New Zealand Population Review, 47, 108–144

The Condition of Owned and Rented Housing in Aotearoa New Zealand

Te Āhuatanga o ngā Whare Noho Whai Rangatira me ngā Whare Noho e Rētihia ana i Aotearoa

VICKI WHITE,[*] ALEXANDRA FERGUSON,[†]
ROSEMARY GOODYEAR,[‡] KAY SAVILLE-SMITH[§]

Abstract

National housing assessment surveys have played a key role in understanding the condition of the New Zealand housing stock for a quarter of a century. Housing should provide a safe, healthy living environment for its occupants. The design and integrity of construction, insulation levels, ventilation and heating systems, and general state of repair will affect the efficacy with which a dwelling fulfils that role.

Using a national housing assessment survey and information on housing tenure, this paper explores the distribution of a range of indicators of housing condition, comparing between owned and rented stock. The results provide evidence of a divide between owner-occupied and rental housing, the latter being more likely to be in a poorer state of repair. The paper also looks at the participation rate of different population subgroups in the survey and considers the implications for our understanding of the distribution of housing conditions across New Zealand households.

Keywords: housing condition, surveys, tenure

[*] Vicki White is a research scientist at BRANZ. He kaipūtaiao rangahau a Vicki White kei BRANZ. Email/Īmēra: Vicki.White@branz.co.nz

[†] Alexandra Ferguson is a senior insights analyst on the Labour and Income team at Stats NZ. He kaitātari māramatanga matua a Alexandra Ferguson kei te rōpū Mahi me te Moni Whiwhi kei Tatauranga Aotearoa.
Email/Īmēra: alexandra.ferguson@stats.govt.nz

[‡] Dr Rosemary Goodyear is a senior data analyst at Stats NZ. He kaitātari raraunga matua a Tākuta Rosemary kei Tatauranga Aotearoa.
Email/ Īmēra:rosemary.goodyear@stats.govt.nz

[§] Dr Kay Saville-Smith is the research director at the Centre for Research, Evaluation and Social Assessment (CRESA) Ko Tākuta Kay Saville-Smith te whakataka rangahau kei te Centre for Research, Evaluation and Social Assessment (CRESA). Email/ Īmēra: kay@cresa.co.nz

Whakarāpopotonga

He tūnga tino nui tō ngā rangahau aromatawai ā-motu i ngā whare noho mō te mārama haere ki te āhuatanga o te katoa o ngā whare noho o Aotearoa puta noa i tētahi hauwhā rautau Ko te tikanga, me whakarato te whare noho i te taiao haumaru me te hauora mo ngā kainoho katoa. Ka aweawetia e te hoahoa me te tōtika o te hanga, e te rahi o te āraimātao, e te kaha o te pūnaha hauhau me te whakamahana me te āhuatanga whānui o te whare noho te kaha e tutuki ai i taua whare noho taua tūnga.

Mā te whakamahi i tētahi rangahau aromatawai whare noho ā-motu me ngā mōhiohio mō ngā āhuatanga whai whare noho, ka torotoro tēnei pepa i te horahora o ngā tohu whānui mō ngā āhuatanga o ngā whare noho, me te hanga whakatairitenga i waenga i ngā whare noho e noho ai te rangatira me ērā ka rētihia atu. Ka kitea i ngā kitenga he taunakitanga o tētahi whakawehenga i waenga i ngā whare e noho ai te rangatira me ērā ka rētihia, ā, tērā tonu pea ka kino atu te tūnga o ngā mea e rētihia ana. E aro ana anō hoki tēnei pepa ki te pāpātanga whai whāi mai o ngā rōpū iti ā-taupori rerekē ki te rangahau me te whai whakaaro ki ngā pāpātanga ki tō tātou mōhiotanga ki te horahanga o ngā āhuatanga whare noho puta noa i ngā kāinga o Aotearoa.

Ngā kupumatua: āhuatanga whare noho, rangahau, whai whare noho

Homes lie at the nexus between people, place and dwellings. The impact of housing performance on a sense of home and well-being is increasingly recognised in research. The association between health and house performance has prompted a raft of policy and regulatory responses, both in New Zealand and elsewhere. Our understanding, however, of the exposure of New Zealand's population to different dwelling performances has been relatively limited. A newly available resource, which combines data from an independent national housing assessment survey (the Pilot Housing Survey (PHS)) with data from the Stats NZ's 2018 General Social Survey (GSS) provides an opportunity to advance our understanding of the interface between population, dwelling performance and well-being. Analysis and reporting of that data is in progress. This paper provides background to this new window of insight into our population and the housing stock in which it resides. It also considers the way in which participation in a national housing assessment survey is variable across population groups and reflects

on the implications of that variability for our understanding of the interaction between people and dwelling performance.

Background

The need for robust data on housing condition

As far back as 1935 the New Zealand government acknowledged the need to collect information on the state of housing in New Zealand, noting the implications of poor housing for occupant health and well-being. The Housing Survey Act 1935 set out provisions and obligations for local authorities to undertake housing surveys:

> For the purpose of ascertaining the extent to which the existing housing accommodation in the Dominion falls short of reasonable requirements and in particular for the purpose of ascertaining particulars as to:
>
> (a) The extent of overcrowding of dwelling houses throughout the Dominion
> (b) The extent to which the physical condition of existing dwelling houses fails to ensure for the people of the Dominion the maintenance of a reasonable standard of health and comfort
> (c) The number of people who are detrimentally affected by existing housing conditions
>
> it shall be the duty of every local authority to which this Act applies…to proceed to make a housing survey of the whole of its district...
>
> (Housing Survey Act 1935)

In 1937, following the passing of the Housing Survey Act, the first national housing assessment surveys began, undertaken by local authorities on behalf of central government. By March 1939, surveys had been carried out in 115 of the 119 local areas. The results covered 225,363 dwellings, where 901,353 people lived (Taylor, 1986). Of buildings used as dwellings, 31,663 were classed as unsatisfactory but repairable and 6827 as totally unsatisfactory.

While significant in scale and findings, these surveys were not repeated. Some basic property information and details on the

condition of roof and wall cladding became available through rating valuation data held by Valuation New Zealand (now Quotable Value) but this was not updated regularly as a matter of course. A study by the National Housing Commission in the 1980s concluded that the information was insufficient for providing an in-depth picture of the condition of our housing stock and detailed inspections of properties were required (Page et al., 1995).

BRANZ began reporting on the condition of New Zealand housing from 1994, building on a model developed in England to deliver a national House Condition Survey (HCS). The HCS adopted a set of objective criteria to rate the condition of dwelling components. The condition rating provided an indication of the state of repair and maintenance requirements, from which repair cost estimates could be derived. As well as being the first survey of its kind in New Zealand, providing a new source of information for policymaking, it also proved useful for building researchers to understand the performance of different building materials and to target further research. The HCS was repeated every five years, and 2015/16 marked the fifth HCS. While the key aims have remained consistent throughout the life of the survey, the content and sample have evolved in line with changing construction practices and data needs. The first three surveys included owner-occupied dwellings in the three main centres (Auckland, Wellington and Christchurch); from 2010, the HCS expanded to nationwide coverage, to include rural houses and rented dwellings.

Linking housing condition and health

There has been considerable effort within building science to establish the relationship between house condition and performance in relation to energy, comfort, humidity and resilience. Similarly, there is an important body of research in New Zealand and elsewhere that connects parameters of dwelling performance to health outcomes. While the HCS played an important role contributing to

this understanding, its focus is on the dwelling rather than the occupants. The extent to which the HCS could be used in distributional analysis of house condition across the population, and people's experience and perceptions of house condition, has therefore been limited. This gap was addressed in 2018/19, when BRANZ entered a partnership with Stats NZ to trial a new approach to collecting robust data on the condition of our housing stock and the use of that stock.

This partnership responded to a series of reviews and papers including the 2009 Review of Housing Statistics which identified what they referred to as 'housing quality' as a key information gap in New Zealand's data system (Statistics New Zealand, 2009), the 2012 Review of Tier 1 Statistics (Statistics New Zealand, 2012), and the 2015 scoping paper by Statistics New Zealand that presented options for addressing the need for more robust data on housing quality and contributing to the development of a Tier 1 Statistic (Statistics NZ, 2015).

In 2018/19, BRANZ undertook to review its HCS and trial a new approach to collecting objective data on the condition of New Zealand housing. This trial included developing new data collection and survey management tools (a mobile and web-based application) and partnering with Stats NZ to utilise its 2018 GSS as a means to recruit participants for a housing assessment survey.

Initially intended to be a small pilot survey of 50 to 100 houses, the Ministry of Business, Innovation and Employment (MBIE), who was at the time leading a project with Stats NZ to progress measures of housing quality, saw this pilot as a unique opportunity to source data to support that work. With co-funding from MBIE, the pilot, which became known as the Pilot Housing Survey (PHS), therefore extended in scale to a national survey with a target of 800 houses. This was achieved, with 832 surveys completed, enabling nationally representative estimates to be generated from the data.

The PHS instrument

The BRANZ 2015 HCS was the starting point for developing content for the PHS. The HCS is a very detailed building assessment, collecting information on materials, defects and condition for all components of a dwelling, inside and out. It typically takes around two to three hours for a trained assessor to complete the survey. To reduce participant burden and test the extent of information that could be robustly recorded within a limited time frame, the PHS was designed to take around one hour on average to complete. This required significantly reducing the previous HCS. Content for the PHS was prioritised based on data needs identified in partnership with MBIE, and the development of the concept of 'housing habitability' within the new Conceptual Framework on Housing Quality (Figure 1).

Originally identified as a dimension of 'housing adequacy' in the 2009 Review of Housing Statistics, housing habitability was later adopted as one of the four dimensions of the conceptual framework for housing quality. It is this dimension that the PHS sought to provide some data on: "the primary function of housing as providing shelter, focusing on the condition of the house's physical structure and the facilities within it" (Stats NZ, 2019). Table 1 provides an overview of the data collected in the PHS. Further details are available in White (2020).

Method: Sample and surveying

Household recruitment and sample selection

The PHS involved a new approach to recruiting households, utilising a national household survey administered by Stats NZ: the General Social Survey (GSS). The GSS is a national survey conducted every two years by Stats NZ. Interviewing around 8000 people, it focuses on well-being across a range of social and economic outcomes. In 2018, the GSS included a supplement collecting data on occupant

Figure 1: The conceptual framework for housing quality

Source: Stats NZ (2019).

perceptions of housing suitability, healthy housing behaviours, home maintenance, housing tenure security and mobility, access to public facilities, sustainable living behaviours and understanding of environmental sustainability issues. Households were recruited to the PHS through the 2018 GSS, with all GSS households asked if they would be willing to be approached to participate in the BRANZ housing survey. Participation was voluntary ('opt-in'). Households that went on to take part in the PHS were offered a supermarket voucher in recognition of their time and contribution. Forty-six per cent of GSS households agreed to be contacted by BRANZ about taking part in the survey.

Table 1. Overview of pilot housing survey content

Topic	Information recorded
Basic amenities	Hygiene and sanitation
	Food preparation and cooking
	Potable and hot water
Health and safety	Slips, trips, fall hazards (access and decks, internal stairs)
	Security (lockable doors, lighting)
	Damp and mould
Keeping moisture out	Condition of exterior envelope (roof, cladding windows and doors
	Drainage (guttering and downpipes)
	Subfloor moisture (ground moisture barrier, subfloor ventilation)
Managing moisture	Mechanical extract ventilation
	Openable windows
Keeping the heat in	Insulation (roof space and subfloor)
	Glazing
	Curtains
	Draughts
Heating	Type and locations
State of repair	Materials, defects and condition of exterior Condition of interior linings

To achieve the overall PHS target of 800 housing assessments, Stats NZ drew a sample each month from consenting GSS households for transferring to BRANZ. The monthly sample size was guided by a monthly quota, set by BRANZ, designed to ensure the overall target of 800 housing assessments was achieved, while also allowing for attrition. The target and quota varied from one month to the next for logistical reasons. For example, an initial trial was run in June 2018 with just a handful of houses from two regions. Once the PHS was fully up and running nationally (from August 2018), the monthly quota was gradually increased, allowing surveyors to become accustomed to using the tool. The quota was then decreased over

December and January to allow for the holiday period, before ramping up again in the final months towards completion (Table 2).

As households were recruited from the GSS, and this was completed in the field in March 2019, the PHS was similarly time stamped. The final sample of consenting households was provided by Stats NZ in April 2019, and housing surveys were completed by the end of May 2019.

A stratified random sampling approach was used by Stats NZ to select the sample from all consenting households each month. Selection weights were applied based on the New Zealand Index of Deprivation 2013 (NZDep2013) (tertiles) and tenure (owner-occupied/ not owner-occupied), aiming to achieve a balance of each group.[1] Geographical distribution was mainly proportional to the number of consents in each region (assuming no strong region-NZDep or region-tenure correlation). However, due to the unpredictable nature of consents, some regions experienced higher uptake rates than others.

Table 2 presents the final unweighted sample count for the PHS, by region, sampling month and tenure. Weights relating to tenure, NZDep and region were developed by Stats NZ and applied to the final PHS dataset to adjust for differing household participation levels.[2]

Survey delivery and data collection tools

A bespoke web-based survey management application and mobile app were developed to deliver the PHS, utilising an existing prototype application developed by Land Information New Zealand (LINZ). The LINZ application was modified and adapted to provide the functionality and content required for the PHS. Dwelling assessors were trained to undertake the survey, with training covering health and safety, ethics and code of conduct, and cultural awareness and sensitivity, as well as using the data collection tools and how to complete the survey.

Table 2. Unweighted sample counts by region, month and tenure

Region	Survey count	Month (2018–19)	Survey count	*Cumu-lative*
Auckland	122	June (2018)*	6	6
Bay of Plenty	65	July*	3	9
Canterbury	145	August	65	74
Gisborne	32	September	114	188
Hawkes Bay	25	October	136	324
Manawatu-Wanganui	92	November	139	463
Marlborough	9	December	56	519
Nelson	9	January (2019)	22	541
Northland	31	February	84	625
Otago	53	March	106	731
Southland	27	April	81	812**
Taranaki	22	May	20	832
Tasman	14	***Total***	***832***	
Waikato	85	**initial trial months. **target achieved.*		
Wellington	98	**Owner-occupied**	505 (60.7%)	
West Coast	3	**Not owner-occupied**	327 (39.3%)	
Total	***832***	***Total***	***832***	

A key component of the PHS, consistent with methods applied in the BRANZ House Condition Survey over the last two decades, is the assessment of the state of repair of different dwelling components. This condition assessment is made based on the extent and severity of defects and is a comprehensive assessment of the overall state of repair and need for maintenance of specific dwelling features, taking account of all defects and issues affecting that component. Table 3 sets out the specification for the condition ratings.

Table 3: Condition rating assessment guide

Condition	Description and Assessment Criteria
Excellent ★★★★★	"As new condition" **Visually:** no signs of damage/wear and tear **Function:** item is performing its main function **Maintenance demand/timeline**: none/none
Good ★★★★	"Good, clean condition" **Visually:** minor signs of wear and tear **Function:** item is performing its main function **Maintenance demand/timeline**: none/none
Average ★★★	"Sound and clean" **Visually:** minor marks, chips and slight deterioration/signs of wear and tear **Function:** item is currently performing its main function **Maintenance demand/timeline**: normal work/minor repairs; e.g. repaint, clean/within a year
Poor ★★	"Needs work" **Visually:** badly marked, damaged or chipped **Function:** evident this is not working as required or it is nearing the end of its expected life **Maintenance demand/timeline**: significant repair or maintenance work within 3 months
Serious (★)	"Urgent attention" **Visually:** item is either broken or needs to be repaired/replaced or item is missing and needs to be installed; check for major and obvious faults, cracks, holes, serious damage, hazards **Function:** evident this item is not working, doesn't meet legislation/regulation requirements, is not installed, is a health and safety, security or fire risk, directly impacts on weathertightness, has major damage where replacing may be less expensive than repair, has reached end of expected life, is obsolete and cannot be repaired. **Maintenance demand/timeline**: major repair/urgently needed.

Source: BRANZ

The dwelling characteristics

Almost everyone in New Zealand lives in a private dwelling and all private dwelling types (houses, joined units, flats/apartments) were eligible to take part in the PHS. This was the first time joined dwellings and multi-storey, purpose-built apartments had been included, as the HCS had previously been largely limited to stand-alone dwellings.

The PHS recorded information on built form (whether the dwelling was joined or stand-alone, and number of storeys), typology, size (approximate total floor area) and number of bedrooms. While all dwelling types were eligible, stand-alone houses made up the vast majority, accounting for 84.0 per cent of the sample, compared with 16.0 per cent for joined dwellings. These figures are consistent with the dwelling types recorded in the 2018 Census, in which 84 per cent were classified as separate house and 15 per cent joined dwellings.

While dwellings in multi-storey buildings (e.g. apartments) were eligible for the PHS, the results show these made up a very small proportion of the sample. This reflects the nature of New Zealand housing, which still predominantly consists of low-rise dwellings. In 2018, the Census recorded that 70 per cent of occupied private dwellings had one storey, while 28 per cent had two or three storeys. Less than 1 per cent of dwellings consisted of 10 or more storeys. The PHS shows similar proportions, with 69.3 per cent of the sample being single storey, 29.1 per cent two or three storeys, and 1.6 per cent more than three storeys. Just under 2 per cent of the sample was classed as a purpose-built flat or apartment block.

There is a strong variation between dwelling type and tenure evident in the analysis of house characteristics from the PHS. Owner-occupied dwellings were more likely to be stand-alone houses while rentals were more likely to be multi-unit/joined dwellings.[3] Rented dwellings also tended to be smaller, with both smaller footprints and fewer bedrooms. This is again consistent with findings from the latest census, which showed a higher percentage of one- and two-bedroom houses among rentals. Differences in dwelling capacity of owner-occupied and rented households have also been evidenced for subgroups of the population. Analysis of 2018 Household Economic Survey data explored the living situations for low-income essential workers in the context of the COVID-19 lockdown. This showed higher rates of crowding and proportionally fewer dwellings with a spare room among essential workers in rented households (Saville-

Smith & Mitchell, 2020). Research into the housing choices by 20- to 40-year-olds in the Auckland region showed that dwelling size was a key driver for moving house (Saville-Smith et al., 2010).

As well as tending to be larger, the PHS showed owner-occupied dwellings were more likely to be newer. Around a quarter of owner-occupied houses surveyed were built post-1996, compared with less than a tenth of rented dwellings. Conversely, a higher proportion of rentals was housing from the 1960s–1980s era (17.3 per cent compared with 2.9 per cent of owned dwellings).

Dwelling condition and implications for performance

A comprehensive overview of findings from the PHS is provided in a BRANZ report (White, 2020) and in the publication *Housing in Aotearoa* (Stats NZ, 2020). In this paper we provide a summary of the key condition parameters and comment on the variation in condition across the owner-occupied and rented housing stock. First, we consider the implications of housing condition in terms of dwelling performance and impact on populations exposed to poorly performing housing.

The condition of houses matters for the people living in them for four key reasons. First, the resilience of dwellings is affected by dwelling condition. The immediate issue for occupants relates to their vulnerability in the context of adverse natural events, such as storms and earthquakes.

The second reason is that house condition affects the safety, thermal performance and health of the dwelling. The extent to which occupants are exposed to overheating or cold, damp and mould, or injury is strongly associated with dwelling design, condition and amenity. The 2018 GSS showed that half of people considered their home sometimes or always colder than they would like in winter. Tenants were much more likely to report feeling cold, with one-third (33.0 per cent) saying their house or flat was always or often colder than they would like, compared with 15.0 per cent of owner-occupiers.

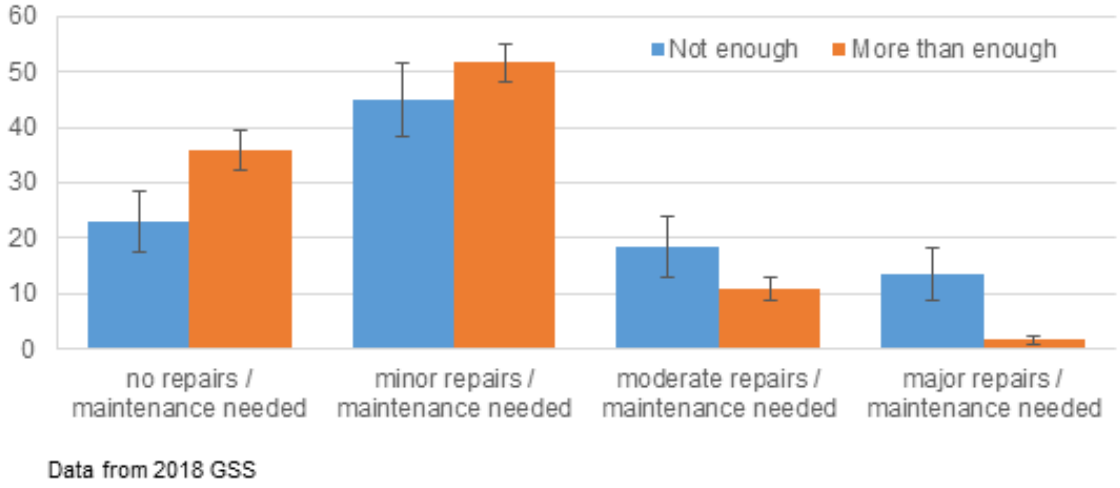
The GSS also showed that people experiencing housing quality problems tended to experience poorer mental well-being and have lower self-rated overall life satisfaction (Stats NZ, 2020).

The third reason house condition matters to occupants is that house condition is associated with operating costs, particularly energy costs and fuel poverty. The 2018 GSS showed that cost was a key factor for occupants not heating their living area in winter. This was higher among rentals (40.5 per cent compared with 23.5 per cent for owner-occupiers).

The final reason house condition matters is because maintenance and repairs represent a financial liability for residents or occupants. Maintenance requirements and costs will vary widely by property; for example, depending on age, design, size, materials and location. BRANZ estimates that the average cost of annual maintenance required to keep a stand-alone house in good condition overtime is around 0.5–2.0% of the value of the house (excluding the land) (Page, 2017). The 2018/19 Household Economic Survey recorded an average weekly expenditure of $28.60 for all households on property maintenance materials and services (equivalent to just under $1500 a year). The 2018 GSS found that people living in an owner-occupied dwelling were more likely to report that their house or flat needed major repairs or maintenance when they did not have enough money for everyday needs (13.5 per cent said this compared with 1.6 per cent of people who said they had more than enough money).

The PHS assessment of the condition of different dwelling components found the following.

Figure 2: Owner-occupier perceptions of maintenance and repairs needed by income adequacy



Data from 2018 GSS

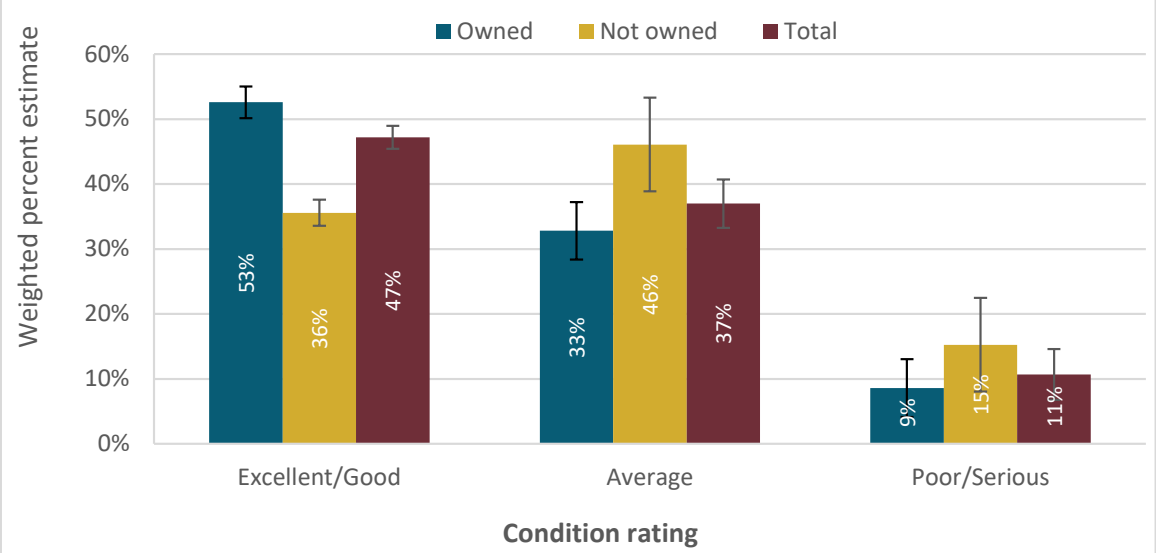
Roofs

In nearly half (47.2 per cent) of houses the roof was in excellent or good condition, while for 10.7 per cent of dwellings the roof was in serious or poor condition. The roof was more likely to be in better condition for owner-occupied dwellings than for non-owner-occupied houses (Figure 3).

Wall cladding

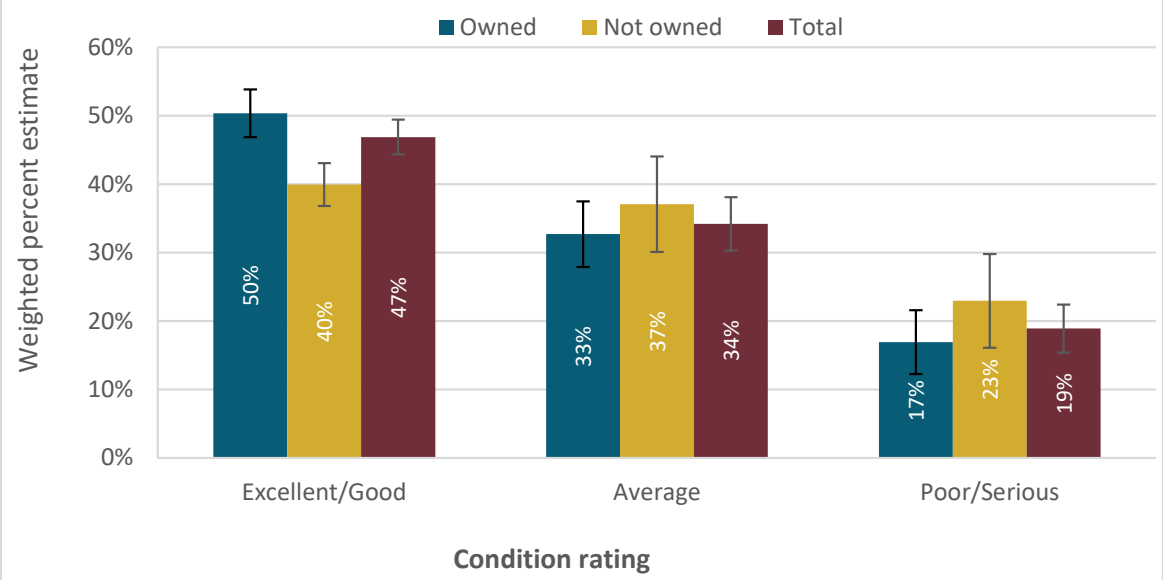
Nearly half of houses (46.9 per cent) had wall cladding in excellent or good condition, while around a fifth (18.9 per cent) had cladding in poor or serious condition (Figure 4). Owner-occupied dwellings were again significantly more likely to have cladding in better condition (excellent or good) than non-owner-occupied houses.

Figure 3: Condition of roofs by tenure and overall



Note: Excludes dwellings with another dwelling above and where the roof condition could not be assessed.

Figure 4: Condition of wall cladding by tenure and overall



Windows and exterior doors

Rented stock also showed more signs of defects with windows and window frames, with 58.1 per cent of rentals having at least one listed defect compared with 42.1 per cent of owner-occupied properties. Around one in five rental dwellings (19.4 per cent) had windows and exterior doors in poor or serious condition. Owner-occupied dwellings were significantly more likely to have windows and doors in excellent

or good good condition (58.2 per cent compared with 37.9 per cent of rented).

Drainage

Drainage, including effective guttering and downpipes, is important for removing sources of moisture away from the dwelling. The PHS showed around a fifth (20.7 per cent, ± 3.1 percentage point (pp)) of houses assessed had guttering and downpipes with holes or broken or missing parts.[4] Blocked guttering was more prevalent in rented houses (17.5 per cent) than owner-occupied houses (9.3 per cent).

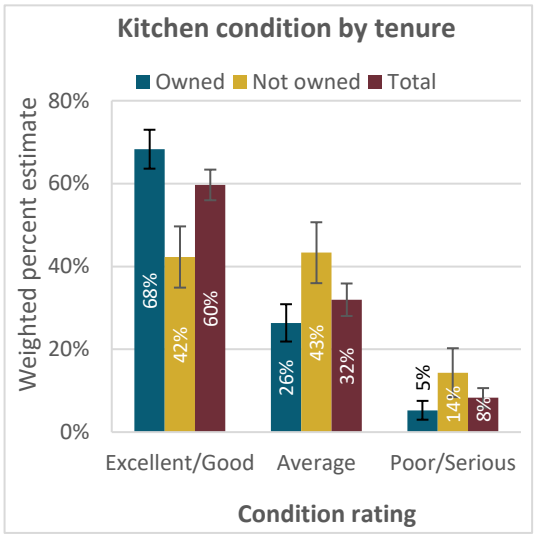
Subfloor moisture control

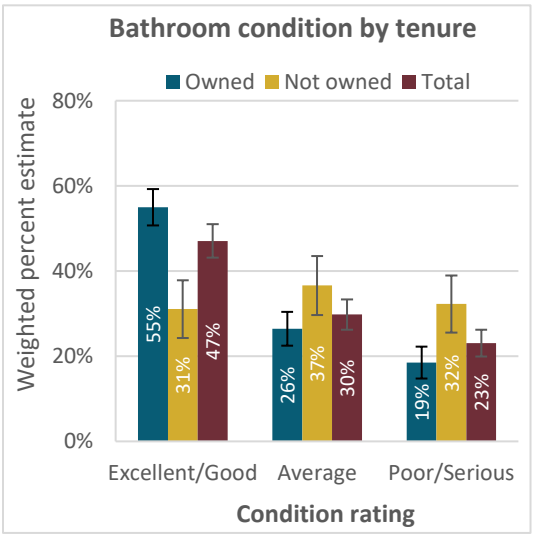
The ground under a house can release 40 litres per day on average for a 100m^2 dwelling (McNeil et al., 2016). Effective management of moisture from the subfloor, to prevent it entering the dwelling or decaying subfloor components, is therefore critical for maintaining a healthy, dry home. Houses with suspended floors are usually older dwellings. Installing a ground cover under the house can be an effective means of managing subfloor moisture. The PHS results showed the majority (72.5 per cent, ± 4.0 pp) of houses with a suspended floor lacked any ground moisture barrier. While around half (47.1 per cent, ± 5.0 pp) of the houses with a subfloor were dry at the time of the survey, over a third (34.9 per cent, ± 5.0 pp) were damp or showed signs of ponding. Damp and ponding under a house is indicative of poor or insufficient drainage, or leaks from the plumbing system.

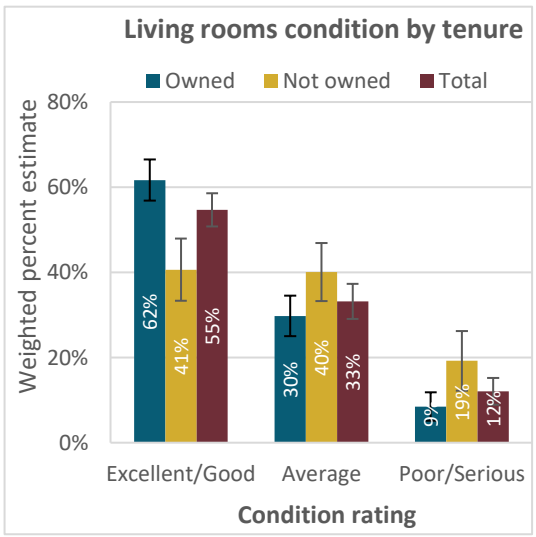
Interior conditions

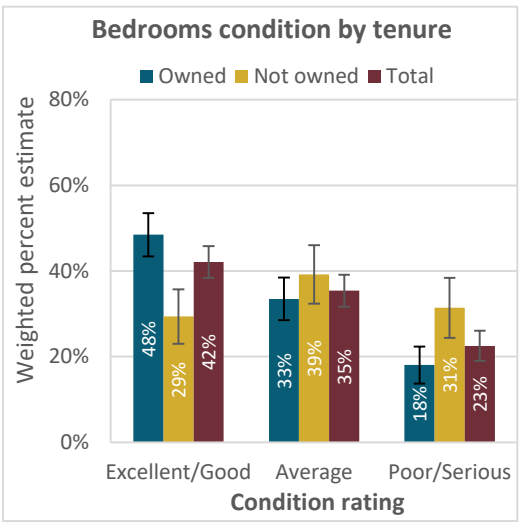
The interior of houses was consistently in poorer condition in rented dwellings compared with the owner-occupied survey sample (Figure 5).

Figure 5: Condition of interior by room and tenure









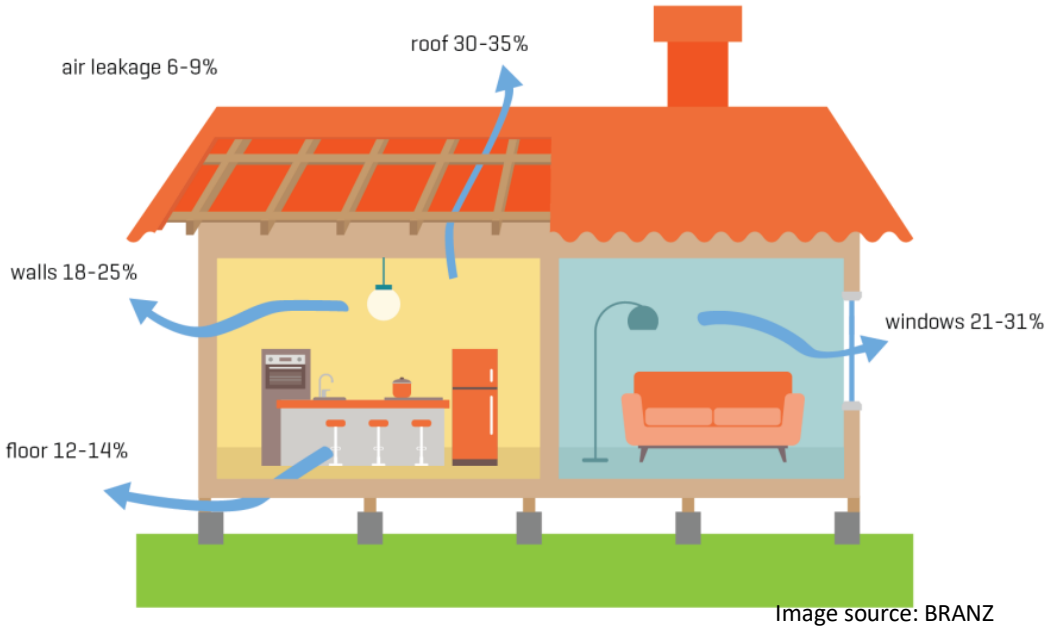
Comfort and energy efficiency

One of the primary functions of houses is to protect people from extremes of temperature and wet. The dwelling design and integrity of construction, as well as factors related to thermal performance such as insulation levels, glazing, draughts, window coverings and state of repair, will have a significant bearing on a dwelling's effectiveness. The 'leaky building' crisis that emerged in the mid-1990s is an example of where poor regulation and monitoring of construction methods resulted in widespread and significant failure of building integrity (Howden-Chapman et al., 2012). The introduction of standards for insulation, heating, draught-proofing, moisture ingress and drainage in rental dwellings through the 2019 Healthy Homes Guarantee Act shows recognition by government of the implications of poorly performing dwellings for occupant comfort and well-being.

An uninsulated house can lose 30–35% of its heat through the roof, with walls and windows being the next most important areas of heat loss (Figure 6). Insulation became mandatory in all new houses in New Zealand in 1978. Retrofitting houses built before this date is necessary to bring older stock up to current standards. The effectiveness of roof insulation retrofits depends on both the depth, material and quality of installation.

The PHS suggests around half (49.2 per cent, ± 4.3 pp) of dwellings had less than 120 mm insulation in the roof space, while 45.4 per cent (± 4.5 pp) had at least 120 mm (the minimum depth recommended by the Energy Efficiency and Conservation Authority). However, around half of insulated roofs had defects with the insulation that could compromise its effectiveness. There was no significant difference between owned and rental properties in roof insulation levels.

Figure 6: Heat loss in an uninsulated dwelling



Over a third of the PHS houses had an entirely concrete slab foundation (35.8 per cent of the sample, ± 3.9 pp). This was more common among owner-occupied houses (39.7 per cent, ± 5.1 pp) than non-owner-occupied dwellings (28.1 per cent, ± 7.5 pp). The finding reflects the comparatively older age of the rented stock relative to the owner-occupied stock. Of those with suspended floors, three in five houses had at least 80% coverage of underfloor insulation. However, almost a quarter (23.1 per cent ± 4.2 pp) had less than 80% coverage, with most of those having no insulation. There was no significant difference between the proportion of owned and rented houses lacking insulation in the subfloor.

Although double glazing conveys significantly better thermal performance, which can help reduce the risk of condensation, mould and damp, over three-quarters (75.7 per cent) of the PHS houses were entirely single glazed. Newer dwellings are more likely to be double glazed, which aligns with changes to the New Zealand Building Code (NZBC) in 2008. Twice the proportion of owner-occupied dwellings were fully double glazed compared with rented houses. Around one-

fifth of owner-occupied dwellings were fully double-glazed – twice the proportion of rented houses.

Gaps around windows and doors, between floorboards or unblocked (unused) chimneys can be a source of draughts and affect comfort in the home, even if the roof and subfloor are well insulated. It is for that reason that the Healthy Homes Standards require landlords to ensure "any unreasonable gaps or holes in walls, ceilings, windows, floors and doors that are not necessary and cause noticeable draughts" are blocked (HUD, 2020).

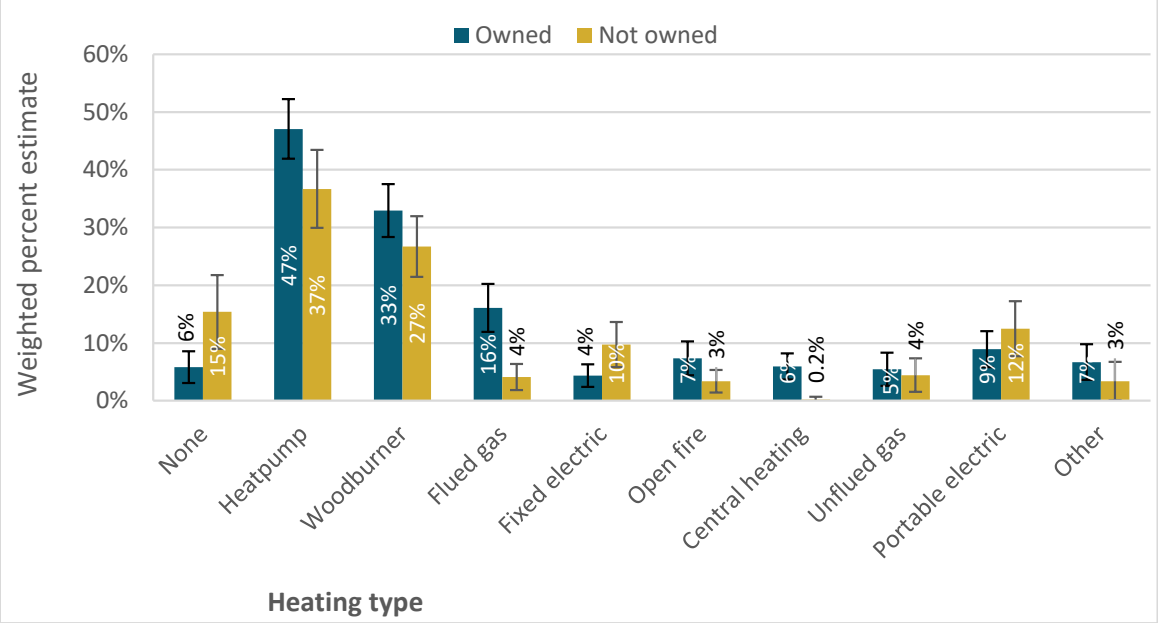
Gaps around windows and doors were more commonly observed in non-owner-occupied properties. Around one third of rental properties (30.6 percent, ± 6.0 pp) had "moderate" or "large" gaps (or "some" or "many") around windows and doors, while 54.9 per cent of owned and 35.6 per cent of rentals had "no visible gaps".

The presence of good insulation in the roof space and subfloor will, in most cases, not in itself result in a consistently and sufficiently warm home. Most dwellings in New Zealand will at some time of the year require some heating to ensure indoor temperatures are maintained at a healthy level (at least 18 °C in occupied rooms (WHO, 2018)).

The type of heating appliance, and its fuel supply, have implications for efficiency and effectiveness, and therefore how much it costs to run to achieve adequate indoor temperatures.

Heat pumps and enclosed wood burners – which are among the most effective heating appliances commonplace to New Zealand – were found in 43.6 per cent and 30.9 per cent of living areas, respectively. Non-owner-occupied houses were more likely to have no permanent heating in living areas compared with owner-occupied houses (Figure 7). The data suggests that owner-occupiers have greater access to heat sources; i.e. there were more fixed and portable heating devices in owner-occupied dwellings compared with rented dwellings, even when allowing for dwelling size (owner-occupied dwellings having more living areas and bedrooms on average).

Figure 7: Presence of different heating types in living areas of owned and rented houses



While these figures indicate the proportion of dwellings in which the assessor recorded a heating appliance in each room at the time of the survey, it possible portable heating appliances were located elsewhere (e.g. stored in cupboards), particularly when surveying in warmer months. These figures could therefore underestimate the availability of heating in some dwellings. Portable devices may also get moved around the home depending on occupants' needs (e.g. from the living area in the evening to the bedroom at night).

While most houses surveyed had a source of heating in the living area, this did not apply to bedrooms. Over half of houses (54.3 per cent) had no heating in any bedrooms. Where heating was present in bedrooms, portable electric was the most common type.

Managing moisture generated within the home

Daily activities within the home generate moisture. It is important to be able to ventilate and effectively move this internally generated moisture to the outside to minimise the risk of damp and mould. This is particularly important in high-moisture areas of the home, such as

the kitchen and bathrooms. This has been recognised within the Healthy Homes legislation for rental properties in New Zealand, which requires landlords to have mechanical extraction in kitchens and bathrooms.

Half of bathrooms and just over half (55 per cent) of kitchens had mechanical extract ventilation that worked and vented outside. Owner-occupied dwellings were significantly more likely to have functional kitchen extraction: 64.5 per cent compared with only 36.7 per cent of rented houses.

Safe Homes

The condition of the dwelling and presence of certain features (such as smoke alarms, water heating and storage, handrails and balustrades) also have implications for the health and safety of occupants.

Smoke alarms

Smoke alarms are a requirement under NZBC clause F7 *Warning systems*. This applies to new homes and all existing homes undergoing building work. Consistent with the NZBC, the Residential Tenancies (Smoke Alarms and Insulation) Regulations 2016 also require all rental homes to have smoke alarms:

- On floors with bedrooms, the smoke alarms must be located either in every sleeping space or within 3.0 m of every sleeping space door.
- In multi-storey homes, there must be at least one smoke alarm on each level.

The location and working status of smoke alarms was recorded as part of the survey (this included testing the alarm where possible). One in ten houses surveyed had no smoke alarms at all, and in a further 6.9 per cent of dwellings, no alarms were working at the time of the survey. In around three-quarters of houses (71.7 per cent, ± 3.5 pp,) all smoke alarms present were working at the time of the survey, with no significant difference between owned and rental

dwellings. In around a quarter of those houses (24.6 per cent, ± 3.1 pp), the smoke alarms were located further than 3 metres from all bedrooms.

Hot water temperatures

The temperature of hot water at the tap should be in a safe range to avoid scalding, but where a cylinder is present, water should also be stored at a sufficient temperature (to a recommended 60 ˚C) to prevent *Legionella* bacteria growth.

The New Zealand Building Code states that in the home, the maximum water temperature at the tap for showers, baths and handbasins is 55°C, and recommends no higher than 45°C in some instances (e.g. if young children are present).

The PHS recorded the temperature at the hot water tap in all bathrooms. The results suggest around one-third of houses had hot water exceeding 55°C in a bathroom. Hot-water tap temperatures exceeding this threshold were more commonly observed in non-owner-occupied dwellings than in owner-occupied houses (28.3 per cent).

Stairs

The NZBC specifies requirements for internal stairs to safeguard against the risk of injury from trips and falls. These include specifications for handrails and balustrades, and tread and riser depth and height. Internal stairs were assessed against some of these requirements and other potential defects that could present a trip or fall hazard. As a large proportion of the housing stock is single storey, this assessment applied to a subset of the survey sample. Just over one-quarter (26.3 per cent, ± 4.0 pp) of the houses surveyed had internal stairs. Stairs were more common in owner-occupied dwellings (31.3 per cent) than in non-owner-occupied dwellings (16.3 per cent), which aligns with the dwelling type as owner-occupied dwellings are more likely to be more than one storey.

Around one in ten houses (8.6 per cent, ± 5.0 pp) that had an internal stair had at least one defect with the stair that could pose a trip or fall hazard; for example, structural issues, loose handrails, unsafe surface, inadequate lighting. If non-Code compliant handrails and balustrades are included, this increases to 38.1 per cent (± 8.5 pp). However, given the smaller sample of houses that had stairs – and hence larger sample errors – these results need to be treated with some caution.

Access paths, steps and decks

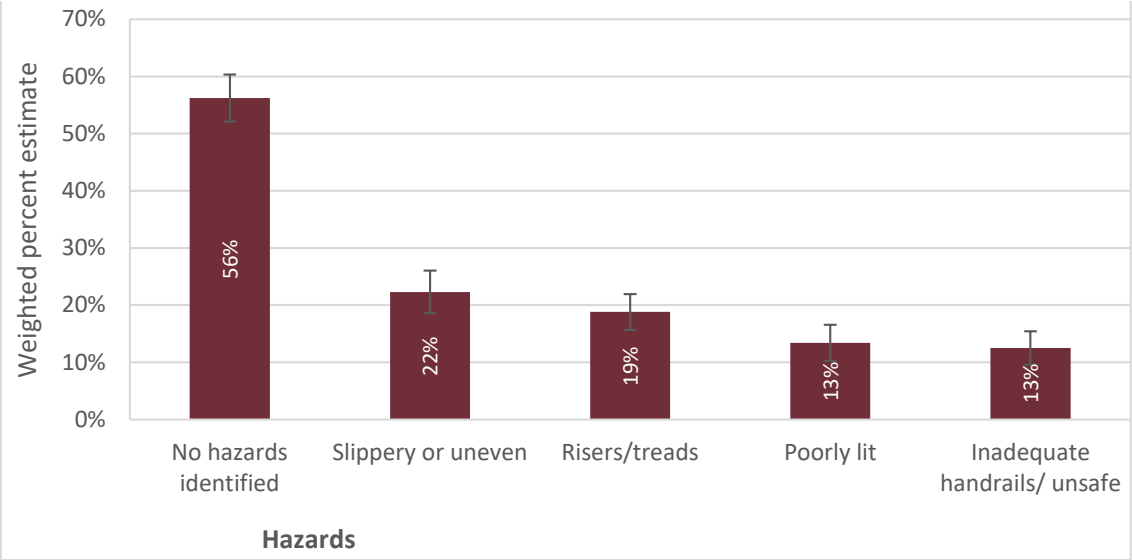
The PHS recorded the presence of potential hazards with access paths and steps, including:

- slippery, uneven, cracked surfaces or obstructions
- risers or treads not to Code requirements (too high or insufficient depth) or varying heights/depths
- unsafe structure (structural cracks, loose fixings)
- inadequate or missing handrails

Over half of the properties had none of these listed hazards (Figure 8). The most common hazard identified was a slippery or uneven surface, affecting around one-fifth of the properties surveyed.

Around one-third (30.5 per cent, ± 4.3 pp) of PHS houses had decks above one metre in height. Over half (55.9 per cent, ± 8.8 pp) of these houses with a deck showed signs of one or more potential hazard.

Figure 8: Presence of different defects and potential hazards with access paths and steps



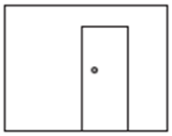
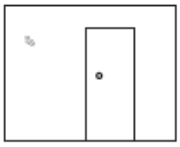
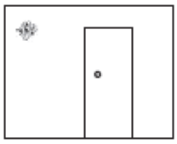
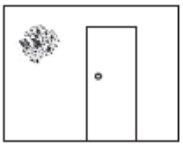
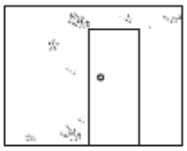
Mould

Mould is a key indicator of poor indoor environmental quality and can compromise occupant health, with links to asthma, respiratory infections and rheumatic fever (see, for example, Mendell et al., 2009).

The PHS assessed the extent of visible mould in all rooms of the house. It used an assessment scale from "none" through to "large or extensive" (see Figure 9). The assessment applied to all surfaces including wall, floor and ceiling linings, windows and curtains.

Mould was observed most in bathrooms, followed by bedrooms. Fifty-seven per cent of bathrooms showed some signs of mould, with 28.4 per cent (± 3.4 pp) having moderate or worse mould. Mould in bathrooms was more commonly observed in rentals, with 41.2 per cent (± 7.1 pp) having moderate or worse mould compared with 22.0 per cent (± 4.3 pp) of owner-occupied dwellings. Mould was also more evident in kitchens in rented houses, with 24.4 per cent (± 8.0 pp) having moderate or worse visible mould compared with 8.4 per cent (± 3.2 pp) of owner-occupied dwellings.

Figure 9: Mould assessment scale used in the PHS

Visible mould categories	Size	Commentary
NONE		You cannot see ANY mould on any surface, taking care to inspect walls, windows, ceilings, floor coverings and backs of curtains.
SMALL ***~door knob***		"manageable for most residents" Size: specks or see image for single patch Location: specks on one or two features or see image for single patch Maintenance demand/timing: surface cleanable (vinegar & water) or wash curtains/linings. Action needed: within a week
MODERATE ***~A4 paper***		"requires concerted resident effort" Size: see image for single patch Location: one patch in a room, i.e. only on one feature (including curtains). Maintenance demand/timing: surface cleanable (vinegar & water) or wash curtains Action needed: within a week
LARGE **OR:**		"needs specialist attention" Size: see image for single patch Location: one patch in a room, i.e. only on one feature including curtains. Maintenance demand/timing: beyond householder DIY action, i.e. embedded in material e.g. lining material or whole curtains need replacement Action needed: urgent, consider not using room.
EXTENSIVE		"infestation, needs specialist attention" Size: varying sizes beyond specks Location: across multiple features in a room Maintenance demand/timing: extent puts this beyond householder DIY action, i.e. embedded in multiple materials, some needing replacement Action needed: urgent, consider not using room.

Source: Based on Shorter et al. (2018).

Moderate or worse mould was observed in the living area(s) in 13.4 per cent (± 4.1 pp) of owner-occupied houses compared with 29.0 per cent (± 7.8 pp) of rentals. Moderate or worse mould was observed in at least one bedroom in 48.3 per cent (± 7.6 pp) of rentals compared with 28.5 per cent (± 5.3 pp) of owner-occupied dwellings. Overall, 54.0 per cent of houses showed some signs of visible mould in bedroom(s), with 35.1 per cent (± 4.3 pp) being moderate or worse.

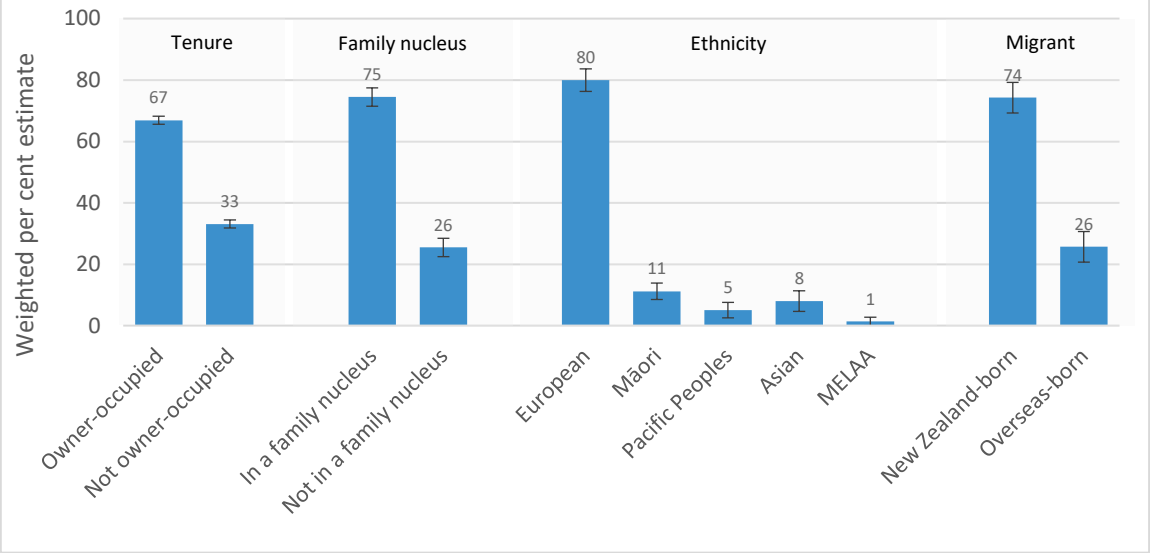
Who participated? The people

As discussed earlier, weights were developed for the final PHS data set to adjust for the sample, which intentionally over-sampled on non-owner-occupied households and aimed for an even spread across the three area-based deprivation levels. The weighting also adjusted for regional spread. Figure 10 shows some socio-demographic characteristics of the weighted PHS data set. Owner-occupied households made up two-thirds (66.9 per cent, ± 1.3 pp) of the weighted sample, and three-quarters (74.5 per cent, ± 3.0 pp) were in a family nucleus (a couple and/or with children). In four-fifths (80.0 per cent, ± 3.7 pp) of households, the consenting participant was of European ethnicity, and in three-quarters (74.3 per cent, ± 5.0 pp) was New Zealand-born.

Consent rates

As outlined earlier in the section on recruitment, all households in the 2018 GSS were asked if they were willing to be contacted by BRANZ about participating in the PHS. This information was recorded and is included as part of the final GSS data set, enabling analysis of consent rates by population subgroups. Such analysis has not been possible before with the BRANZ HCS, which has typically relied on outbound calling to recruit participants (with no information recorded on those who declined). This therefore presents an opportunity to help to develop an understanding of the likelihood of different household types/individuals agreeing to take part in a

Figure 10: Household and occupant characteristics of the weighted PHS data set



survey of this nature which, in turn, could help to inform future survey work, providing insight into household types who may be harder to reach and require different approaches to recruitment. It is also important for understanding any potential bias in the PHS which could influence the representativeness of the housing data.

Overall rate of consent

Overall, 46.1 per cent (± 1.7 pp) of households in the GSS agreed to be contacted by BRANZ about participating in the PHS. As this represented far more households than required to achieve the survey target of 800, only a proportion were selected (as per the sampling method described earlier) and passed on to BRANZ.

Consent rates amongst different household types

Analysis was undertaken to explore consent rates by a range of GSS household variables, including tenure, the NZ Deprivation index, family type, household income, length of time at address, occupant perception of house condition, crowding and self-reported damp, mould and cold.

The results showed owner-occupied households were significantly more likely to agree to participate in the survey than

were non-owner-occupier households and the general population: 50.5 per cent (± 2.0 pp) of households who owned their home agreed compared with 37.3 per cent (± 2.3 pp) of those who did not own their home (Figure 11). This is consistent with the experience of previous HCS, in which recruiting rental households proved a challenge (White et al., 2017).

Households not in a family nucleus were less likely to agree, both compared with those in a family nucleus (anyone in a couple, and/or with children at home) and the general population. This effect remained even when examined by tenure, showing it is not just an attribute of renters being more likely to live in non-family groups.

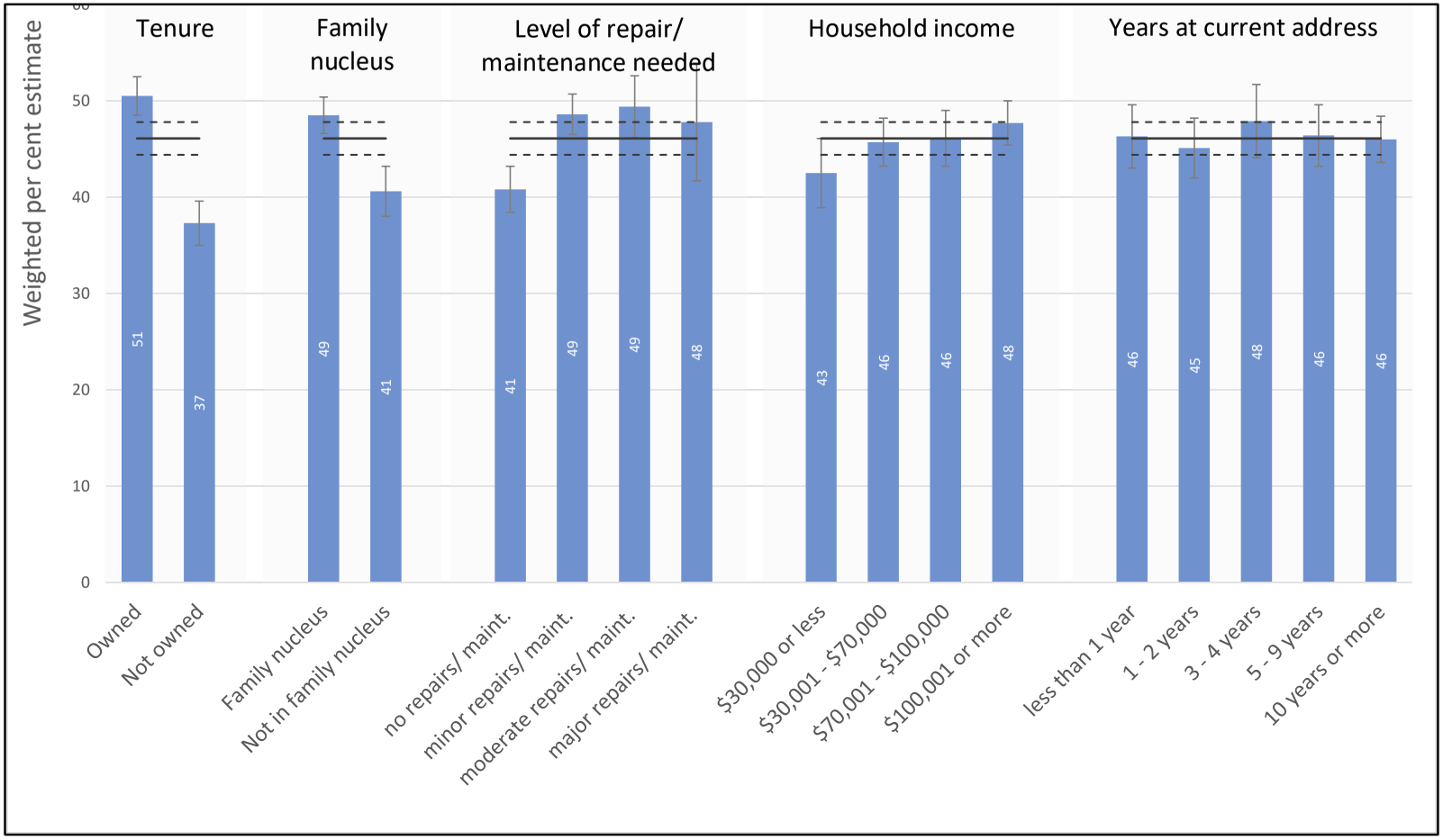
Households who considered their home did not need repair or maintenance were less likely to agree compared with the general population and all other repair/maintenance subgroups.

There were also significant differences by crowding (although this appears mostly explained by ethnicity). There was no significant difference in the consent rates by self-reported damp, mould and cold, household income, and years at address.

Consent rates by respondent characteristics

The GSS includes a household questionnaire and personal questionnaire. One randomly selected individual in the household completes the person questionnaire. Analysis was undertaken to explore consent rates for subgroups of households where the respondent who consented to participate in the PHS (which was asked in the household questionnaire) was also the main (personal questionnaire) GSS respondent. This applied to approximately 60 per cent of households in the GSS. Analysis looked at consent rates by ethnicity, migrant status, generalised trust, sex, material hardship,

Figure 11: Rates of consent to passing contact details to BRANZ by household characteristics



Key: — Overall level of agreement (all households); – – – lower and upper 95% confidence interval

highest qualification, labour force status, income sufficiency and age band.

Table 4 summarises the results for variables where there was a significant difference between subgroups. This shows females, European and Māori, non-migrants, those with high general trust and those with severe material hardship were significantly more likely to agree to be contacted by BRANZ than were the other subcategories. While these all showed within-group differences, not all were significant compared with the general population, as illustrated by Figure 12.

There were no significant differences in consent rates by highest qualification, labour force status, age band or income sufficiency of the main respondent.

Understanding potential bias

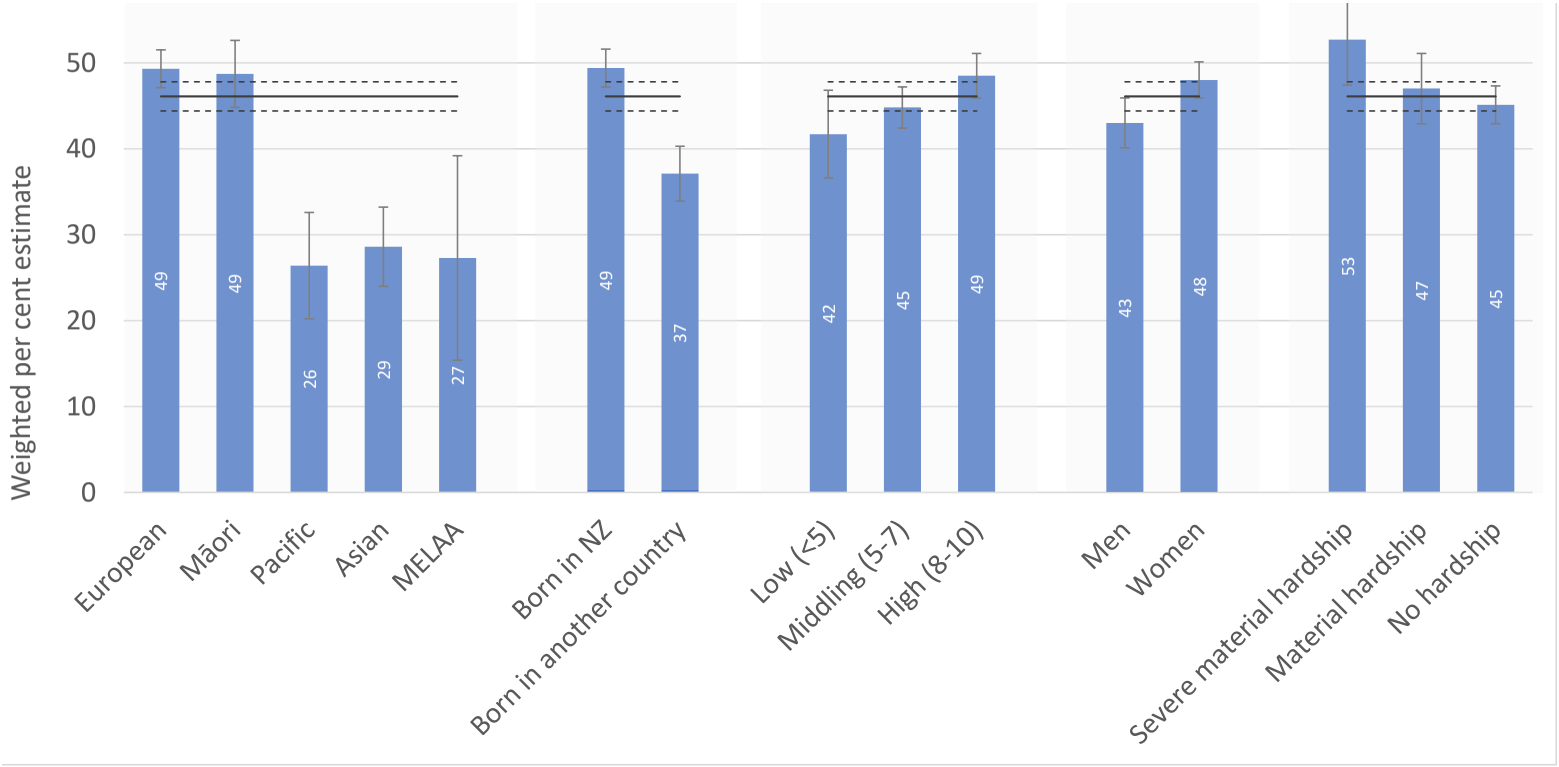
Further analysis was undertaken to compare some key socio-demographic characteristics of the GSS with the final (weighted) PHS dataset.

Table 4: Characteristics of main respondent and likelihood to agree to take part in the PHS

Subgroup (main respondent)	More likely to agree to participate in the PHS	Less likely to agree to participate
Sex	Female	Male
Ethnicity	European or Māori	Pacific, Asian, or MELAA
Migrant status	Born in New Zealand	Migrant
Generalised trust	High (8–10) general trust	Moderate or low general trust
Material hardship	Severe material hardship	Not experiencing material hardship

Note: Results are shown where there was a significant difference at the subgroup level.

Figure 12: Rates of consent for households where the respondent who consented to participate in the PHS was also the main GGS respondent, by subgroup



Key: — Overall level of agreement (all households); – – – lower and upper 95% confidence interval

The results show that where differences in consent rates did exist (i.e. those described above), many have largely been corrected for by the post-sampling weights applied.

For example, even though weights were only applied to correct for tenure, NZ-Dep and region, the weighted PHS data shows the impact of this benchmarking in correcting for not only uptake by tenure but also for ethnicity and migrant status.

Whilst part of the 'correction' is down to the larger sample errors on the PHS compared with the GSS, due to the reduced sample size in the former, the effects observed also highlight the benefits and importance of applying appropriate weights and explicit benchmarking.

Conclusion

The Pilot Housing Survey was an opportunity to provide a new data resource that could be used to help to inform measures of housing quality for Aotearoa New Zealand.

The method employed in recruiting households through a Stats NZ national survey was novel and offered significant advantages over recruitment methods used in previous national housing assessment surveys. In addition to helping to overcome recruitment challenges, the link with a nationally representative survey also presents opportunity to gain insight into the likelihood of different population groups taking part in a survey of this nature. The analysis of consent rates highlights the way in which participation in the PHS is variable across population groups. It verified experience from the BRANZ House Condition Survey that rental households are harder to recruit than owner-occupied households. It also showed lower uptake among households not in a family nucleus (whether owner-occupiers or tenants). At the individual level, Pacific, Asian and MEELA (Middle Eastern/Latin American/African) peoples and migrants were less likely to take part. This has important implications for our understanding of the

interactions between people and dwelling performance. Future national housing assessment surveys could look to alternative recruitment approaches, such as working with local community groups or frontline workers, to ensure harder-to-reach or marginalised groups are represented.

The analysis presented in this paper provides insight into the different housing conditions experienced by owner-occupiers and renters. It shows that on average across the New Zealand housing stock, rental dwellings are more likely to be in a poorer state of repair and experience higher rates of visible mould than owner-occupied dwellings.

This trend is consistent with previous BRANZ House Condition surveys. While condition and mould showed significant differences by tenure, insulation levels did not differ significantly. This finding could be indicative of the requirements for insulation in rentals taking effect.

BRANZ has worked with Stats NZ to ensure the data set could be made available to researchers in a secure, safe environment through its Data Lab and the Integrated Data Infrastructure (IDI). The PHS-GSS linked data provides an important new resource for researchers and policy analysts to gain further insight into the different housing conditions experienced by different populations. Further analysis will be undertaken to explore housing condition parameters by socio-demographics and self-reported measures of well-being. This in turn can help to inform interventions and targeting of measures to support those affected by poorly performing housing.

Notes

1 NZDep2013 is an index of socioeconomic deprivation. It combines census data relating to income, home ownership, employment, qualifications, family structure, housing and access to transport and communications (Atkinson et al., 2014).

2 All analyses used the complete weighted PHS data set, unless otherwise stated.

3 Where properties are referred to as 'rentals' or 'rented dwellings', this means all housing that is not owner-occupied.

4 Sample errors are reported at 95% confidence intervals.

References

Atkinson, J., Salmond, C., & Crampton, P. (2014). *NZDep2013 Index of Deprivation*. Department of Public Health, University of Otago, Wellington. https://www.otago.ac.nz/wellington/otago069936.pdf

Housing Survey Act 1935. http://www.nzlii.org/nz/legis/hist_act/hsa193526gv1935n40283/

Howden-Chapman, P., Viggers, H., Chapman, R., O'Sullivan, K., Telfar Barnard, L., & Lloyd, B. (2012). Tackling cold housing and fuel poverty in New Zealand: A review of policies, research, and health impacts. *Energy Policy*, *49*, 134–142. https://doi.org/10.1016/j.enpol.2011.09.044

HUD. (2020). *About the healthy home standards*. Ministry of Housing and Urban Development. https://www.hud.govt.nz/residential-housing/healthy-rental-homes/healthy-homes-standards/about-the-healthy-home-standards/

McNeil, S., Li, Z., Cox-Smith, I. & Marston, N. (2016). *Managing subfloor moisture, corrosion and insulation performance* (BRANZ study report 354). BRANZ. https://www.branz.co.nz/pubs/research-reports/sr354/

Mendell, M., Mirer, A., Cheung, K., Douwes, J., Torben, S., Bønløkke. J., Meyer, H., Hirvonen, M., & Roponen, M. (2009). Health effects associated with dampness and mould. In *WHO Guidelines for Indoor Air Quality*. World Health Organization.

Page, I. (2017). Costly to delay repairs. *Build 160,* June/July. BRANZ. https://www.buildmagazine.org.nz/index.php/articles/show/costly-to-delay-repairs

Page I. C., Sharman W. R., & Bennett A. F. (1995). *New Zealand House Condition Survey 1994* (BRANZ study report 62). BRANZ. https://www.branz.co.nz/pubs/research-reports/sr62/

Saville-Smith, K., James, B., & Mitchell, I. (2010), *The determinants of tenure and location choices of 20–40 year old households in the Auckland region.* Centre for Housing Research Aotearoa New Zealand (CHRANZ). https://www.interest.co.nz/sites/default/files/tenure-location-choices-20-40-year-old-households-auckland-region-bulletin.pdf

Saville-Smith, K., & Mitchell, I. (2020). *Essential workers' bubbles: Crowding, housing affordability and tenure* (Research Bulletin, 4 May 2020, for Building Better Homes, Towns and Cities (BBHTC)). BBHTC. https://www.buildingbetter.nz/publications/homes_spaces/Saville-Smith_Mitchell_May2020_crowding_affordability_stress_among_essential_workers.pdf

Shorter, C., Crane, J., Pierse, N., Barnes, P., Kang, J., Wickens, K., Douwes, J., Stanley, T., Täubel, M., Hyvärinen, A., & Howden-Chapman, P. (2018). Indoor visible mold and mold odor are associated with new-onset childhood wheeze in a dose-dependent manner. *Indoor Air*, *28*(1), 6–15. https://doi.org/10.1111/ina.12413

Statistics New Zealand (2009). *Review of housing statistics report 2009*. https://statsnz.contentdm.oclc.org/digital/collection/p20045coll1/id/2704/

————. (2012). Tier 1 statistics. http://infoshare.stats.govt.nz/about_us/who-we-are/home-statisphere/tier-1.aspx#gsc.tab=0

————. (2015). *Measuring housing quality: Potential ways to improve data collection on housing quality in New Zealand*. https://www.stats.govt.nz/methods/measuring-housing-quality-potential-ways-to-improve-data-collection-on-housing-quality-in-new-zealand

Stats NZ. (2019). *Framework for housing quality*. https://www.stats.govt.nz/methods/framework-for-housing-quality#:~:text=Framework%20for%20housing%20quality%20outlines,helping%20address%20that%20information%20gap

————. (2020). *Housing in Aotearoa: 2020*. https://www.stats.govt.nz/reports/housing-in-aotearoa-2020

Taylor, N. M. (1986). The home front (Vol. 2). In *The Official History of New Zealand in the Second World War 1939–1945*. War History Branch of the Department of Internal Affairs. http://nzetc.victoria.ac.nz/tm/scholarly/tei-WH2-2Hom.html

White, V., Jones, M., Cowan V. J., & Chun, S. (2017). *BRANZ 2015 House Condition Survey: Comparison of house condition by tenure* (BRANZ Study Report SR370). BRANZ. https://www.branz.co.nz/pubs/research-reports/sr370/