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Estimating the Willingness to Pay for Warmer and Drier Homes¹

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Abstract

New Zealand is one of several countries to use subsidies for retro-fitting insulation and installing improved heating devices such as heat pumps. The valuations of these devices by the affected populations remains unknown. We investigate willingness to pay for such devices, using a choice experiment with a sample of Pacific Islanders in the upper North Island. This is a high risk group for respiratory disease, who typically rent crowded and inadequately heated dwellings. Using both conditional logit and panel mixed logit models we find reasonably precise estimates of the willingness to pay for four improved heating and humidity control devices, which would cover the capital costs of two of the devices, and about three-quarters of the cost of the other two devices.

Keywords: Choice experiments, Housing, Respiratory health, Subsidies

JEL codes: C25, I12, Q53

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1. Introduction

Respiratory disorders impose a costly disease burden in New Zealand. Previous research shows that the poor quality of indoor air, which is both too cold and too damp, contributes to these disorders. These indoor air quality problems reflect the poor standard of construction and insulation of New Zealand dwellings, which is exacerbated by the damp and humid climate and by traditions of relying on ineffective and polluting devices to heat a single room (e.g. an open fireplace) instead of clean and effective heating of the whole house. There are various devices that can alter dwelling humidity and temperature, including clean heating (e.g., flued gas heaters, heat pumps), heat-recovery ventilation systems (HRV), and dehumidifiers. The positive impact on respiratory health of replacing ineffective and polluting forms of heating, such as unflued gas heaters, with cleaner and more effective devices is demonstrated by randomized control trials (Howden-Chapman et al, 2008; Preval et al., 2010). There is also quasi-experimental evidence using electricity price variation to examine the effect of home heating on hospital asthma admissions (Menclova and Webb, 2015).

To mitigate some of these housing-related health issues, the New Zealand Government recently funded a NZ\$350 million four-year program (“Warm Up New Zealand: Heat Smart”) to subsidize retro-fitting insulation and installing clean heat sources in 190,000 houses. Similar schemes operate elsewhere, such as Warm Homes Plus in Northern Ireland. Initial evaluations show that the insulation component contributes most to the positive cost-benefit ratio of the New Zealand scheme (Grimes et al 2012). Similarly, in the United Kingdom there appears to be positive fiscal benefits from insulation schemes (Rosenow et al 2014).

It is unclear what values the affected population themselves place on improved heating, since randomized trials typically give the improved heating devices away for free and the national schemes lack plausible methods of estimating how much of the subsidized

activity might have occurred anyway. Moreover, renters pose a particular problem for cost-benefit analysis of such schemes; the heating devices are typically immobile and landlords receive the device for free (or with a subsidy), so it is difficult to target the intervention to mobile beneficiaries. Thus, the analysis by Preval et al (2010) assumes the occupants stay for the entire 12-year period over which costs and benefits are simulated (the assumed lifetime of the heating device) or equivalently assumes that moving households with a high proportion of asthmatics are replaced by households with similarly high asthma rates.¹ A further problem for economic evaluations is that landlords may increase the rent on properties for which they have received subsidized heating devices, affecting the distribution of who benefits.

It may therefore help to have more direct evidence on the willingness to pay (WTP) for improved heating devices by groups that suffer from a high burden of respiratory disorders. Such evidence may help determine who should pay for improved heating devices, since interventions applied to landlords (e.g., subsidized installations or regulated minimum heating standards for rental properties) may ultimately be borne by tenants, depending on supply and demand conditions in the rental market. Evidence on the WTP for improved heating devices is also useful because existing evaluations of home heating interventions put a value on any health improvements in terms of foregone costs, such as for visiting a doctor or hiring a caregiver to look after children when asthma prevents them going to school, but do not factor in the value of the reduced disutility due to sickness, which is a part of the WTP. Moreover, the evidence for New Zealand is that groups affected by these interventions do not place much value on improved heating devices; Vujcich (2008) reports that participants in the Housing, Heating and Health Study (HHHS) placed an average value on heat pumps that was only one-half of the actual cost, and a valuation on wood burners that was less than one-fifth of the actual cost.

In this study we use choice experiment data collected from a sample of Pacific Islanders living in the upper North Island. We explore the preference structure over household devices that can affect indoor air quality, dampness and warmth. We contrast these preferences with the current availability in the respondent's dwelling of each of these devices. We focus on Pacific Island immigrants because they are an at-risk group for respiratory disorders, they often have little familiarity with these disorders from their home countries, and they typically live in crowded and inadequately heated dwellings that are rented rather than owner-occupied. While there is an existing literature on housing adequacy and respiratory health (Gorman and Asaithambi, 2008), little is known about preferences over heating and humidity control devices that affect indoor air quality and the distribution of the willingness to pay for these commonly available devices. Pivoting on current rental costs and dwelling characteristics, the present study derives such estimates from stated binary choices between experimentally designed alternatives, and relates them to current availability of the devices.

The remainder of the paper is as follows: Section 2 provides the background to the study, in terms of the population studied, the sample and survey, and the experimental design. In Section 3 the model specifications and econometric analysis of the choice experiment data are discussed. Section 4 contains the results and discussion and Section 5 the conclusions.

2. Background context, the sample, and the survey

New Zealand has one of the highest asthma rates in the world, with this disorder affecting one in six adults and one in four children (Holt and Beasley, 2001). Moreover, respiratory disease was second only to cardiovascular disease, in terms of disability-adjusted life years (DALYs) lost in New Zealand in 1996 (Tobias et al, 2001). There is an ethnic inequality in this disease burden, with high rates of respiratory illnesses for Pacific Islanders reflecting

their relatively low economic status, high rates of smoking, and poor standard of housing with substantial overcrowding. For example, Pacific Islanders have the highest rate of reporting that their house is either too cold or too small, with 33 percent finding their house too cold compared with the average of just 15 percent for other New Zealanders (SNZ, 2013). Consequently, Pacific Island immigrants are a relevant population for deriving the WTP for heating and humidity control devices.

2.1 The Sample

Immigrants are a rare population, especially when one focuses on those from a specific region, so obtaining a representative sample can be prohibitively expensive (McKenzie and Mistiaen, 2009). We therefore decided to recruit study participants through intercept points where migrant populations are known to congregate, mimicking the approach that may typically be used by health and housing authorities that were rolling out home heating interventions. This has the advantage of making our results relevant for the population most likely to be the subject of such interventions, even if it doesn't allow measurement of the WTP of immigrants not found in these locations.

We focused on Pacific Islanders living in Auckland and Hamilton. Both cities are damp and humid, with mean rainfall of about 1200 mm per year, relative humidity (at 9am) of about 85 percent, and a temperate climate; Auckland's mean annual temperature is 15 degrees Celsius and is 10.9 degrees in the coldest month, while Hamilton's annual mean is 14 degrees with a coldest month average of 8.9 degrees. While not cold on a global scale, these are much lower than what Pacific Islanders are used to in their home countries, where average temperatures are around 23 degrees and 21 degrees in the coldest month. Moreover, homes in New Zealand are poorly heated and insulated, with average indoor temperatures below World Health Organization (WHO) guidelines (Howden-Chapman et al, 2012). A further risk to respiratory health is from 'leaky homes' built in the 1990s after relaxation of

building regulations and during a trend of Mediterranean-style designs; these homes allowed external water to penetrate internal cavities, causing mold and the rotting of untreated timber used for the framing of such houses (Howden-Chapman and Bennett, 2010). The recent rapid population growth in Auckland and Hamilton means that a high proportion of their housing stock was constructed during this ‘leaky home’ period.

Recruitment of the sample was mainly through churches and church-based groups (such as choirs), following the approach of some medical studies with a focus on Pacific Islanders (e.g., Simmonds, et al. 2004). The respondents were predominantly (three-quarters) born in Tonga, with the remainder born in the Solomon Islands, Samoa, Papua New Guinea, and Australia and New Zealand. We did not rule out the small number (less than ten percent) of second-generation migrants born in Australia or New Zealand because anthropological studies show that second-generation Pacific Island migrants exhibit similar behavior and values to first generation migrants (Lee, 2003). Amongst those born overseas, two-thirds had resided in New Zealand for fewer than ten years.

In order to ensure that the surveys were conducted in the most effective and culturally appropriate way we recruited individuals from these same migrant populations to lead the field work. The interview team leader was a Tongan with a PhD in economics, and she was assisted by a Solomon Islander with a PhD and by other tertiary qualified Pacific Islanders. The questionnaires and any written material given out were available in English and Tongan (English is the language of schooling throughout the Pacific) so comprehension problems should not interfere with the choice tasks. Both the lead author and the interview team leader have carried out several other surveys amongst Pacific Island immigrants in New Zealand (Gibson, McKenzie and Zia, 2014; Gibson et al., 2013) and the visibility of the research team to this particular community assisted in recruiting participants.

2.2 Survey Description

We conducted the survey between December 2012 and March 2013, obtaining data from 249 adults (age 18 and above), who together provide 2,241 choice responses. The first part of the survey asked about use of various home heating devices, and satisfaction with the current dwelling (especially in terms of warmth and dryness) and with health. The survey also covered some background characteristics and details on dwelling tenure and costs, since the choice experiments are based on hypothetical variations in rents for a dwelling similar in all respects to their current one, except in terms of the changes in heating options that were offered under each choice. Information regarding attributes was given to respondents immediately before the choice experiment, including the use of pictures of typical examples of the options that were in the choice sets.

Summary statistics show that 43 percent of respondents were male, with an average age of 39 years (38 years for women and 40 for men). Almost one-half (47 percent) of them had high school qualifications, while 31 percent had some tertiary education (including ongoing and sub-degree courses). The employment rate amongst respondents was 51 percent, which is the same as for the overall Pacific Island ethnic group in the March quarter of 2013 in the *Household Labour Force Survey* (HLFS). However, the sample had a lower proportion unemployed than in the national survey; 11.2 percent were unemployed compared with 15.2 percent in the HLFS. Those participants not in the labor force included housewives, unpaid caregivers and some tertiary students. The average personal income of respondents in the previous 12 months, from all sources, was \$21,500 (based on nine bracketed intervals); this is slightly below the national average of \$24,900 for the Pacific Island ethnic group in New Zealand (which is itself just two-thirds of the overall average income).

In terms of housing, 82 percent of the respondents were renting while just 18 percent were home owners (either with or without a mortgage). Previous studies have shown that the Tongan population in New Zealand has the second lowest rate of home ownership, at around

30 percent in the 2006 Census (SNZ, 2012). The even lower ownership rate amongst the respondents here may reflect their recent arrival in the country, and also the decline in home ownership rates since 2006. The average weekly rent paid for the dwelling was NZ\$311, while home owners reported an average of \$377 for the hypothetical rent that they could receive if they rented out their dwelling.

By the standards of many populations, these houses are crowded with a median of eight residents per dwelling (mean=7.4) and 2.4 persons per bedroom. There is no significant difference in crowding between owned and rented properties, although the same is not true for all other dwelling attributes. Table 1 displays the mean values for the dwelling and heating variables and also the mean responses to questions about major problems associated with the dwelling, separately for renters and owner-occupiers. Approximately two-thirds of renters have major problems with cold, damp, moldy houses and an even higher proportion have problems with the cost of heating their house. Owner-occupiers are less likely to have major problems with cold and damp, but the other problems are just as widespread as for renters. Fewer than ten percent of the respondents have improved devices that either warm or dry the air, such as dehumidifiers, HRV systems, and heat pumps. The main forms of heating are electric heaters (either in-built or plug-in), open fireplaces, and in-built gas heaters (and also enclosed wood burners for owner-occupiers).

In terms of respiratory health, 53-55 percent of respondents reported that in the last 12 months they had either been woken by an attack of shortness of breath, had wheezed or had difficulty breathing, or had been unable to do normal activities because of difficulties in breathing. Between 17-25 percent of respondents reported that children in their household also had these symptoms of respiratory disorder within the last 12 months. Yet just seven percent of respondents reported ever having been diagnosed by a doctor or nurse as having asthma or ever having taken medication for asthma and only 15 percent reported that children

in their household had ever been diagnosed with asthma or taken medication for asthma. In addition to potentially undiagnosed asthma, self-awareness also appeared to be low, with just four percent of respondents reporting having had an attack of asthma during the last 12 months, even though more than one-half of them reported wheeze and other breathing difficulties that are often symptoms of asthma.²

2.3 Experimental Design

Choice experiments use experimental design techniques to identify the effects that attributes of qualitatively different alternatives have on estimated utility. Design techniques are required to define the efficient allocation of attributes and their levels in the alternatives that are combined into the separate choice tasks. Design efficiency is a salient issue when sample sizes are naturally restricted, such as in this study. Drawing from the rapidly expanding literature on efficient designs for stated choice for non-market valuation from small samples (Sandor and Wedel, 2001, Ferrini and Scarpa 2007, Scarpa et al 2007, Rose and Scarpa 2008, Bliemer, Rose and Hensher, 2009, Vermeulen et al 2011, Kessels et al 2011) we adopted a sequential Bayesian D-efficient design where prior values of the mean and variance of parameter estimates were drawn from a pilot study.

Since our interest was in the willingness-to-pay for improved heating and humidity control devices, the choice tasks excluded two unimproved heating options from those shown in Table 1; the portable gas bottle heater and the open fireplace. The choices were therefore over various combinations of the other six devices listed in Table 1 – heat pump, electric heater, in-built gas heater, enclosed wood burner, dehumidifier, and HRV – along with the rental cost variation. The initial design used in the pilot was orthogonal in the differences of the seven main effects, inclusive of the cost variation. The final design consisted of 72 pairwise choice tasks, blocked orthogonally into eight blocks each of nine choice tasks. This was obtained by using Ngene and minimizing the D-error of the multinomial logit model over

the allocation of attributes, conditional on the assumed prior values. By allocating a different block to each respondent, after every eight respondents the design was complete. Since these blocks were allocated to 249 respondents, (44 home owners and 205 renters) we collected 31 balanced and complete designs, with a minor redundancy.

3. Empirical Specification and Econometric Analysis

Our interest is in the implicit values assigned by the sample to different devices for controlling indoor air quality. These willingness-to-pay (WTP) values can be obtained by estimating a conditional logit model under the assumption that respondents choose their preferred alternative according to the random utility maximization paradigm. Using maximum likelihood, estimates of utility coefficients can be obtained and the ratios of the attribute coefficients with respect to the coefficient for rent give an asymptotically consistent estimate of the marginal WTP for each attribute (Adamowicz et al. 1998).

The assumed utility structure is linear in the parameters and contains an interaction between the effect of rent change and the status of being a home owner. This is justified by the fact that those who rent are likely to have a different marginal utility of money from those who own the house they live in. The utility structure employed is:

$$U = \alpha \times ASC_{LHS} + \beta_1 \times HRV + \beta_2 \times WoodBurner + \beta_3 \times Elect_Heating + \\ \beta_4 \times Gas_Heating + \beta_5 \times Heat_Pump + \beta_6 \times Dehumidifier + \\ \gamma \times RENT + \delta \times RENT \times 1(HOME_OWN) + u,$$

where we have dropped the usual subscripts denoting choice task and respondent for simplicity. In this model, ASC_{LHS} is an alternative specific constant for the first alternative of the two alternatives presented (hence, it is on the left-hand side (LHS) of the page), with the use of this covariate suggested by the work of, amongst others, Dobel, Diesendruck, and Bölte (2007) to account for left-to-right bias in choice. The variables associated with the

parameters β_1 to β_6 are dummy variables for the presence in the choice alternative of the various heating and humidity control devices, RENT is the cost per week of a house identical to the one in which the respondent lives, but with the set of devices proposed in the design, and the last covariate is the interaction between rent and the home ownership dummy variable. This last variable is included to account for differences in marginal utility of money between respondents who rent and those who are home-owners. In the specified utility structure, the random component u is assumed to follow an independently and identically distributed (i.i.d.) Gumbel distribution.

A secondary issue of interest is whether the results that are obtained from the fixed coefficient, conditional logit model are robust to the assumptions of independence of choices by the same respondent (i.e. allowing for the panel nature of the data where the same respondent is making nine choices). The robustness to the presence of unobserved taste heterogeneity (i.e. taste variation across respondents) is also of interest. To address these issues we also report estimates of a panel mixed logit (PMXL) model (Revelt and Train 1998, Train 1998, 2003). The PMXL model has multivariate normal random taste coefficients, with the exception of the coefficients for rent and the interaction between rent and home-owner status. The multivariate nature of the distributional assumption also lets us uncover the correlation across tastes, which illustrates how taste intensities for the various attributes under evaluation co-vary in the population. In other words, this specification assumes that the vector of beta parameters is multivariate normal, while α , γ and δ are fixed. The estimation of the PMXL model is conducted by simulating the integral of the unconditional choice probabilities by means of 500 Halton draws (Train 2000, Baiocchi 2005).

4. Results and Discussion

The conditional logit results are reported in Table 2, with the parameter estimates in the top panel of the table and the marginal WTP estimates in the bottom panels (for renters and owner-occupiers separately). The estimated parameters suggest that there are statistically significant increases in utility from the presence of four of the devices; the heat-recovery ventilation (HRV) system, the enclosed wood burner, the heat pump, and the dehumidifier. The other two heating options (in-built gas and electric heaters) have confidence intervals that include zero. The negative coefficient on RENT indicates that utility falls as rents rise for all respondents, and would do so at a faster rate for owner-occupiers since the coefficient for the interaction term is negative.

The estimates from the panel mixed logit model are reported in Table 3. This PMXL model appears to perform better than the conditional logit model, in terms of both log-likelihood values and the Akaike information criterion (AIC). Specifically, the PMXL model converges with a maximized simulated likelihood of -1297.18 and an AIC/N of 1.184, which significantly outperforms the conditional logit specification, for which the maximized log-likelihood was -1327.86 and the AIC/N was 1.193. These comparisons suggest that the panel nature of the data, whereby each respondent made nine choices, along with the presence of taste heterogeneity, require a more flexible model than is provided by the conditional logit specification. We therefore concentrate the discussion of the results on those from the PMXL model, while noting that the substantive results are confirmed by both specifications.

We first focus on the means of the random taste coefficients for the PMXL model, which are reported in the top panel of Table 3. All attributes subject to investigation have the expected positive values, but for the in-built gas heater and the in-built electric heater these are not significantly different from zero. While these two heating options both have statistically insignificant means for the random parameters in the utility function, there is an important difference between the two, which is shown in the bottom panel of Table 3 where

the implied standard deviations of the parameter distributions are reported. There is substantial heterogeneity in the distribution of tastes for in-built electric heating, as seen by a statistically significant standard deviation estimate of $\sigma_3 = 0.719$ around a mean estimated at $\beta_3 = 0.166$, but this variation is not apparent for the in-built gas heating option. We conclude that in-built electric heating is “disliked” by some (the proportion predicted to have negative utility coefficients under the estimated normal distribution can be derived by computing the normal cdf for $\Phi(x=0|\beta_3 = 0.166, \sigma_3 = 0.719)$, which equals 0.41) and “liked” by others (the complement to the previous proportion, which is the proportion predicted to have positive utility coefficients), with the ratio of dislikes to likes close to 40:60. In contrast, gas heating is shown to induce indifference since the standard deviation of the parameter distribution is so small and the mean so close to zero ($\beta_4 = 0.015$ and $\sigma_4 = 0.144$).

The four devices with statistically significant mean estimates for the respective random taste coefficients in the utility function are the heat-recovery ventilation (HRV) system, the heat pump, the enclosed wood burner and the dehumidifier (ranked in order of the size of their means), i.e. β_1 , β_5 , β_2 , and β_6 . While the heat pump and wood burner have similar estimated means, the estimated standard deviation of the parameter distribution is 60 percent larger for the heat pump, which suggests that there is much greater heterogeneity in tastes for this device. These results can also be interpreted in terms of the proportion of respondents disliking a device, which is lowest for the HRV system, at 11 percent disliking it, followed by the wood burner at 20 percent. In contrast, the heat pump and dehumidifier have a dislike-like ratio close to 30:70; although between these two devices the heat pump has a much higher estimated mean and spread of the random taste coefficients.

The results for the non-random parameters in the utility functions are shown in the second block of Table 3. Importantly for our distinction between renters and home-owners we note that the interaction term for home-owners is statistically significant. This result

provides empirical corroboration for our expectation that different implicit values for these devices that aim to improve air quality will be generated by the two tenure groups.

Because of the full correlation structure of the multivariate normal used in the PMXL model we can also derive the correlation matrix of the random taste coefficients. This is reported in Table 4 and shows a positive and strong correlation for several pairs of devices, including the in-built electric heater and the dehumidifier (0.94), and the in-built gas heater and the HRV (0.92). There is also a moderate positive correlation between the HRV and the heat pump (0.75), while the strongest negative correlation is -0.52 between the dehumidifier and the wood burner.

Finally, marginal WTP estimates can be derived at the estimated means of the taste parameter distributions. Because of the separate rental cost coefficients derived for renters and home-owners we obtain separate WTP estimates for the two groups. These are reported in Table 5 for the PMXL model and in the lower part of Table 2 for the conditional logit model with fixed parameters. The results are similar, so we focus on the former. Renters display a higher marginal WTP by virtue of a marginal utility of money that is closer to zero than that estimated for home-owners (the interaction term between rent and home-ownership is negative). Based on the point estimates, the HRV system is the most valued device at the margin. For this device, renters revealed a willingness to pay of NZ\$10.60 per week and for owners it was NZ\$6.70 per week. The next two devices, the heat pump and the enclosed wood burner, are valued almost equally, at about half the value placed on the HRV system. The lowest statistically significant marginal valuation is obtained for the dehumidifier, at NZ\$3.30 per week by renters and NZ\$2.10 per week by home owners.

How do the willingness to pay estimates compare with the costs of these devices? In order to convert the flow of weekly payments into a lump sum, we assume that each device has a life of 12 years and we use a discount rate of 0.05, following the assumptions used by

Preval et al (2010). We use the WTP of renters in the calculations, implicitly asking whether the willingness of renters to pay higher rent would enable a landlord to pay back the cost of one of these devices without any government subsidies. The results in Table 6 suggest that the HRV system and dehumidifiers could be fully paid back by tenants' willingness to pay higher rent for dwellings with these devices, while for the heat pump and the enclosed wood burner the WTPs add up to between two-thirds and three-quarters of the capital cost.

One implication of finding a willingness to pay for these devices that approximately equals their average cost is that, absent concern over the distribution of benefits, schemes to subsidize or freely provide these devices are not necessarily wasteful in the sense of giving people something that costs much more than the value they place on it. Our results contrast with those reported by Vujcich (2008), who analyzed contingent valuation data produced by the Housing, Heating and Health Study (HHHS), which is the same study used in the cost-benefit analysis of Preval et al (2010). The participants in the HHHS were reported to place an average value on heat pumps which was only one-half of actual cost, and a valuation on wood burners which was less than one-fifth of the actual cost. But there are reasons to doubt these valuations, since the HHHS simply asked respondents how much they would pay for their new heater, with six interval values available (including zero and an open-ended interval above \$5000) rather than deriving these values from a robust choice experiment. Moreover, the questions that were asked by the HHHS emphasized that the heaters would be given away for free, stating that: "In fact, the heater will be free to you – you will not be asked to pay", which may have caused systematic under-reporting of value, compared with what is found from a carefully conducted choice experiment.

Finally, it is interesting to contrast the revealed preferences for these devices with their availability in the dwellings that the respondents either rent or own. The most preferred device, the HRV, is available to only three percent of the respondents. The next most

preferred devices – the enclosed wood burner and the heat pump – are available to just 1.5 percent and 7.8 percent of renters (but 30 percent of the owner-occupiers have a wood burner). Conversely, the most common devices available to renters are the electric heater and the gas heater, both of which had a willingness-to-pay that was not statistically significantly different from zero. The mis-match between what is supplied in rental dwellings and what is preferred by tenants suggests that some improvement in warmth and reduction in dampness for rented homes might come just from information interventions. For example, highlighting the willingness of tenants to pay higher rent for dwellings with improved heating and humidity control devices may be sufficient to convince landlords to undertake the investment in the capital cost of at least some of these devices.

5. Conclusions

We investigated the willingness to pay for household devices that affect indoor air quality, dampness, and warmth. The analysis is based on choice experiment data collected from a sample of Pacific Island immigrants, who are an at-risk group for respiratory disorders and who have a poor standard of housing. Most of this sample rent, and therefore have little day-to-day choice over the heating and humidity control devices that they can use. Amongst these renters, around two-thirds had major problems with cold, damp, moldy houses and more than one-half of them exhibited symptoms of respiratory disease.

The efficient design of the choice experiment meant that even a small sample ($n=249$) yielded reasonably precise estimates of the willingness to pay for four improved heating and humidity control devices, which ranged from NZ\$2.10 to \$10.60 per week in extra rent that respondents would pay for a dwelling with one of these devices. For two of the devices under consideration, this extra rent would be enough to cover the capital cost of installing the device, while for the other two the willingness to pay was equivalent to between two-thirds

and three-quarters of the capital cost. Despite this, very few of the dwellings that were rented had any of these preferred devices, although around 30 percent of owner-occupiers had one of the preferred devices – the enclosed wood burner. Our findings contrast with an earlier study which found much lower valuations on improved heating devices, but which used a less reliable contingent valuation method than the estimates here which come from stated binary choices between experimentally designed alternatives.

Improved heating devices were less highly rated than was the retro-fitting of insulation in the cost-benefit evaluation of Warm Up New Zealand: Heat Smart (Grimes et al, 2012). The results reported here suggest that public policy to promote the installation of improved heating devices may still be worthwhile. We have studied a group who are part of the population likely to be affected by such interventions – Pacific Islanders who mostly rent rather than own homes, who have poor respiratory health, and who report problems with cold, damp, dwellings – and this group reveal quite high willingness to pay (via higher rents) for improved heating devices. Hence even if these devices are being subsidized, this is not necessarily socially wasteful since the affected population value them highly. However, the relatively high willingness to pay for these devices uncovered by our choice experiments also raises the question of why private rental contracts do not evolve to see a greater supply of improved heating and that is a question that future research may consider. A more general conclusion regarding future research is that health-related interventions are made in many sectors other than just in housing, and evaluation of these interventions may benefit from more widespread use of efficiently designed choice experiments, since they can elicit valuations from amongst the affected populations even when using relatively small samples.

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Notes

¹ The assumption of immobility is particularly ill-suited to New Zealand (the context of the study by Preval et al, 2010) since 2006 Census data reveal that 55 percent of the population changed their usual residence from five years earlier (http://www.stats.govt.nz/browse_for_stats/population/Migration/internal-migration/are-nzs-moving-longer-distances.aspx).

² In a study of a different health problem on a similar population, Gibson et al (2013) find a similar result; while 35 percent of a sample of Tongan immigrants in New Zealand had measured hypertension just four percent of them reported that they had ever had a diagnosis of high blood pressure.