposure causing childhood asthma of 12.3% (WHO, 2011). This calculation was based on an exposure prevalence of indoor mould of 10%, much lower than estimates for New Zealand homes.

Ventilation is essential for the removal of indoor-generated air pollutants including combustion by-products such as nitrogen dioxide and carbon monoxide gases from unflued gas heating and cooking, or attached garages.^{29–32} Toxic organic compounds, including formaldehyde and bioaerosols from building and cleaning products, may also accumulate at concentrations that are harmful to health. Exposure to elevated levels of such compounds increases the risk of asthma, allergy, and pulmonary infections.^{33,34}

Ventilation has been found to be an effective intervention for children with moderate to severe asthma. A randomised control study of UK children found that installing cost-effective ventilation systems to their housing was associated with significantly improved physical and psychosocial functioning.^{35,36} A New Zealand study found reduced respiratory hospitalisation rates among children aged under 5 years following installation of positive pressure residential ventilation systems, though no difference for other age groups.³⁷

Home injury hazards

To reduce injuries in homes, the WoF requires the following criteria:

- Hot water at the tap should be supplied at a temperature of 55°C, ± 5°C (item 4);
- Security stays must be present on any window where it is possible for a person to fall out of that window and where the possible fall height is more than 2 m to the ground (item 15);
- Glass doors with clear glazing must have visibility strips (item 17);
- There must be handrails for all internal stairs and all outdoor steps that access the house, and all balconies and decks of 1000 mm above ground level must have balustrades (item 27);
- There must be operational smoke alarms in the house, situated in accordance with New Zealand Building Code clause F7 (item 13);
- All power outlets and light switches must be safe and in good working order, and wiring must be safe (item 11);
- The house must contain secure or high-level cupboards or shelves for storing hazardous or toxic substances out of children's reach (item 7).
- There must be adequate operational lighting at or near entrance ways (item 25);

- There must be at least one working light in each room and staircase, and staircases must have a working light switch at both the top and bottom of the stairs (item 12);
- The house number and main entrance must be clearly labelled and identifiable (item 28).

Tap temperatures should be set at a maximum of 55°C to reduce risk of burns and scalds from hot water. A New Zealand study indicates that hot water scalds and burns account for 26% of adult thermal injury hospitalisations and 67% for children.³⁸

In New Zealand, from 2005 to 2015, there was an average of 18 deaths per year due to house fires.³⁹ Research indicates that effective smoke detectors can reduce fatal fire injury by as much as 70%.⁴⁰ Several incidents of fire have been reported in homes that use wood fires, candles, and gas as an alternative to electricity.⁴¹ For example, the use of candles in homes for lighting caused 416 fires between 2010 and 2015. Malfunction of electrical equipment is another major risk factor for the ignition of fires. From 2008 to 2013, there were 3338 fires that were started due to electrical failure or short circuit and earth failure. Electrical burns occur in homes with exposed wiring or faulty apparatus and account for approximately 2%–3% of all burns. The vast majority of these are from electrical and extension cords (60%–70%) and wall outlets (10%–15%).

Childhood poisoning was the second leading cause of early childhood home injury hospitalisations, accounting for approximately 19% of early childhood home injury hospitalisations between 1989 and 2000.⁴² The effects of most toxic agents can be controlled once the infant is hospitalised, but the child may still suffer from long-term health implications, particularly if the agent affects the liver, kidneys, or central nervous system.^{43,44} Lockable or secure high-level cupboards reduce the risk of infants coming into contact with such agents.⁴⁵

Falls in the home and community account for over a quarter of all new claims to the Accident Compensation Corporation (ACC), a Crown entity which provides all New Zealanders accident and injury insurance. Each year, these falls cost the New Zealand economy over \$400 million.⁴⁶ It is estimated that globally, 28%–35% of people aged 65 and over fall in the home each year, increasing to 32%–42% for those over 70 years of age.^{47,48} Environmental home hazards contribute to falls in as many as 50%–80% of patients treated in emergency departments.⁴⁹ Home hazards that increase fall risks are narrow steps, slippery surfaces, and insufficient lighting.⁵⁰ A New Zealand study found an estimated increase of 22% in the odds of injury occurrence associated with each additional home injury hazard.⁵¹

Adequate indoor lighting is necessary for visibility in the absence of natural light, allowing tasks to be completed at any time and encouraging a safer home environment. It has an impact on tenant health through improved mood and perception,⁵² circadian rhythm balance,⁵³ and reduction of fall risk.⁹

The address of the property should be clearly labelled and identifiable to make it easier for services to locate people

ple promptly in case of emergency, which can improve survival and recovery rates.

Hygiene

The following items are required as part of the WoF in relation to hygiene:

- There must be at least one safe working element, hob, or means of cooking as well as an oven (item 1);
- There must be adequate facilities to store, wash, and prepare food (item 2);
- There must be a reliable and adequate source of hot and cold water, plumbed into the house (item 3);
- There must be a functional toilet, which does not have a cracked or broken seat, cistern, or bowl (item 5);
- There must be a suitably located bath or shower in good working order (item 6);
- There must be a reasonably watertight stormwater collection system and sound connection to a wastewater system (item 23);

Adequate kitchen surface is necessary to keep raw and cooked food separate during preparation, and a sink is imperative for equipment to be washed.⁵⁴ Unhygienic food preparation can lead to infective illness due to cross contamination and bacterial growth. In New Zealand, there are an estimated 120,000 episodes of foodborne infectious disease every year. The attributed cost of these cases is \$55.1 million due to medical costs and loss of productivity. The main cause of foodborne disease is bacteria from the genus *Campylobacter*.

A potable clean water supply is required for personal and domestic use, including hydration, food preparation, and maintaining hygiene.⁵⁵ An average of 16.8 waterborne disease outbreaks occur annually, causing an average of 145 cases (3.6 per 100,000 people per year) of gastrointestinal disease per year.⁵⁶ While the majority of outbreaks are caused by contamination at the source, there are a number of isolated cases that were caused by damaged stormwater or sewage collection systems mixing with drinking water supplies.⁵⁷ This was seen after the Christchurch earthquake, as damaged home sewage-disposal systems contaminated drinking water and caused outbreaks of salmonella, campylobacter, norovirus, giardia, and hepatitis A.⁵⁸ These spread predominantly via faecal-oral transmission and by collecting on toilets and the surrounding surfaces.⁵⁹ If a toilet is non-functional or cracked, then it may precipitate the spread of infectious organisms. The requirement for housing to have potable drinking water and functional toilets and waste systems is the minimum standard required to prevent transmission of infection.

Hot tap water temperatures below 50°C put people at risk of infectious disease, specifically legionella infection. A WHO report on prevention of legionella infection determines a minimum flow temperature of 60°C at the heating unit combined with an at-tap temperature above 50°C will reduce the risk.⁶⁰ Poor water quality, stagnation, and inappropriate construction

materials can also increase the likelihood of legionella colonisation. The 2012 legionella incidence in New Zealand was 1.4 cases per 100,000 members of the population.⁶¹ It is suggested that around 30% of cases had been exposed to a water-related risk factor in the 10 days prior to disease onset, meaning as many as 19 legionella cases per year in New Zealand could be attributed to tap water.

A functioning oven or stove and adequate facilities for food preparation can promote home cooking in favour of processed and fast food alternatives. Given the rise in diet-related disease, homes need these basic kitchen necessities to encourage a healthier diet. Hygiene is also important to reduce disease burden as cleanliness reduces the risk of infection. The WoF will look to ensure that all properties have at least one functional bath or shower, promoting cleanliness and improved general health for people. ‘Functional’ means having visibly clean water that flows at a steady rate with adjustable temperature.

Security

To ensure dwellings are secure, the WoF requires the following criteria:

- Each opening window must have an effective latch or means of closure (item 14);
- The house must be able to be secured by means of lockable doors or entranceways (item 29).

Securely locking doors, effective window latches, and curtains are included in the WoF criteria as they protect against burglary and privacy invasion. Curtains are important for privacy in the home and can be used as a safety measure to prevent potential intruders from viewing the internal layout of the home and any material possessions that may become the target of burglary.

Basic repair

- The house, installed services, and finishes must be in a reasonable state of repair (item 22);
- The house must appear to be structurally sound, with no obvious indications of current or imminent movement or collapse (item 26);

The WoF assessment requires that the house be in a ‘reasonable state of repair’ and structurally sound, to identify any building issues that could pose potential health and safety risks to occupants or impact on the security or weather tightness of the structure.⁶²

Limitations

This article is limited to a summary of the evidence for each of the criteria in the housing WoF. The need to bring evidence for all 29 criteria together means that a full meta-analysis or

economic burden of disease estimate for each item is out of the scope of this article. In addition, this article addresses only the evidence for the criteria and not any of the economic, political, legal, or practical challenges involved in implementation.

Discussion and conclusion

The United Nation's advice on the right to housing includes the principle of habitability; ensuring adequate space; protection from cold, damp, heat, rain, wind, or other threats to health; structural hazards; and disease vectors.⁶³ Currently, a considerable amount of New Zealand housing, particularly in the private rental sector, does not adequately fulfil this principle of habitability and contributes to significant ill health.^{14,64} The government has obligations, under international settings, to take steps to ensure that all New Zealanders are able to fully realise their rights, including the right to habitable housing. In addition, the WHO⁶⁵ has recently released housing and health guidelines, which provide a set of recommendations to promote healthy housing for a sustainable and equitable future.

The WoF, properly enforced, would ensure a basic minimum standard to mitigate many of the disease burdens associated with, or caused by, poorer quality housing. This article has outlined the range of health effects that the WoF seeks to address. Aside from potential fiscal and economic advantages of the scheme, including reduced hospitalisations and increased productivity, the WoF could have positive impacts on well-being.

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Ethical approval

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