Bathroom habits falling short

A companion study to the latest BRANZ House Condition Survey showed surprisingly high humidity levels in our bathrooms – even when not being used – coupled with unacceptably low temperatures.

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THE EFFECTIVENESS of ventilating a house is largely dependent on the behaviour of the occupants. However, little is known about ventilation habits, particularly the frequency and extent of opening windows and internal doors, and the effect this has on indoor environmental quality.

To help address this knowledge gap, BRANZ researchers devised the Occupant Ventilation Behaviour study.

Data collected over 2016 winter

Funded by the Building Research Levy, this research project measured the temperature and relative humidity (RH) in bedrooms and bathrooms of 64 houses throughout New Zealand over the 2016 winter months.

At the same time, sensors were fitted to the internal doors and windows to record how often and by how much they were opened. Measurements were recorded at 15-minute intervals, amounting to some 20 million temperature and relative humidity data pairs over the duration of the project.

Once the sensors were recalled, participants were sent a questionnaire to find out more about their ventilation habits and any problems experienced with damp and mould and comfort in the home.

In addition to the new data collected in this study, all but five of the participating households were also part of the BRANZ 2015 House Condition Survey (HCS). For more on the HCS, see *Rental houses need TLC,* pages 66-67.

Combining the 2015 HCS data with the information in the occupant ventilation behaviour study provides new insights into how householders ventilate their homes and the impact of their behaviours on the indoor environment.

High humidity for long periods

The median RH recorded across all bathrooms over the study period was 67% (range 43-88%) (see Figure 1). One-third of houses had a median RH of 70% or higher, and six houses (10% of participants) 75% or higher.

While we'd expect to see peaks in moisture levels when the bathroom is in use, these should be brief.

However, what we're seeing is a high proportion of houses - over half of study participants - with a relative humidity above 65% at least half the time. Humidity at these levels over sustained periods of time presents greater risk of problems with condensation and mould.

Half the bathrooms too cold

Temperature is also a key factor as a cold bathroom affects more than comfort. The lower the temperature, the more likely condensation and mould will develop, particularly if surfaces, such as walls and ceilings, are cold when moisture is generated.

The average (median) temperature in bathrooms of study participants' homes was 16°C, but this ranged from a low of 8°C to a high of 20°C (see Figure 1). Nearly half of households (48%) had a median temperature

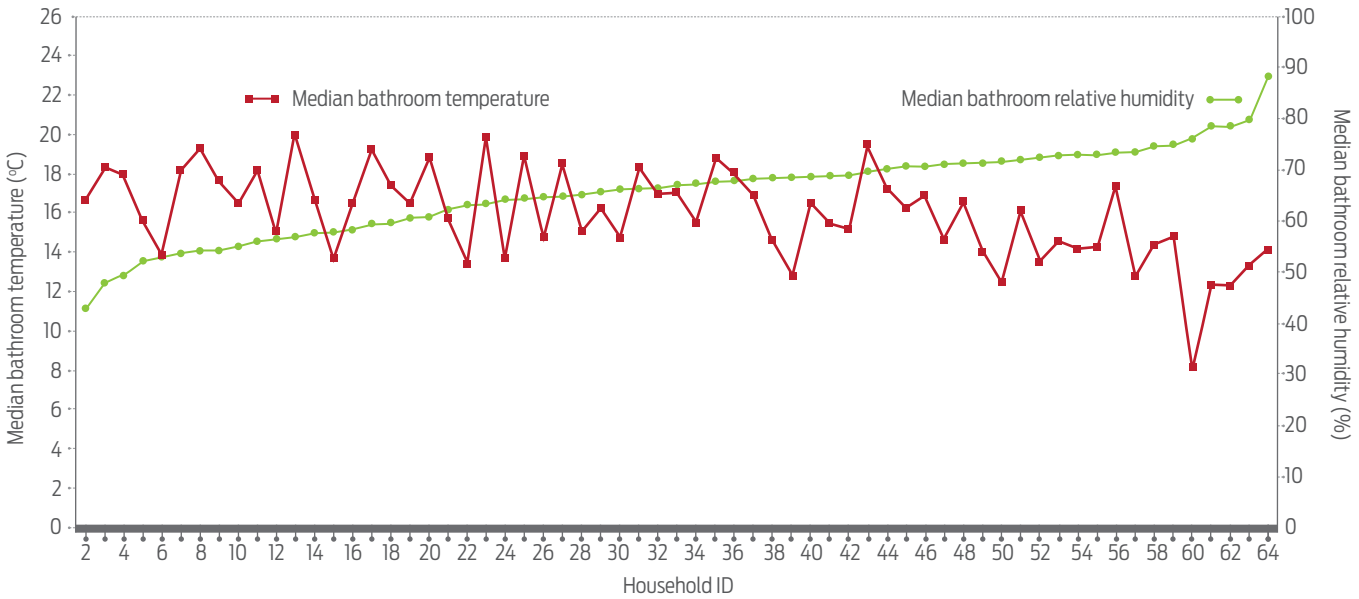

Figure 1: Median relative humidity and temperature in the bathroom of study participants' homes (ordered by RH level).

of less than 16°C in the bathroom, and nearly one-fifth (19%) below 14°C. This means that, for 50% of the study period, these bathrooms were colder than levels recommended for a healthy indoor environment.

Prime site for mould

Combining the relative humidity and temperature data highlights cases where the bathroom was both particularly cold and damp and therefore more susceptible to condensation and mould.

The red bubble in Figure 2 shows a key group of concern. These 10 houses (representing 16% of study participants) had median bathroom temperatures in the coldest 25% (8-14°C) and median RH levels in the top 25% (72-80% RH) of all houses surveyed.

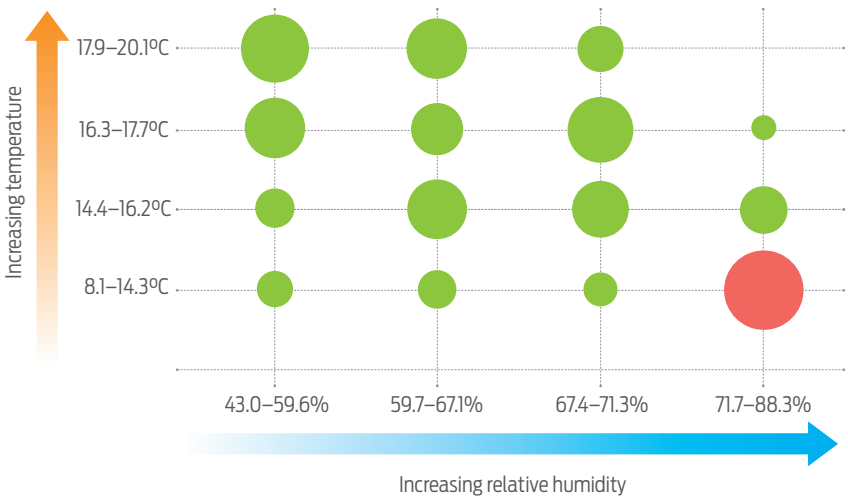

Figure 2: Quartiles of median relative humidity and median temperature in bathrooms of study participant homes (bubble size proportional to number of houses represented).

Good ventilation practice reported

Study participants were asked about how often they opened windows and used an extractor fan whilst and after taking a bath/shower. The responses show a high tendency to ventilate the bathroom - 73% always ventilated the bathroom while showering or bathing and 70% after (see Figure 3).

Use of an extractor fan was more common while showering or bathing, while opening windows was slightly more common afterwards.

Over one-quarter of study participants (27%) did not have an extractor fan in the bathroom (shown by N/A in Figure 3), while 2% did not have openable windows.

Heating and ventilation not enough

These results provide evidence of good practice among study participants in helping to control moisture levels in the bathroom. However, there were still instances of sustained high relative humidity. Comparing occupant-reported ventilation habits with the RH data presents a mixed picture.

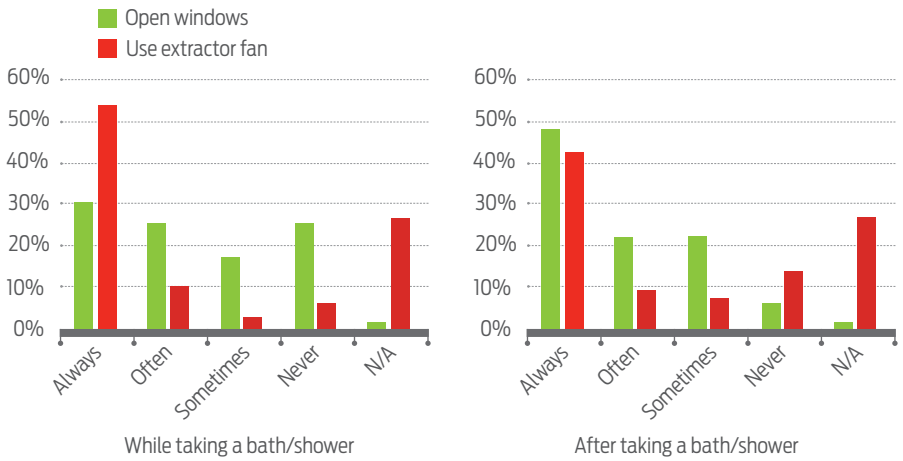

Figure 3: Occupant-reported ventilation practices in the bathroom while and after taking a bath/shower.

Some of the highest levels of relative humidity were recorded in bathrooms where the occupant 'never' ventilated while taking a bath or shower, which is what we might expect. However, houses with similarly high RH said they 'always' ventilated the bathroom. Overall, there was no significant difference in the median RH of bathrooms based on occupant-reported ventilation habits.

Similarly, comparing temperature data with information collected in the HCS about heating systems in bathrooms suggests there was no significant difference in the average temperature of bathrooms with and without heating available.

Controls insufficient or not working well

What does this lack of evidence of any relationship between occupant-reported ventilation habits, heating systems and humidity and temperature data mean?

It suggests that, where systems are available to help control moisture in the bathroom, these are not being used sufficiently or effectively and/or are not functioning adequately.

The fact that occupants largely reported good practice in ventilating the bathroom while and after showering could suggest that householders think they are doing the right thing. However, their actions fall short of what's needed to maintain a healthy environment and minimise the risk of condensation and mould.

Next steps to explore more deeply

Further analysis is being undertaken. This is to understand the drivers behind the relative humidity levels and temperatures recorded and how these relate to occupant ventilation and heating behaviour and problems with condensation and mould.

We will also look more closely at the RH and temperature data in combination with data from the windows and doors sensors. Focusing on high moisture events, this will show:

- how warm or otherwise bathrooms were at the point of high moisture generation
- how quickly moisture levels declined
- for how long and how far windows and doors were open and how long they should be.

Tips for managing bathroom moisture

- **Extract:** If you have an extractor fan, always use it while having a shower or bath, and leave it running afterwards until the moisture has cleared. Opening a window will help airflow, but keep the bathroom door closed to avoid the moist air escaping to the rest of the house.
- **Ventilate:** If there is no extractor fan in the bathroom, open windows during (if not too cold to do so) and after showering/bathing.
- **Heat:** If there is heating available, it will help to warm up the bathroom beforehand - a cold bathroom will increase the likelihood of condensation forming. Open the windows afterwards to allow the moist air to escape, and keep the door closed.
- **Remove:** Wipe excess moisture and condensation from surfaces and windows - droplets take a long time to dissipate, even with the most efficient systems. Dry the wet cloth outside, so the moisture is removed from the room. A shower dome can also help to contain the moisture within the shower cubicle, preventing it from reaching other surfaces.

For more See www.ecodesignadvisor.org.nz/factsheets/.