

**Residential Movement in the Housing, Insulation
and Health Study**

Helen Viggers

He Kainga Oranga/Housing and Health Research Programme
University of Otago

Philippa Howden-Chapman

He Kainga Oranga/Housing and Health Research Programme
University of Otago

and

Geoffrey Jones

Institute of Fundamental Sciences, Massey University

1. Introduction

It is accepted that moving house affects health, but the relationship is complex.¹ Some research shows that residential movement has a positive influence on the physical and psychological health of movers, other research finds the opposite result.² Some research indicates that it is the number of moves over a short period that drives both health outcomes³ and health service access.⁴ Rather than a straightforward causal relationship, there seems to be many factors mediating the impact of moving on health outcomes. Moreover, the impacts of moving can have differential impacts on family or household members⁵ and have different implications for people at different stages of life.⁶ The Housing, Insulation and Health Study, undertaken in 2001 and 2002 in seven geographically dispersed communities across New Zealand, provided a unique opportunity to explore this dynamic.⁷ This paper presents a secondary analysis of the two-year prospective cohort of the 1,314 households in this Study and examines the factors affecting residential movement and health. Because this Study was a community trial, we were able to control for confounding factors, look at direct and indirect effects and draw some conclusions about the direction of causation between moving house and health outcomes.

2. Participation in the Housing, Insulation and Health Study

The households participating in the Study were drawn from seven communities from Otago in the north to Christchurch in the south. It included both urban and rural areas and Otago, one of the case studies for the Building Attachment research, was also one of the communities involved in this Study.

The households participating in the study tended to be low income. About 80 percent of households reported that they were eligible for Community Service Cards. Like most New Zealanders, they lived in detached houses (93 percent), built prior to 1978 (99 percent), and over half (56 percent) were built before 1960. The median duration of occupation in a dwelling was greater than seven years. The majority of households in the Study owned their dwelling (76 percent) and ownership levels were higher than the national ownership rates in the 2001 Census (67.8 percent). Over half (56 percent) of households lived in dwellings with only one person or less per bedroom. The study households were also dominated by households with children (61 percent); in 28 percent of the households the youngest person was a working age adult; and 10 percent were retired households. The Study had targeted



¹ Larson et al. (2004); Norman et al. (2005).

² Gilman et al. (2003); Jolleyman et al. (2008).

³ Costello et al. (2001).

⁴ Feldman et al. (1971).

⁵ Fauth et al. (2004); Leventhal (2003).

⁶ Verropoulou et al. (2002); Longino et al. (1991).

⁷ Howden-Chapman et al. (2005); Howden-Chapman et al. (2007).

communities with high Māori or Pacific populations. This is reflected in the prioritised ethnicity profile of the households; 51 percent of households were Māori and 16 percent Pacific Island, the remaining households were exclusively European or of “Other” ethnicities.

3. Residential Movement Among Study Participants

Planning to stay in their house for the two years of the Study was an inclusion criteria for participants. While participant retention was high in the study, residential movement was signalled by households withdrawing from the Study (15.3%). Of the households that withdrew, we knew half (49 percent) had definitely withdrawn because they were moving; about one fifth (18 percent) withdrew for other known reasons; but the remaining households withdrew for unknown reasons. We undertook the analysis distinguishing these three different groups of households:

- Households that withdrew for any reason (Categories 1, 2, and 3).
- Households that withdrew because they were moving, or for unknown reasons (Categories 1 and 2).
- Households that withdrew because they were moving (Category 1).

Table 1 shows this division diagrammatically.

Table 1: Categorisation of households recruited

| | Did not withdraw from the Study | Mutually exclusive withdrew Category 1: Withdrew because moving | Mutually exclusive withdrew Category 2: Withdrew for unknown reasons | Mutually exclusive withdrew Category 3: Withdrew for reasons unrelated to moving |
|------------------------------------|--|--|---|---|
| Remained in study | ✓ | | | |
| Withdrew — all | | ✓ | ✓ | ✓ |
| Withdrew — may have moved | | ✓ | ✓ | |
| Withdrew — definitely moved | | ✓ | | |

A total of 201 households (15.3 percent of the initial sample) withdrew from the study between the first and second years. It is notable that the proportion of households withdrawing is similar to the proportion of New Zealand households that move over the period of a year. In 2001, 23 percent of the population reported living at a different address from where they had been living 12 months previously.

The number of households withdrawing from the study and their reason for withdrawing is presented on a regional basis in Table 2.

Table 2: Reason for withdrawal by region

| Region | Reason for withdrawal | | | Total |
|--------------|--------------------------------------|---|---|-------|
| | Category 1 — withdrew because moving | Category 2 — withdrew for unknown reasons | Category 3 — withdrew for reasons unrelated to moving | |
| Christchurch | 9 | 3 | 5 | 17 |
| Hokitika | 24 | 10 | 4 | 38 |
| Mahia/Nuhaka | 13 | 9 | 7 | 29 |
| Opotiki | 17 | 11 | 5 | 33 |
| Otara | 15 | 12 | 2 | 29 |
| Porirua | 11 | 12 | 4 | 27 |
| Taranaki | 10 | 9 | 9 | 28 |
| Total | 99 | 66 | 36 | 201 |

The likelihood of reporting the reason for withdrawal was similar across the regions (from 56 percent to 82 percent). The proportion of “moved” of all known reasons varied slightly more, (from 52 percent to 89 percent). There seemed to be no pattern by urban/rural areas or a north/south gradient. Most of the unknown withdrawals were likely to be uncontactable.

4. Planned or Unplanned Moves

Households recruited into the study in the first year were asked about their intentions to move. Of the 1,314 households, 1,157 (88.1 percent) reported that they definitely were not moving in the coming year. A total of 40 households (3 percent) reported that they would definitely move in that time, while 106 (8.1 percent) of households were unsure about whether they would move. Around 12.6 percent of the sample withdrew, either because they had moved, or were likely to have moved. This is slightly higher than the proportion of households that expressed a definite intention of moving, or were unsure about moving (Table 3).

Table 3: Planning to move

| | Definitely not moving | Not sure about moving | Definitely moving | Chi-sq p | Wilcoxon p |
|---------------------------------|------------------------------|------------------------------|--------------------------|-----------------|-------------------|
| Remained in study (%) | 1,000 (91) | 76 (7) | 28 (3) | | |
| Withdrew — all (%) | 157 (79) | 30 (15) | 12 (6) | <0.0001 | <0.0001 |
| Withdrew — may have moved (%) | 126 (78) | 25 (15) | 11 (7) | <0.0001 | <0.0001 |
| Withdrew — definitely moved (%) | 77 (79) | 15 (15) | 5 (5) | 0.0023 | 0.0010 |

Households that indicated they were planning to move in the first year questionnaire were much more likely to move than those that said they were not planning to move. However there may have been some bias in the answering of this question. Because of the initial inclusion criteria, it is possible that “planning to move” was underreported.

5. Household Sociodemographics and Moving

Some sociodemographic household characteristics are strongly associated with moving. These are discussed and relevant data set out in Tables 4–17. In summary, however, it was found that there was a univariate relationship between household movement and:

- house size
- length of time living in the dwelling
- tenure
- prioritised ethnicity
- willingness-to-pay for insulation
- Community Service Card eligibility.

There was no apparent relationship between household movement and:

- type of dwelling
- dwelling age
- number of people living in a dwelling
- number of people per bedroom
- household life stage.

Household characteristics relating to behaviour (such as ventilation) that are not primarily related to socio-demographics were measured, but are not reported in this paper.

There was no apparent relationship between the type of dwelling and household mobility, nor was there a relationship between residential movement and the age of the

dwelling (data not shown). However, households that moved tended to have been living in smaller or average size dwellings — one to three bedrooms (Table 4).

Table 4: Number of bedrooms

| | 1 | 2 | 3 | 4 | 5+ | Chi-sq p | Wilcoxon p |
|---------------------------------|-----------|-------------|-------------|-------------|-----------|-------------|---------------|
| Remained in study (%) | 24 (2) | 167 (15) | 668 (61) | 209 (19) | 28 (3) | | |
| Withdrew — all (%) | 7 (4) | 38 (19) | 126 (63) | 22 (11) | 6 (3) | 0.057 | 0.0090 |
| Withdrew — may have moved (%) | 5 (3) | 31 (19) | 105 (64) | 19 (12) | 3 (2) | 0.16 | 0.0141 |
| Withdrew — definitely moved (%) | 3 (3) | 20 (20) | 61 (62) | 13 (13) | 1 (1) | 0.36 | 0.0393 |

The length of time the household had been occupying the house was highly significantly related to moving status. Households that had been living in their dwelling for short amounts of time were more likely to move, than those that had been living there for there several years (Table 5). It was found that households that rented their dwellings were also significantly more likely to move than households that owned their dwellings (Table 6).

Table 5: Length of time in house

| | Less than 1 yr | 1–4 yrs | 5–7 yrs | More than 7 yrs | Chi-sq p | Wilcoxon p |
|---------------------------------|----------------|----------|----------|-----------------|-------------|---------------|
| Remained in study (%) | 76 (7) | 250 (23) | 121 (11) | 662 (60) | | |
| Withdrew — all (%) | 24 (12) | 67 (34) | 23 (12) | 85 (43) | <0.0001 | <0.0001 |
| Withdrew — may have moved (%) | 21 (13) | 58 (36) | 22 (14) | 61 (38) | <0.0001 | <0.0001 |
| Withdrew — definitely moved (%) | 14 (14) | 41 (42) | 11 (11) | 32 (33) | <0.0001 | <0.0001 |

Table 6: Tenure

| | Own | Rent | Chi-sq p |
|---------------------------------|----------|----------|----------|
| Remained in study (%) | 879 (79) | 227 (21) | |
| Withdrew — all (%) | 112 (56) | 87 (44) | <0.0001 |
| Withdrew — may have moved (%) | 82 (51) | 80 (49) | <0.0001 |
| Withdrew — definitely moved (%) | 44 (45) | 53 (55) | <0.0001 |

Despite households in smaller dwellings being more likely to move, the number of people reported as living in the household did not appear to be related to the households moving status (data not shown). Nor was there evidence that higher bedroom occupancy was associated with residential movement among the households (Table 7), although this was somewhat less evenly distributed.

Table 7: Number of people per bedroom

| | 1 or <1 | >1 | >1.5 | >2 | >2.5 | Chi-sq p | Wilcoxon p (categories) | Wilcoxon p (actual ratio) (normal approximation) |
|---------------------------------|----------|----------|----------|--------|--------|----------|-------------------------|--|
| Remained in study (%) | 616 (56) | 235 (21) | 186 (17) | 33 (3) | 26 (2) | | | |
| Withdrew — all (%) | 107 (54) | 40 (20) | 38 (19) | 9 (5) | 5 (3) | 0.74 | 0.36 | 0.40 |
| Withdrew — may have moved (%) | 79 (48) | 39 (24) | 32 (20) | 8 (5) | 5 (3) | 0.36 | 0.0500 | 0.0436 |
| Withdrew — definitely moved (%) | 48 (49) | 26 (27) | 17 (17) | 5 (5) | 2 (2) | 0.53 | 0.22 | 0.12 |

The sociodemographic characteristics of these households showed a mixed association with the tendency to move. In relation to life stage, there did not seem to be any statistically significant effect, although there was some indication that those with school-age children were more likely to move (Table 8). However, prioritised ethnicity,⁸ was significantly related to moving status for the “withdrew — all” and “withdrew — may have moved” categories. In these groups, Māori households were more likely to have moved than the others, and non-Māori/non-Pacific households were less likely to have moved (Table 9). The households in the study were often relatively

⁸ A prioritised ethnicity was calculated for each household (if anyone in a household listed any of their ethnicities as Māori, then the household was categorised as Māori, if not, and anyone in the household listed any of their ethnicities as one of the Pacific ethnicities then the household was classified as “Pacific” otherwise the household is classified as “non-Māori/non-Pacific”).

poor, as shown by the high rate of eligibility for Community Service Cards (about 80 percent). There was a tendency for households that moved to be more likely to be eligible for these cards (Table 10).

Table 8: Life stage of households

| | School age | Working age | Retired | Chi-sq p | Wilcoxon p |
|---------------------------------|-------------------|--------------------|----------------|-----------------|-------------------|
| Remained in study (%) | 680 (61) | 318 (29) | 115 (10) | | |
| Withdrew — all (%) | 128 (64) | 53 (26) | 20 (10) | 0.78 | 0.52 |
| Withdrew — may have moved (%) | 114 (70) | 37 (23) | 13 (8) | 0.12 | 0.0408 |
| Withdrew — definitely moved (%) | 70 (71) | 22 (22) | 6 (6) | 0.11 | 0.0375 |

Table 9: Prioritised ethnicity of household

| | Prioritised Māori | Prioritised Pacific | Prioritised non-Māori non-Pacific | Chi-sq p |
|---------------------------------|--------------------------|----------------------------|--|-----------------|
| Remained in study (%) | 547 (49) | 178 (16) | 384 (35) | |
| Withdrew — all (%) | 113 (58) | 33 (17) | 50 (26) | 0.0386 |
| Withdrew — may have moved (%) | 93 (58) | 30 (19) | 38 (24) | 0.0213 |
| Withdrew — definitely moved (%) | 51 (53) | 15 (16) | 30 (31) | 0.7557 |

Table 10: Community Services Card eligibility

| | Not eligible for Community Services Card | Yes, eligible for Community Services Card | Chi-sq p |
|---------------------------------|---|--|-----------------|
| Remained in study (%) | 253 (23) | 841 (77) | |
| Withdrew — all (%) | 32 (16) | 164 (84) | 0.0346 |
| Withdrew — may have moved (%) | 25 (16) | 134 (84) | 0.0358 |
| Withdrew — definitely moved (%) | 17 (18) | 78 (82) | 0.24 |

6. Health Status

We measured the health status of adult members of households in the Study by using a selection of SF-36® scales. The SF-36® is a standardised set of questions on health status⁹ and broadly assumes two largely separate components to health status — the mental and the physical. It contains 36 questions which map onto nine subscales. Because we measured *individual* health status, we constructed an overall *household* health measure, by mapping the health attributes of household members to the household. This household health measure was calculated in three ways:

- Typifying a household’s health by the health of the least well person in the household. This approach implies that ill health of any individual member is a restriction that prevents that household as a whole from attaining overall well-being. This is referred to as “worst” health.
- Typifying a household’s health as defined by some aspect of the mid-level health of a household, i.e. creating an overall average for a household. This approach implies that any ill-health experienced by a household member may in some way be compensated for if other household members experience exceptionally good health. This is referred to as “pooled” health.¹⁰
- Typifying a household’s health as defined by whether a proportion of the people in the house reported something (in this report the proportions used are 100 percent, 50 percent and 1 percent). This is referred to as “proportionate” health.¹¹

We calculated these measurements for the household as a whole, as well as constructing some measures that applied just to the adults or just to the children.

The SF-36® has been extensively used to measure health-related quality of life in many countries, and New Zealand norms developed.¹² These show that, in most respects, the SF-36® performs similarly in New Zealand as in other Western countries: men tend to score higher than women and increasing age is associated with decreasing scores (except on the mental health scale). People of New Zealand European ethnicity tended toward higher scores than people of Māori or Pacific ethnicity. However, the overall model of health implicit in the design of the SF-36® may not well represent traditional non-Western cultures’ views of well-being.¹³

⁹ Ware et al. (1993).

¹⁰ These scores were found by modelling the distribution of individual scores and taking the residuals from the model (which by definition have a mean of zero) then summing the residuals inside households to create a household value for that variable.

¹¹ Variables constructed in this way have been left in binary form (rather than constructing a 0–3 scale — based on: none, any, half, all), to reduce compositional effects as there were a number of households which contained only one participant which would inevitably have had extreme values of the variable.

¹² Scott et al. (1999).

¹³ Scott et al. (1999).

In particular, it has been found that one of the subscales (Role Emotional) was apparently associated with different aspects of well-being in the three ethnic groups. In the New Zealand European participants it was associated with the “mental” component, while for Māori it was associated with both “physical” and “mental” components, and for Pacific people it was associated with the “physical” component.¹⁴ Therefore, although the individual scales can be (and have been) used, the Role Emotional scale must be interpreted cautiously.

Only a subset of questions in the SF-36® were asked in this study of people filling in the “adult” questionnaire (i.e. those 18 years and over). Specifically three scales and the health transition question were asked in their entirety, and for three other scales some of the questions were asked (Table 11).

Table 11 Health questions

| Scale | Scale Measures | Number of Items in Full SF36® (number of levels) | Number of items used in this study (number of levels) |
|-----------------------------------|--|---|--|
| Physical Functioning | Limitation in carrying out activities of daily living | 10 (21) | — |
| Role-Physical | Limitation in carrying out social role due to physical health | 4 (5) | 4 (5) |
| Bodily Pain | Limitations due to pain | 2 (11) | — |
| General Health | Overall personal health | 5 (21) | 1 (5) |
| Vitality | Feeling of energy or tiredness | 4 (21) | 1 (6) |
| Social Functioning | Large interference to social activities due to mental or physical health | 2 (9) | 2 (9) |
| Role-Emotional | Limitation in carrying out social role due to emotional health | 3 (4) | 3 (4) |
| Mental Health | Contrasts feelings of calmness and happiness with nervousness or sadness | 5 (26) | 2 (11) |
| Reported Health Transition | Compares current health status to that of a year ago | 1 (5) | 1 (5) |

¹⁴ Scott et al. (2000).

7. Health Status and Moving

“Worst” health — all household members

There was no apparent relationship between moving and the worst rated general health of the people in the dwelling. This was the case when considering more detailed categories (Table 12) and when using a dichotomisation of “fair/poor” and “better than fair/poor” (data not shown). Neither was there a relationship between moving status and whether anyone in the house (adult or child) reported having had days off work or school (see Table 13).

Table 12: Worst general health in household

| | Excellent | Very Good | Good | Fair | Poor | Chi-sq p | Wilcoxon p |
|---------------------------------|------------------|------------------|-------------|-------------|-------------|-----------------|-------------------|
| Remained in study (%) | 27 (2) | 162 (15) | 421 (38) | 371 (34) | 126 (11) | | |
| Withdrew — all (%) | 10 (5) | 18 (9) | 81 (41) | 62 (32) | 25 (13) | 0.0703 | 0.77 |
| Withdrew — may have moved (%) | 10 (6) | 14 (9) | 64 (40) | 53 (33) | 20 (12) | 0.0304 | 0.78 |
| Withdrew — definitely moved (%) | 5 (5) | 9 (9) | 35 (36) | 34 (35) | 13 (14) | 0.31 | 0.42 |

Table 13: Anyone in household had days off work/school

| | Didn't have days off work/school | Had days off work/school | Chi-sq p |
|---------------------------------|---|---------------------------------|-----------------|
| Remained in study (%) | 660 (73) | 245 (27) | |
| Withdrew — all (%) | 124 (76) | 40 (24) | 0.47 |
| Withdrew — may have moved (%) | 103 (74) | 37 (26) | 0.87 |
| Withdrew — definitely moved (%) | 57 (69) | 26 (31) | 0.41 |

“Proportionate” health — all household members

About 85 percent of households reported that they had visited a GP and GPs reported visits from about 90 percent of the households, which they had on their books. Although self-reported GP contact did not vary with moving status, GP-reported GP-contact did. This may have been an artefact of households that withdrew having fewer opportunities to convey accurate contact information for their GP (data not shown).

Therefore GP-reported GP-contact was stratified by whether half or more of the household was acknowledged by a GP (Table 14 and Table 15). The statistical significance of the relationship then disappeared, however there was still a tendency for households that moved to have fewer doctor visits reported than those that remained.

Table 14: Any GP-reported visits to GPs by households where half or more of household had contactable GP

| | No GP-reported a visit from anyone in the household | Yes, GP-reported a visit from someone in the household | Chi-sq p |
|---------------------------------|---|--|----------|
| Remained in study (%) | 116 (13) | 756 (87) | |
| Withdrew — all (%) | 19 (17) | 91 (83) | 0.2545 |
| Withdrew — may have moved (%) | 17 (20) | 70 (80) | 0.1085 |
| Withdrew — definitely moved (%) | 8 (16) | 41 (84) | 0.5463 |

Table 15: Any GP-reported visits to GPs by households where less than half of household had contactable GP

| | No GP-reported a visit from anyone in the household | Yes, GP-reported a visit from someone in the household | Chi-sq p | MH Summary chi-sq for both tables |
|---------------------------------|---|--|----------|-----------------------------------|
| Remained in study (%) | 32 (31) | 72 (69) | | |
| Withdrew — all (%) | 13 (42) | 18 (58) | 0.2470 | 0.1420 |
| Withdrew — may have moved (%) | 12 (43) | 16 (57) | 0.2284 | 0.0613 |
| Withdrew — definitely moved (%) | 7 (50) | 7 (50) | 0.1510 | 0.2516 |

“Pooled” health — adults

Households that withdrew from the study had, on average, somewhat better adult pooled health than those that remained. Tables 16 to 18 show the averages and standard deviations for the means of the residuals summed by household categories for each of the three models.¹⁵ However, when the models included age group, gender and

¹⁵ Generally the households that moved had positive residuals and the households that remained had negative residuals. Wilcoxon and t-tests on the significance of the differences between the groups

ethnicity, the results showed no statistically significant difference between the households. When the model included just the overall mean for the scale, some results attained borderline significance.¹⁶ Overall, there was little evidence that pooled adult health was strongly related to moving status.

Table 16: Role-Physical residuals — summed by household

| | Role-Physical — means only Mean (stdev) | Role-Physical — age group, sex, ethnicity Mean (stdev) | Role-Physical — age group, sex, ethnicity, region Mean (stdev) |
|-----------------------------|--|---|---|
| Remained in study | -1.2 (68) | -0.7 (65) | -0.4 (64) |
| Withdrew — all | 6.6 (65) | 2.9 (61) | 2.0 (59) |
| Withdrew — may have moved | 10.4 (64) | 4.3 (61) | 3.4 (60) |
| Withdrew — definitely moved | 9.4 (63) | 0.4 (58) | 0.1 (57) |

Table 17: Role-Emotional residuals — summed by household

| | Role-Emotional — means only Mean (stdev) | Role-Emotional — age group, sex, ethnicity Mean (stdev) | Role-Emotional — age group, sex, ethnicity, region Mean (stdev) |
|-----------------------------|---|--|--|
| Remained in study | -0.9 (69) | -0.67 (67) | -0.51 (67) |
| Withdrew — all | 4.0 (64) | 2.1 (63) | 1.2 (62) |
| Withdrew — may have moved | 9.4 (64) | 6.1 (63) | 5.1 (63) |
| Withdrew — definitely moved | 12.3 (63) | 6.1 (63) | 5.6 (62) |

produced congruent results in all cases. Although the residuals are not normally distributed a sufficiently large number of them are summed that the central limit theorem should apply and the t-test be useful.

¹⁶ In order to simplify the table, the Wilcoxon and t-test p-values are not shown, but in all cases were somewhat similar and congruent. Cells where the ‘withdrew’ category were significantly different at five percent from the ‘remained’ category are shaded light grey.

Table 18: Social Functioning Residuals — summed by household

| | SF — means only Mean (stdev) | SF — age group, sex, ethnicity Mean (stdev) | SF—age group, sex, ethnicity, region Mean (stdev) |
|-----------------------------|--|---|---|
| Remained in study | -0.6 (41) | -0.4 (40) | -0.3 (40) |
| Withdrew — all | 3.1 (39) | 1.8 (38) | 1.2 (37) |
| Withdrew — may have moved | 4.4 (39) | 2.6 (39) | 2.1 (38) |
| Withdrew — definitely moved | 8.9 (39) | 5.6 (39) | 5.5 (39) |

“Worst” health — adults

Overall the adults in the households that withdrew because they moved house experienced better “worst” health than those that stayed in the study (Table 19). However, although the same trend was apparent, when residuals for the models including age group, gender and ethnicity were examined for the full SF-36® scales, the differences were not generally statistically significant (Table 20).

Table 19: Worst general health of adult in household

| | Excellent | Very Good | Good | Fair | Poor | Chi-sq p | Wilcoxon p |
|---------------------------------|------------------|------------------|-------------|-------------|-------------|-----------------|-------------------|
| Remained in study (%) | 57 (5) | 216 (20) | 408 (37) | 317 (29) | 105 (10) | | |
| Withdrew — all (%) | 20 (10) | 33 (17) | 86 (44) | 30 (20) | 17 (9) | 0.0052 | 0.0319 |
| Withdrew — may have moved (%) | 17 (11) | 29 (18) | 71 (43) | 32 (20) | 13 (8) | 0.0123 | 0.0208 |
| Withdrew — definitely moved (%) | 11 (11) | 22 (23) | 37 (39) | 18 (19) | 8 (8) | 0.0404 | 0.0118 |

Table 20: Lowest SF36® residuals in the household: model includes sex, age and ethnicity

| | Role-Physical Mean (stdev) | Role-Emotional Mean (stdev) | Social Functioning Mean (stdev) |
|-----------------------------|---------------------------------------|--|--|
| Remained in study | -18.6 (39) | -17.4 (43) | -10.9 (26) |
| Withdrew — all | -14.9 (39) | -13.1 (43) | -7.2 (24) |
| Withdrew — may have moved | -14.7 (39) | -10.3 (43) | -6.8 (24) |
| Withdrew — definitely moved | -16.9 (39) | -9.5 (43) | -4.1 (24) |

In the “Vitality” question, the same tendency was observed for the households that withdrew to report, on average, slightly better vitality, although the differences were not statistically significant (Table 21), and only for the “withdrew — definitely moved” category was the p-value even close to borderline.

Table 21: Lowest Vitality category in the household

| | 1 | 2 | 3 | 4 | 5 | 6 | Mean (stdev) | Chi-sq p | Wil- coxon p | t-test p |
|---------------------------------|-----------|-------------|-------------|-------------|-------------|-----------|-------------------------|---------------------|-------------------------|---------------------|
| Remained in study (%) | 51 (5) | 219 (20) | 449 (41) | 182 (17) | 179 (16) | 22 (2) | 3.3 (1.1) | | | |
| Withdrew — all (%) | 12 (6) | 34 (18) | 73 (38) | 31 (16) | 36 (19) | 7 (4) | 3.3 (1.2) | 0.5247 | 0.3929 | 0.3577 |
| Withdrew — may have moved (%) | 9 (6) | 28 (18) | 57 (36) | 27 (17) | 31 (20) | 6 (4) | 3.4 (1.2) | 0.4937 | 0.2253 | 0.1965 |
| Withdrew — definitely moved (%) | 3 (3) | 17 (18) | 32 (34) | 20 (21) | 20 (21) | 3 (3) | 3.5 (1.2) | 0.4764 | 0.0723 | 0.0667 |

The question about “feeling calm” (Table 22) again showed the tendency for households that moved to report more positive health, although only for the “Withdrew — all” category was this statistically significant. In contrast, “Feeling down” (Table 23) had less significant p-values and perhaps showed a tendency for households that moved to report worse mental health.

Table 22: Worst “feel calm” category in the household

| | 1: None of the time | 2: A little of the time | 3: Some of the time | 4: A good bit of the time | 5: Most of the time | 6: All the time | Mean (stdev) | Chi- sq p | Wilcoxon p | t-test p |
|---|--|--|--|--|--|--------------------------------|-------------------------|--------------------------|-----------------------|---------------------|
| Remained in study (%) | 40 (4) | 195 (18) | 412 (37) | 167 (15) | 251 (23) | 36 (3) | 3.5 (1.2) | | | |
| Withdrew — all (%) | 3 (2) | 24 (12) | 76 (39) | 32 (16) | 50 (26) | 9 (5) | 3.7 (1.2) | 0.2370 | 0.0275 | 0.0264 |
| Withdrew — may have moved (%) | 3 (2) | 22 (14) | 58 (36) | 29 (18) | 40 (25) | 7 (4) | 3.6 (1.2) | 0.5230 | 0.0701 | 0.0709 |
| Withdrew — def- initely moved (%) | 0 (0) | 13 (14) | 34 (36) | 20 (21) | 25 (26) | 3 (3) | 3.7 (1.1) | 0.2408 | 0.0607 | 0.0642 |

Table 23: Worst “feel down” category in the household

| | 1: All the time | 2: Most of the time | 3: A good bit of the time | 4: Some of the time | 5: A little of the time | 6: None of the time | Mean | Chisq p | Wilcoxon p (normal approx ?) | t-test p |
|---|------------------------------------|--|--|--|--|--|--------------|--------------------|---|---------------------|
| Remained in study (%) | 37 (3) | 114 (10) | 149 (14) | 482 (44) | 238 (22) | 80 (7) | 3.9 (1.2) | | | |
| Withdrew — all (%) | 6 (3) | 20 (10) | 27 (14) | 71 (37) | 48 (25) | 21 (11) | 4.0 (1.2) | 0.3617 | 0.1993 | 0.2402 |
| Withdrew — may have moved (%) | 6 (4) | 16 (10) | 23 (14) | 53 (33) | 42 (26) | 19 (12) | 4.0 (1.3) | 0.1070 | 0.1414 | 0.2086 |
| Withdrew — definitely moved (%) | 5 (5) | 7 (7) | 13 (14) | 35 (37) | 27 (28) | 8 (8) | 4.0 (1.2) | 0.4628 | 0.3013 | 0.4607 |

“Proportionate” health — adults only

Tables 24 and 25 show the proportions of working adults in the houses which reported having had sick days off paid work. There is a slight trend that households that withdrew from the study reported better adult health, although this was not statistically significant.

Table 24: Any working adult in household had days off paid work

| | No | Yes | Chi-sq p |
|---------------------------------|----------|----------|----------|
| Remained in study (%) | 440 (52) | 399 (48) | |
| Withdrew — all (%) | 89 (61) | 58 (39) | 0.0692 |
| Withdrew — may have moved (%) | 77 (61) | 50 (39) | 0.0847 |
| Withdrew — definitely moved (%) | 42 (52) | 39 (48) | 0.9189 |

Table 25: Half or more working adults in household had days off paid work

| | No | Yes | Chi-sq p |
|---------------------------------|----------|----------|----------|
| Remained in study (%) | 604 (64) | 343 (36) | |
| Withdrew — all (%) | 110 (66) | 56 (34) | 0.5380 |
| Withdrew — may have moved (%) | 93 (66) | 48 (34) | 0.6152 |
| Withdrew — definitely moved (%) | 50 (57) | 37 (43) | 0.2428 |

“Worst” health — child or teenager

Not all the households in the study contained children or teenagers. Among the households that did, there was a tendency for households that withdrew to have a child in worse general health than those that remained in the study (see Table 26). This was only statistically significant for the “Withdrew — definitely moved” category.

Table 26: Worst general health of child or teenager in household

| | Excellent | Very Good | Good | Fair | Poor | Chi-sq p | Wilcoxon p |
|---------------------------------|------------------|------------------|-------------|-------------|-------------|-----------------|-------------------|
| Remained in study (%) | 63 (9) | 196 (29) | 249 (37) | 134 (20) | 28 (4) | | |
| Withdrew — all (%) | 7 (6) | 35 (28) | 42 (34) | 32 (26) | 8 (6) | 0.30 | 0.0699 |
| Withdrew — may have moved (%) | 7 (6) | 30 (27) | 38 (35) | 28 (25) | 7 (6) | 0.46 | 0.0984 |
| Withdrew — definitely moved (%) | 4 (6) | 14 (21) | 26 (38) | 19 (28) | 5 (7) | 0.22 | 0.0185 |

Likewise, there was a very slight tendency for households where the sickest child had experienced more attacks of wheezing to withdraw from the study — however again this was only statistically significant for the “Withdrew — all” category (Table 27). Similarly, caregivers whose households withdrew from the study were more likely to report a child with doctor-diagnosed asthma in their dwelling, although this was not statistically significant (Table 28).

Table 27: Worst frequency of childhood wheezing in household

| | No attacks of wheezing | 1–3 attacks of wheezing | 4–12 attacks of wheezing | 13+ attacks of wheezing | Chi-sq p | Wilcoxon p |
|---------------------------------|-------------------------------|--------------------------------|---------------------------------|--------------------------------|-----------------|-------------------|
| Remained in study (%) | 220 (41) | 191 (35) | 85 (16) | 45 (8) | | |
| Withdrew — all (%) | 34 (31) | 39 (36) | 29 (27) | 7 (6) | 0.0346 | 0.0477 |
| Withdrew — may have moved (%) | 33 (34) | 31 (32) | 27 (28) | 6 (6) | 0.0362 | 0.1084 |
| Withdrew — definitely moved (%) | 20 (33) | 20 (33) | 17 (28) | 4 (7) | 0.11 | 0.14 |

Table 28: Any children with doctor-diagnosed asthma in house

| | No Doctor-diagnosed asthma | Yes, Doctor-diagnosed asthma | Chi-sq p |
|---------------------------------|----------------------------|------------------------------|----------|
| Remained in study (%) | 238 (43) | 317 (57) | |
| Withdrew — all (%) | 40 (36) | 71 (64) | 0.1818 |
| Withdrew — may have moved (%) | 38 (38) | 61 (62) | 0.4037 |
| Withdrew — definitely moved (%) | 24 (38) | 39 (62) | 0.4662 |

Caregivers who reported a child who had disturbed sleep, speech or exercise from wheezing were somewhat more likely to subsequently withdraw (although this difference was only statistically significant for the “withdrew — all” category — the other two categories were borderline (Table 29). If a caregiver reported a child who had two or more of these disturbed then there was a greater difference with a both the “withdrew — all” and “withdrew — may have moved” categories being statistically significant (Table 30).

Table 29: At least one child in house whose speech, sleep or exercise disturbed by wheeze

| | No | Yes | Chi-sq p |
|---------------------------------|----------|----------|----------|
| Remained in study (%) | 194 (35) | 361 (65) | |
| Withdrew — all (%) | 27 (24) | 84 (76) | 0.0299 |
| Withdrew — may have moved (%) | 26 (26) | 73 (74) | 0.0917 |
| Withdrew — definitely moved (%) | 14 (23) | 48 (77) | 0.0506 |

Table 30: At least one child in house who had two activities disturbed by wheeze in last three months

| | No | Yes | Chi-sq p |
|---------------------------------|----------|----------|----------|
| Remained in study (%) | 315 (57) | 238 (43) | |
| Withdrew — all (%) | 46 (41) | 65 (59) | 0.0027 |
| Withdrew — may have moved (%) | 44 (44) | 55 (56) | 0.0211 |
| Withdrew — definitely moved (%) | 28 (44) | 35 (56) | 0.0581 |

Overall, there was a perceptible tendency for households which moved to be more likely to report a child in ill health.

“Proportionate” health — children and teenagers

There was no statistically significant difference in whether a household that subsequently withdrew reported a child who had had days off school (Table 31), although there was some tendency for a greater proportion of households that subsequently withdrew to report this.

Table 31: School age child in household had days off school

| | Any child in household | | | Half or more children in household | | |
|---------------------------------|------------------------|----------|----------|------------------------------------|----------|----------|
| | No | Yes | Chi-sq p | No | Yes | Chi-sq p |
| Remained in study (%) | 115 (21) | 445 (79) | | 143 (26) | 417 (74) | |
| Withdrew — all (%) | 16 (17) | 80 (83) | 0.3810 | 20 (21) | 76 (79) | 0.3246 |
| Withdrew — may have moved (%) | 15 (18) | 68 (82) | 0.6020 | 18 (22) | 65 (78) | 0.4500 |
| Withdrew — definitely moved (%) | 7 (15) | 41 (85) | 0.3230 | 8 (17) | 40 (83) | 0.1723 |

8. Movement Factors

In order to control for confounding factors that could have explained these results, two sets of multiple regressions were done: backwards and forwards regressions using (i) the variables that the screening had picked up as potentially related to movement status at the five percent level,¹⁷ and (ii) variables suspected *a priori* to be related to moving. Table 32 shows the variables included in the final models for each withdrawal category.¹⁸ Table 33 shows the results for each withdrawal category of the variables chosen *a priori*.

¹⁷ GP acknowledgement of a household was excluded from the screened variable regression in the analysis shown despite the lack of acknowledgment being a strong predictor of moving due to the possibility that the lack of acknowledgment may have been an artefact of the data collection.

¹⁸ Table 32 has only one column for the all-withdrawn dataset as these results were identical whether forward or backward regression was carried out.

Table 32: Multiple regression results

| | All- withdrawn | Withdrawn might have moved | | Withdrawn definitely moved | |
|------------------------------------|-----------------------|-------------------------------|------------------------|----------------------------|---------------------|
| | | | | | |
| Region | (p = 0.0750) | (p <0.0001) | (p <0.0001) | (p=0.0309) | (p=0.0622) |
| Tenure | 3.072 (p <0.0001) | 3.532 (p = 0.0004) | 3.356 (p = 0.0002) | 4.961 (p<0.0001) | 4.910 (p<0.0001) |
| House Condition | 0.776 (p =0.0052) | 0.689 (p = 0.0288) | 0.672 (p = 0.0712) | | 0.749 (p=0.0296) |
| Bedrooms | 1.353 (p = 0.0105) | | 1.277 (p = 0.0418) | | |
| Sunniness | 0.834 (p = 0.1217) | | | | |
| Perceived Coldness Of Winter | | 1.493 (p = 0.1746) | 1.472 (p = 0.1278) | | |
| Damp living room | | | | 0.528 (p=0.0158) | 0.603 (p=0.0605) |
| Electrical Heating | 1.851 (p = 0.0008) | | | | |
| Any Pet | | | 1.508 (p = 0.0183) | | |
| Cat | | 1.584 (p = 0.0146) | | 1.695 (p=0.0431) | |
| Smoking In House | | 0.637 (p= 0.0041) | 0.817 (p = 0.0063) | | |
| Community PC | | 1.075 (p = 0.0194) | 1.086 (p = 0.0111) | | |
| Lack of trust of neighbours | | | | 1.472 (p=0.0320) | 1.468 (p=0.0337) |
| Wheezy Child | 0.761 (p =0.0044) | 0.736 (p = 0.0036) | 0.743 (p = 0.0063) | 0.728 (p=0.0143) | 0.742 (p=0.0221) |
| Lowest SF | | 0.989 (p = 0.0036) | 0.989 (p = 0.0029) | 0.986 (p=0.0029) | 0.985 (p=0.0024) |

Table 33: A priori variable regression results

| | All withdrawn | All might have moved | All definitely moved |
|----------------------|-----------------------|-----------------------|-----------------------|
| Region | (p = 0.0120) | (p = 0.0060) | (p = 0.0569) |
| Tenure | 2.770 (p <0.0001) | 3.079 (p <0.0001) | 3.837 (p <0.0001) |
| Time in Dwelling | (p = 0.1255) | (p = 0.0547) | (p = 0.0893) |
| House Condition | 0.720 (p = 0.0003) | 0.689 (p = 0.0003) | 0.750 (p = 0.0258) |
| Community PC | 1.059 (p = 0.2333) | 1.103 (p = 0.0592) | 1.111 (p = 0.1000) |
| People per Bedroom | 0.903 (p = 0.2927) | 0.883 (p = 0.2335) | 0.945 (p = 0.6701) |
| Lifestage | (p = 0.2985) | (p = 0.6825) | (p = 0.9977) |
| Worst General Health | 0.980 (p = 0.8183) | 0.990 (p = 0.9136) | 0.917 (p = 0.4718) |

Both *a priori* models and screened variable models found similar associations with mobility. The models support the hypothesis that tenure and house condition are related to moving status. The screened variable models also suggest that in addition to overall house condition, consideration of other aspects of the dwelling's ability to protect the occupant from the environment may be valid (three such measures included in the different models were Sunniness, Dampness of the living room, and Perceived coldness of the previous winter).

However, crowding (as measured by number-of-people-per bedroom) was not supported as a precipitating factor for moving and neither was life stage. The number of bedrooms in the dwelling was included in only some of the models.

Many of the models included a variable that related to perceptions of the community that the dwelling was located in; households that reported positively on their community were less likely to move. The inclusion of a community variable in the *a priori* model was based on the social capital literature which has shown the importance of good community relationships and networks enhance health and community attachment.¹⁹

Both smoking status and pet ownership were independently predictive in some of the models, although not expected in the *a priori* model. They could be nuisance variables. However, they may also be markers for an overall household vulnerability that was not adequately expressed in any of the demographic variables used. The households were predominantly low income, so most of the households reported

¹⁹ Larson et al. (2004).

eligibility for a Community Services Card — giving the variable little explanatory power, and there were no other variables so directly related to income. Tenuous relationships could be hypothesised between each of these variables and education or income.

The most interesting finding, however, related to the impact of household health status on moving. As anticipated, the moving status of households was related to health status. However, the dynamics of that relationship was quite different to that expected. Households where adults reported ill health had reduced odds of moving, while households where children reported ill-health had greater odds of moving. The *a priori* model that did not distinguish adult and child ill-health found no relationship between moving status and health.

It is unclear why this pattern has emerged. It may be that ill health constrains adults in some way. They may have less personal resources to plan or implement a move. They may be more closely tied to health services in their current location and this may have an inhibiting affect. It may be that adults with compromised health are less likely to have opportunities for employment elsewhere. Similarly, the drivers and implications of the association between residential movement and households with children reported to be in ill health also need future exploration. It is conceivable that child ill health is an active driver of decisions to move either because that ill health is seen to be connected with poor housing or environmental conditions, or because the household is seeking to access health care or other supports elsewhere. On the other hand, child ill health may be associated with a constellation of household stressors that generate a high propensity to move.

9. Conclusion

Are people more likely to stay put in certain kind of houses? Does moving house have any impact on health? Analysis of households that withdrew from The Housing, Insulation and Health Study enabled us to explore the direction of causality between residential mobility and health, that is do people move because they are not well, or does moving increase the chances of them being unwell? We were able to distinguish retrospectively the 15 percent of the households that withdrew from the Study, into those that withdrew because they moved houses, and those that withdrew for other reasons, such as ill health. Because the data were collected prospectively and we could control for confounding factors, we can also draw causal conclusions.

Our univariate analysis showed that households were more likely to move if they lived in a smaller house, that was rented and in which they had lived a shorter amount of time. Households that were more likely to move were also more likely to be eligible for Community Service Cards. Not surprisingly, people who were more likely to move, given the likelihood that they had less disposable income, were less inclined to indicate that in a hypothetical question that they were willing to pay for insulation. Households that moved were more likely to have people with Māori and Pacific Island ethnicities.

In the multivariate analyses, people who rented rather than owned their houses were also more likely to move. Those households whose houses were in poorer condition, shadier, damper and colder in the previous winter, were also more likely to move.

Household crowding, despite the anticipated stress, did not seem to cause people to move. Nor was stage of life significantly related to moving. Households with children were not more likely to move than working age households or retired people. However, households where adults reported ill health were *less* likely to move, while households where children reported ill health were *more* likely to move. In conclusion, both the quality of housing and the health of occupants seem to be important determinants of residential mobility.

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